European University Institute

DEPARTMENT OF LAW

The Challenge of Three-Dimensional Printing: Questioning Established Concepts in Intellectual Property Law

Viola Elam

Thesis submitted for assessment with a view to obtaining
the degree of Doctor of Laws of the European University Institute

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Department of Law

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Thesis Summary

Over the last years, academics, practitioners and policy makers have focused their attention on an emerging technology: three-dimensional printing ("3DP").
3DP is often portrayed as a game changer, showing the potential to disrupt established socioeconomic paradigms and exert profound implications in disparate areas of law.
3DP not only is well integrated in the manufacturing industry, but also increasingly adopted at consumer level. Recent developments have made it possible for ordinary people to take an active role in the production, customization and distribution of goods, and likewise paved the way for the proliferation of new market entrants, such as 3DP online platforms.
Against this background, this thesis aims to shed some light on the implications that 3DP may have for Intellectual Property Law. In particular, this work attempts to predict and grasp the consequences that the digitization of real world things may carry in the area of IP law, both from the side of protection and infringement.
This contribution is intended to create general awareness about the current state of the art and likewise delineate possible future scenarios in the 3DP ecosystem.
The research question at the core of the analysis is whether the current legal framework of different IPRs already offers suitable means for regulating the thin dividing line between the digital and the analogue world, or rather needs to be amended, in order to cope with such a fascinating reality.
To this end, the analysis contributes insights to the best legal treatment that CAD files shall receive, in case such files embed products protected by copyright, designs, patents and trademarks. Hence, it addresses right owners' concern that the online transmission of CAD files, combined with the ease of converting such files into the final printout, will facilitate mass-scale and worldwide infringement of all IPRs.

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International Treaties/Conventions

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Agreement on trade-related aspects of intellectual property rights, Marrakesh Agreement Establishing the World Trade Organization Annex 1C, 1869 U.N.T.S. 299, 33 I.L.M. 1197 (15 April 1994)

Berne Convention for the protection of literary and artistic works, 828 U.N.T.S. 221 (9 September 1886)

76/76/EEC Convention for the European patent for the Common Market (Community Patent Convention), OJ L 17 (26 January 1976)

Convention on the grant of European patents, (European Patent Convention), 1065 U.N.T.S. 199 (5 October 1973)

Hague Agreement concerning the international deposit of industrial designs, 2279, U.N.T.S 156 (2 July 1999)

Locarno Agreement establishing an international classification for industrial designs, Locarno 1968, as amended in 1979

Madrid Agreement concerning the international registration of marks, 14 April 1891, as revised at Stockholm 14 July 1967, 828 U.N.T.S. 389

Nice Agreement concerning the international classification of goods and services for the purposes of the registration of marks (Nice, 15 June 1957) as revised at Stockholm on 14 July 1967

Paris Convention for the protection of industrial property (Paris, 20 March 1883) as amended at Stockholm on 14 July 1967, 21 U.S.T. 1583, 423 U.N.T.S. 305

Patent Cooperation Treaty, 28 U.S.T. 7645, 1160 U.N.T.S. 231 (19 June 1970)

Protocol relating to the Madrid Agreement concerning the international registration of marks, adopted at Madrid on 27 June 1989, WIPO doc. MM/DC/27 Rev.

Vienna Agreement establishing an international classification of the figurative elements of marks (Vienna, 12 June 1973) as amended at Vienna 1 October 1985

WIPO Copyright Treaty (Geneva, 20 December 1996), TRT/WCT/001, entered into force on 6 March 2002

EU Legislation

Treaty on the Functioning of the European Union, 26 October 2012, OJ L 326/47

Treaty of Lisbon Amending the Treaty on European Union and the Treaty Establishing the European Community, signed at Lisbon 13 December 2007, entered into force 1 December 2009 OJC 306, 2007/C 306/01

Regulation (EU) No 1257/2012 of the European Parliament and of the Council of 17 December 2012 implementing enhanced cooperation in the areas of the creation of unitary patent protection [2012] OJ L 361/1.

Regulation (EU) No. 207/2009 of 26 February 2009 on the Community trade mark, OJ L 78 (24 March 2009)

Regulation (EU) 2015/2424 of the European Parliament and of the Council of 16 December 2015 amending Council Regulation (EC) No 207/2009 on the Community trade mark and Commission Regulation (EC) NO 2868/95 implementing Council

Regulation (EC) No 40/94 on the Community trade mark, and repealing Commission Regulation (EC) no 2869/95 on the fees payable to the OHIM

Council Regulation (EC) No 6/2002 of 12 December 2001 on community designs [2001] OJ L 3/1, amended by Council Regulation No 1891/2006 of 18 December 2006 amending Regulations (EC) No 6/2002 and (EC) No 40/94, OJ EC No L 386

Directive 2000/31/EC of the European Parliament and of the Council of 8 June 2000 on certain legal aspects of information society services, in particular electronic commerce, in the Internal Market, OJ L 178 (17 July 2000)

Directive 2001/29/EC of the European Parliament and of the Council of 22 May 2001 on the harmonization of certain aspects of copyright and related rights in the information society, OJ L 167

Directive 2006/116/EC on the term of protection of copyright and certain related rights of 12 December 2006, OJ L 372 (27 December 2006)

Directive 2006/115/EC of the European Parliament and of the Council of 12 December 2006 on rental right and lending right and on certain rights related to copyright in the field of intellectual property (codified version) OJ L 376

Directive (EU) 2015/2436 of the European Parliament and of the Council of 23 April 2009 on the legal protection of computer programs, OJ L 111 (5 May 2009)

Directive 96/9/EC of the European Parliament and of the Council of 11 March 1996 on the legal protection of databases, OJ L 77 (27 March 1997)

Directive 2004/48/EC on the enforcement of intellectual property rights, OJ L 157 (30 April 2004)

Design Directive 98/71/EC of the European Parliament and Council of 13 October 1998 on the legal protection of designs, O.J. L289

Directive 2008/95/EC of the European Parliament and of the Council of 22 October 2008 to approximate the laws of the Member States relating to trade marks (codified version) OJ L 372 (27 December 2006)

Directive (EU) 2015/2436 of the European Parliament and of the Council of 16 December 2015 to approximate the laws of the Member States relating to trade marks, OJ L 336 (23 December 2015)

Explanatory Memorandum to proposed Design Directive, COM(93) 344, December 23, 1993 [1993] O.J. C345/1

Explanatory Memorandum to proposed Design Regulation, COM(93) 342, January 31, 1994 [1994] O.J. C29

EC Green Paper on the legal protection of industrial designs of the Commission of the European Communities, III/F/5131/91-EN (June 1991)

EC Green Paper on copyright and the challenge of technology, copyright issues requiring immediate action, COM (88) 172 final (June 1998)

National Laws

Austria

Federal Law Concerning Author's Right in Works of Literature, Art and Neighbouring Rights of 9 April 1936 (No. 111/1936), as amended

Canada

Copyright Act (R.S.C., 1985, c. C-42)

France

French Intellectual Property Code, Law No 92-597 of 1 July 1992, as amended

Germany

Act on Copyright and Related Rights (Copyright Act of 9 September 1965), as amended

The German Act on the Protection of Designs and Models of 2004 (*Geschmackmustergesetz,* Design Act), as amended

Italy

Code of Industrial Property, Legislative Decree No 30, 10 February 2005, as amended

Italian Copyright Act, Law No. 633 of 22 April 1941 for the Protection of Author's Right and Other Rights Connected with the Exercise Thereof, as amended

Spain

Law on Intellectual Property, Royal Legislative Decree 1/1996 of 12 April 1996, as amended

The Netherlands

Benelux Convention on Intellectual Property (Trademarks and Designs) of February 25 2005, as amended

Law of 23 September 1912 Containing New Regulation for Author's Right (Copyright Act of 1912), as amended

United Kingdom

Copyright Designs and Patents Act of 1988, as amended

Enterprise and Regulatory Reform Act 2013

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Constitution of the Unites States (1787)

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Lanham Act, US Trademark Law, 15 U.S.C. §§ 101 et seq.

Patent Code, U.S. Patent Law, 35 U.S.C. §§ 1 et seq.

U.S. Copyright Act of 1976, 17. U.S.C. §§ 101 et seq.

U.S. Tariff Act (1930)

Table of Cases

Europe

Joined Cases C-397/16 and C-435/16 *Acacia Srl, Pneusgarda Srl and Audi AG v Acacia Srl, Rolando D'Amato and Dr. Ing. H.c. F. Porshe*, ECLI:EU:C:2017:992

Case C-435/12 *ACI Adam BV v Stichting de Thuiskopie et al.*, ECLI:EU:C:2014:254

Case C-48/05 *Adam Opel AG v Autec AG* [2007] ECR I-1017

Case C-408/01 *Adidas-Salomon v Fitnessworld Trading Ltd* [2003] ECR I-12537

Case C-166/15 *Aleksandrs Ranks e Jurijs Vasiļevičs contro Finanšu un ekonomisko noziegumu izmeklēšanas prokoratūra e Microsoft Corp.*, ECLI: EU:C:2016:762

Case C-206/01 *Arsenal Football Club plc. v Reed* [2002] ECR I-10273

Case C-419/13 *Art & Allposters International BV v Stitching Pictoright* [2015] ECDR 8

Case C-24/05 *August Storck KG v OHIM*, 22 June 2006, ECLI:EU:C:2006:422

Case C-393/09 *Bezpečnostní softwarová asociace – Svaz softwarové ochrany v Ministerstvo kultury*, [2011] ECDR 3; [2011] FSR 18

Case C-63/97 *BMW and BMW Nederland v Deenik* [1999] ECR I-905

Case C-203/02 *British Horseracing Board Ltd v William Hill Organization Ltd* [2004] ECR I-10415

Case C-39/97 *Canon Kabushiki Kaisha v Metro-Goldwyn-Mayer Inc.* [1998] ECR I-5507

Case C-17/06 *Céline SARL v Céline SA* [2007] ECR I-7041

Case C-463/12 *Copydan Bandkopi v Nokia Denmark,* EU:C:2015:144

Case C-683/17 Request for a preliminary ruling from the Supremo Tribunal de Justiça (Portugal) lodged on 6 December 2017 — *Cofemel — Sociedade de Vestuário SA v G-Star Raw CV*, *OJ C 52, 12.2.2018*

Case C-5/11 *Criminal proceedings against Titus Alexander Jochen Donner*, EU:C:2012:195

Case C-413/11 *Daiichi Sankyo Co. Ltd Sanofi-Aventis Deutschland GmbH v Demo Anonimos Viomikhaniki kai Emporiki Etairia Farmakon,* ECLI:EU:C:2013:520

Joined Cases C-361/15 P and C-405/15 P *Easy Sanitary Solutions BV v European Union Intellectual Property Office (EUIPO), Group Nivelles NV,* ECLI:EU:C:2017:720

Case C-145/10 *Eva-Maria Painer v Standard VerlagsGmbH and Others* [2011] ECR I-12533

Joined Cases C-403\08 & C-429\081 *FA Premier League et al. v. QC Leisure et al. & Murphy v. Media Protection Services Ltd*, ECLI:EU:C:2011:631

Case C-444/02 *Fixtures Marketing Ltd v OPAP* [2004] ECR I-10549

Case C-168/09 *Flos SpA v Semeraro Casa e Famiglia SpA* [2011] ECR I-00181

Case C- 604/10 *Football Dataco v Yahoo! UK Ltd* [2013] FSR 1

Case C-218/01 *Henkel KgAA v OHIM* [2004] ECR I-1715; [2005] ETMR 45

Case C-479/12 *H. Gautzsch GroBhanden GmbH & Co. KG v Münchener Boulevard Möbel Joseph Duna Gmbh,* ECLI:EU:C:2014:75

Joined Cases C-361/15 P and C-405/15 P *Easy Sanitary Solutions BV v EUIPO/Group Nivelles NV, UK intervening,* ECLI:EU:C:2017:720

Case T-9/07 *Grupo Promer v OHIM* [2010] ECR II-981; [2010] ECDR 7

Case T-526/13 *H&M Hennes & Mauritz BV & Co. KG v OHIM – Yves Saint Laurent* (handbags), OJ C 346

Case C-572/13 *Hewlett-Packard Belgium SPRL v Reprobel SCRL*, ECLI:EU:C:2015:750

Case C-533/06 *02 Holdings Ltd v Hutchinson 3G ltd* [2008] ECR I-4231

Case C-5/08 *Infopaq International A/S v Danske Dagblades Forenig* Case [2010] FSR 20

Case C-252/07 *Intel Corporation Inc. v CPM United Kingdom Ltd* [2008] ECR I-8823

Case C-323/09 *Interflora v Marks & Spencer* [2012] ETMR 1

Case C-345/13 *Karen Millen Fashions Ltd v Dunnes stores et al*. ECDR 17

Case C-192/2004 *Lagardère Active Broadcast contro Société pour la perception de la rémunération équitable (SPRE) e Gesellschaft zur Verwertung von Leistungsschutzrechten mbH (GVL)*, ECLI:EU:C:2005:475.

Case C-487/07 *L'Oréal SA et al. v Bellure NV* et al. [2009] ECR I-5185

Case C-324/09 *L'Oréal SA and Others v eBay International AG and Others* [2011] ECR I-6011

Case C-291/00 *LTJ Diffusion SA v. SA Sadas* [2003] ECR I-2799

Cases C-236/08 to C-238/08 *Louis Vuitton v Google France* [2010] ECR I-2417

Case C-324/08 *Makro Zelfbedieningsgroothandel CV v Diesel SpA* [2009] ECR I-10019

Case T-305/02 *Nestlé Waters France v OHIM*, ECLI:EU:T:2003:328

Case C-355/12 *Nintendo Co. Ltd and Others v PC Box Srl and 9Net Srl,* EU:C:2014:25

Case T-289/09 Judgement of the General Court, *Omnicare, Inc. v OHIM*, ECLI:EU:T:2011:452

Case C-467/08 *Padawan SL v Sociedad General de Authores y Editores de España* (SGAE), EU:C:2010:620

Case C-145/10 *Painer v Standard Verglas GmbH* [2012] ECDR 6

Case C-281/10 P *PepsiCo v Grupo Promer* [2011] ECR I-10153; [2012] FSR 5

Case C-275/06 *Promusicae v Telefónica de España SAU*, ECLI:EU:C:2008:54

Case C-361/04 *Ruiz-Picasso v OHIM* [2006] ECR I-643

Case C-251/95 *Sabel BV v Puma AG and Rudolf Dassler Sport* [1998] ECR I-6191

Case C-406/10 *SAS Institute Inc. v World Programming Ltd* [2012] 3 CMLR 4

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Case C-173/98 *Sebago v GB-Unic SA* [1999] ECR I-4101

Case T-153/08 *Shenzhen Taiden v OHIM* [2010] ECR II-2517

Case T-411/14 *The Coca-Cola Company v OHIM*, ECLI:EU:T:2016:94

Case C-128/2011 *UsedSoft GmbH v Oracle International Corp.* ECR 2012 I-0000

Case C-265/2016 *VCAST Ltd v RTI S.p.A.*, EU:C:2017:913

Case C-442/07 *Verein Radetzky-Orden v Bundesvereinigung Kameradschaft 'Feldmarschall Radetzky'* [2008] ECR I-9223

Case C-174/15 *Vereniging Openbare Bibliotheken v Stichting Leenrecht*, ECLI:EU:C:2016:459

Joined Cases C-457/11 to C-460/11 *Verwertungsgesellschaft Wort (VG Wort) v Kyocera and Others* (C-457/11) *and Canon Deutschland GmbH* (C-458/11) *and Fujitsu Technology Solutions GmbH* (C-459/11) *and Hewlett-Packard GmbH* (C-460/11) *v Verwertungsgesellschaft Wort (VG Wort)*, ECLI:EU:C:2013:426

Case C-689/15 *W. F. Gözze Frottierweberei GmbH and Wolfgang Gözze v Verein Bremer Baumwollbörse*, ECLI:EU:C:2017:434

Italy

Italian Supreme Court, decision of 5 July 1990, No. 7077

Italian Supreme Court, decision of 7 December 1994, No. 10514

Italian Supreme Court, decision of 29 October 2015, No. 22118

Italian Supreme Court, decision of 13 November 2015, No. 23292

Italian Supreme Court, decision of 22 January 2018, No. 2402

Court of Florence, decision of 6 August 2003, in *AIDA*, 2004, n. 987

Court of Milan, decision of 13 September 2012, No. 9917, *Vitra Patente AG* v *High Tech srl*, R.G. 1983/2007

Court of Milan, decision of 17 February 2014, No. 2311 *Cassina Spa v High Tech Srl*, R.G. 37937/2011

Court of Milan, decision of 28 Novemebr 2006, in *Giur. Ann. Dir. Ind*., 2007, 530

Court of Milan, decision of 29 December 2006, *Giur. Ann. Dir. Ind*., 2007, 587

Court of Milan, decision of 5 June 2012, upheld by Court of Milan, decision of 24 July, 2012, *Riv. Dir. Ind, 2012*, II, 418

Court of Venice's decision of 4 February 2004, in *AIDA* 2005, n. 1032

The Netherlands

Kecofa BV v Lancome Parfums [2006] ECDR 26

Stokke v H3 Products (2013) ECLI: NL:HR:2013:BY1529, HR 22.02.2013, RvdW 2013

Stokke v Fikszo (2013) ECLI:NL:HR:2013:BY1532, HR 12.04.2013, RvdW 2013

Hauck v Stokke (2013) ECLI:NL:HR:2013:BY1533, HR 12.04.2013, RvdW 2013

France

Court of Cassation, *Barbir v Haarmann & Reimer* [2006] ECDR 28

Court of Cassation, decision of 7 March 1986, *Babolat Maillot Witt v Pachot*, C Cass, Assemblée plénière, No 82

Paris Court of Appeal, decision of 6 November 2013, No. 12/12518; Paris CA, decision of 8 February 2012, No. 11/02407

Tribunale de Grande Instance de Paris 3ème Chambre 4ème Section, decision of 25 September 2014, RG12/16149,

Paris Court of Appeal, decision of 6 December 2013, no 12/17382

Tribunal de Grande Instance de Paris *Rautureau Apple shoes v Sonia Rykiel créations et diffusion de modèles* 3ème chambre 4ème section RG12/16149, 25 September 2014

Germany

Federal Court of Justice, decision of 22 June 1995, Case No. I ZR 119/93, *Silberdistel* 28 IIC 140 ("Silver Thistle")

Federal Court of Justice, decision of 13 November 2013, Case No. IZR 143/12, *Geburtstagzug* ("Birthday Train")

Federal Court of Justice, Case No. I ZR 53/10 GRUR 2012, 58 *Seilzirkus* ("Spacenet")

Federal Court of Justice, decision of 9 October 2008, Case No. I ZR 126/06, [2009] GRUR 79, *Gebackpresse*

Higher Regional Court in Schleswig, GRUR-PR 2015, 1 – *Geburtstagszug II* ("Birthday Train II")

Higher Regional Court in Köln, decision of 20 February 2015, GRUR-PR 2015, *Airbrush-Urnen* ("Airbrush Urns")

United Kingdom

Amstrad Consumer Electronics Plc v British Phonographic Industry Limited [1986] FSR 159

Anacon Corp Ltd v Environmental Research Technology Ltd [1994] FSR 659

Breville Europe Ltd v Thorn EMI Domestic Appliances Ltd [1995] FSR 77

Brigit Foley Ltd v Ellott [1982] RPC 433

Burke v Spicer's Dress Designs [1936] 1 Ch 400

Burge v Swarbrick [2007] HCA 17, (2007) 234 ALR 204

George Hensher Ltd v Restawile Upholstery (Lancs) Ltd [1976] AC 64

Grimme Maschinenfabrik GmbH & Co KG v Derek Scott [2010] EWCA Civ. 1100

Hazel Grove Limited v Euro-League Leisure [1995] RPC 529

Interlego AG v Tyco Industries Inc [1998] RPC 343

Ladbroke v William Hill [1964] 1 All ER 465

Lucasfilm Ltd v Ainsworth [2008] EWHC 1878 (Ch); [2009] FSR 103

Lucasfilm Ltd v Ainsworth [2009] EWCA Civ. 1328; [2010] FSR 10

Lucasfilm Ltd v Ainsworth [2011] 3 WLR 487

Lucasfilm Ltd v Ainsworth [2012] 1 *AC* 208

Magmatic Ltd v PMS International Ltd [2014] EWCA Civ. 181

Menashe Business Mercantile Ltd v William Hill Organization Ltd [2003] RPC 31

Merlet v Mothercare P.L.C. [1984] 2 I.PR 456

Nova Productions Ltd v Mazooma Games Ltd & Others [2007] EWCA Civ. 219

PMS International Group Plc v Magmatic Ltd [2016] UKSC 12

Procter & Gamble Co v. Reckitt Benckiser (UK), Ltd [2007] EWCA Civ. 936

Samsung Electronics (UK) Ltd v Apple Inc [2012] EWCA Civ. 1339

Samsung Electronics Co Ltd v Apple Retail UK Ltd & Arnor [2014] EWCA Civ. 376

SAS Institute Inc. v World Programming Ltd [2013] EWHC 69 (Ch)

Sawkins v Hyperion Records [2005] EWCA Civ. 565

Schultz (UK) v Werit (UK) Ltd (Rev 1) [2013] UKSC 16

Sheldon & Hammond Pty Ltd v Metrokan Inc., 135 FCR 34

Smith, Kline and French Laboratories Ltd v Evans Medical Ltd [1989] FSR 513

United Wire Ltd v Screen Repair Services (Scotland) Ltd [2000] 4 All ER 353

University of London Press v University Tutorial Press [1916] 2 Ch 209

EUIPO's case law

OHIM Third Board of Appeal, decision of 26 March 2010 – R 9/2008-3, *Crocs*, *Inc*. *v Holey Soles Holdings Ltd*

OHIM Third Board of Appeal, decision of 22 November 2006, *Daka Research Inc. v Ampel 24 Vertiebs-GmbH & Co. KG*

OHIM Invalidity Division, decision of 27 April 2004, *Eredu S. Coop v Arrmet S.r.l.*

OHIM third Board of Appeal, decision of 14 September 2015, *Hessy s.r.o. v Crocs, Inc*.

OHIM Third Board of Appeal, decision of 2 September 2008, *Imperial International Limited v Handl Cookware Limited*

OHIM Board of Appeal, decision of 11 July 2007, *Kirschenhofer GmbH v WS Teleshop International Handles-GmbH*

OHIM third Board of Appeal, decision of 4 November 2010, *Mafin S.p.A. v Leng-D'Or S.A.*

OHIM Invalidity Division, decision of 10 July 2014, *Mariusz Adamski Adams Group v Abakus Direct Ltd*

OHIM Invalidity Division, decision of 24 February 2015, *Napco Beds B.V. v Leopold Meijnen Oosterbaan*

OHIM Invalidity Division, decision of 30 August 2005, *Rodi Commercial S.A. v ISCA S.p.A.*

OHIM Invalidity Division, decision of 05 July 2013, *Samsung Electronics CO. Limited et al. v Apple Inc*

Australia

Bonz Group v Cooke [1994] 3 *NZLR* 216 (High Court of New Zealand)

Coogi Australia Ltd v Hysport International Pty, 86 FCR 154 (1998)

U.S.A.

Aalmuhammed v Lee 202 F.3d 12271229-30 (9th Cir. 2000)

Aitken, Hazen, Hoffman, Etc. v Empire Const. Co., 542 F. Supp. 252 (D. Neb. 1982)

Alice Corp. Pty. Ltd. v V CLS Bank Int'l 134 S. Ct. 2347 (2014)

American Fruit Growers, Inc v Brodgex Co., 283 U.S. 1 (1931)

Animal Fair Inc. v Amfesco Industries. Inc. 620 F.Supp 175 (D.C. Minn. 1985), *aff. d without op*., 794 F.2d 678 (8th Cir. 1986)

Arris group Inc. v British Telecommunications Plc., 639 F.3d 1368 (Fed. Cir. 2011)

Barbour v Head, 178 F. Supp. 2d 748, 764 (S.D. Tex. 2002)

Bauer & Cie v O'Donnel 229, U.S. 1, 10 (1913)

Baystate Technologies, Inc. v Bentley Sys., Inc., 946 F. Supp. 1079 (D. Mass. 1996)

Brandir Int'l, Inc. v Cascade Pac. Lumber Co., 834 F.2d 1142, 1142 (2nd Cir. 1987)

Capitol Records, LLC v ReDigi, Inc. 934 F.Supp. 2D 640 (S.D.N.Y. 2013)

Carol Barnhart, Inc. v Economy Cover Corp., 773 F.2d 411 (2nd Cir. 1985)

Cartoon Network, LP v CSC Holdings, Inc. 536, F.3d 121 (2nd Cir. 2008)

Certain Digital Models, Inv. No 337-TA-833, U.S.I.T.C. (Apr. 10, 2014)

Certain Network Devices, Related Software and Components Thereof, U.S.I.T.C. Washington D.C. 20436, Investigation No. 337-TA-944

Chevron U.S.A., Inc. v Natural Res. Def. Council, Inc., 467 U.S. 837, 843 (1984)

Chosun Int'l, Inc. v Crisha Creations, Ltd., 413 F. 3d 324, 329 (2nd Cir. 2005)

ClearCorrect Operating, LLC v ITC, 810 F.3d 1283, 1287 (Fed. Cir. 2015)

Comics v Towel, 989 F. Supp. 2d 948 (C.D. Cal 2013)

Computer Associates Int'l v Altai inc., 982 F.2d 693 (2nd Circ. 1992)

Dastar Corp. v Twentieth Century Fox Film Corp., 539 U.S. 23 (2003)

DC Comics v Towle 989 F.Supp. 2d 948 (C.D. Cal. 2013)

DC Comics v Towle, 802 F.3d 1012 (9th Cir. 2015)

Digitech Image Technologies, LLC v Electronics for Imaging, Inc. 758 F.3d 1344 (2014)

DSU Med. Corp. V JSM Co., Ltd., 471 F3d 1293 (Fed. Cir. 2006)

Eales v Environmental Lifestyles, Inc. 958 F.2d 876 (9th Circ. 1992)

Ecodyne Corp v Croll-Reynolds Engineering Co., 491 F.Supp. 194 (D. Conn. 1979)

Feist Publ'ns, Inc. v Rural Tel. Serv. Co., 449 U.S. 340, 345 (1991)

Forest River, Inc. v Heartland Recreational Vehicles, LLC, 753 F. Supp. 2d 753, 758 (N.D. Ind. 2010)

Gay Toys, Inc., v Buddy L Corp., 703 F.2d 970, 973 (6th Cir. 1983)

Gen. Universal Sys., Inc. v Lee, 379 F.3d 131, 142 (5th Cir. 2004)

Global-Tech Appliances, Inc. et al. v SEB S.A., 563 U.S. 754 (2011)

Graver Tank & Mfg. Co. v Linde Air Prods. Co., 339 U.S. 605 (1950)

Hasbro Bradley, Inc. v Sparkle Toys, Inc. 780 F.2d 189, 192 (2nd Cir. 1985)

Herbert Rosenthal Jewelry Corp. v Kalpakian 446 F.2d 738 (9th Cir. 1971)

Infodeck, Inc. v Meredith-Webb Printing Co., 830 F. Supp. 614, 623 (N.D. Ga. 1993)

Inhale, Inc. v Starbuzz Tobacco, Inc., 793 F.3d 446 (9th Cir. 2014)

In re Nuijten 500 F.3d 1346 (Fed. Cir. 2007)

Kieselstein-Cord v Accessories by Pearl, Inc. 632 F.2d 989 (2nd Circ. 1980)

Lanard Toys Ltd. V Novelty, Inc., 2010 WL 1452527 (April 13, 2010)

Lang v Pacific Marine & Supply Co., 895 F.2d 761

Lego A/S v Best-Lock Constr. Toys, Inc. 874 F.Supp.2d 75, 97 (D. Conn 2012)

Mattel, Inc. v MGA Entertainment, Inc., No. 11-56357 (9th Cir. 2013)

Mayo Collaborative Services v Prometheus Laboratories, Inc. 132 S. Ct 1298, 566 U.S. 66

Mendenhall v Cedarapidis 5 F.3d 1557, 1579 (Fed. Cir. 1993)

Meshwerks, Inc. v Toyota Motor Sales U.S.A., Inc., 528 F.3d 1258 (10th Cir. 2008)

Metro-Goldwyn Mayer Studios, Inc. v Grokster, *Ltd*, 125 S. Ct. 2764 (2005)

Microsoft Corp. v AT&t Corp., 550 U.S. 437, 449-52(2007)

Moleculon Research Corp. v CBS, Inc. 793 F.2d 1261, 1272 (Fed. Cir. 1986)

Nichols v Universal Pictures Corp 45 F.2d 119 (2nd Cir. 1930), cert. denied, 282 U.S. 902 (1931)

Pivot Point Int'l v Charlene Prods., Inc. 372 F.3d 913 (7th Cir. 2004)

Publ'ns Int'l, Ltd v Meredith Corp. 88 F.3d 473

Rolls-Royce Motors Ltd v a & a Fiberglass Inc., 428 F.Supp. 689 (1976)

Star Athletica, L.L.C. v Varsity Brands, Inc., 137 S.Ct. 1002 (2017)

Stern Electronics Inc. v Kaufman, 669 F.2d 82 (2nd Cir. 1982), aff'g 523 F. Supp. 635 (EDNY 1981)

Transocean Offshore Deepwater Drilling, Inc. v Maersk Contractors U.S.A., Inc. 617 F.3d 1296

Universal Furniture Int'l, Inc. v Collezione Europa USA, Inc., 618 F.3d 417, 433 (4th Cir. 2010)

Vernor v Autodesk, Inc., 621 F.3d 1102, 96 U.S.P.Q.2d 1201 (9th Cir. 2010)

Warner-Jenkinson Co. V Hilton Davis Chem. Co., 520 U.S. 17, 39-40 (1997)

Whelan v United States, 11 U.S. 112 (1812)

Chapter I

The Magic World of Three-Dimensional Printing Becomes Reality

1. An Overview of Three-Dimensional Printing: From Digital Designs to Finished Products

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1. An Overview of Three-Dimensional Printing: From Digital Designs to Finished Products

Three-dimensional printing (from now on "3DP") stands for a set of Additive Manufacturing ("AM") technologies that build physical objects layer upon layer, by the consecutive addition of material such as plastic, metal, ceramics, composite, etc., which may be liquid, powder or filament[1].

In contrast with traditional "subtractive" manufacturing processes, which postulate the gradual removal of material (e.g. cutting or drilling), 3DP relies on an "additive" process.

Every object produced by 3DP begins its design process with a digital model, which is embedded in the so-called "Computer-Aided Design file" (from now on "CAD file"). A CAD model can be obtained from scratch, by using digital modelling software (e.g. CAD software), by scanning an existing object, and by means of photogrammetry.

More in detail, three main modelling techniques can be used to obtain a CAD model: wireframe modelling, surface modelling and solid modelling.

A wireframe model is the simplest representation of an object that is defined by edges (lines curves) and vertices (corners or points in space). The logical evolution of a wireframe model is a "surface" model, which is defined by edges, vertices and faces (surfaces) in x, y and z. A wireframe model can, in fact, be "converted" into a surface model by adding theses faces.

Surface models, however, do not contain information about the physical properties of the object (mass, volume and centre of gravity).

Alternatively, it is possible to create a 3D solid model of a design, through the composition of pre-rendered shapes, so-called primitives (cones, spheres, cubes, cylinders, etc.). As opposed to a 3D surface model, a 3D solid model defines also the mass, material and dynamic properties of the design (i.e. volume, density, centre of gravity and stress-strain).

Therefore, from the creator's perspective, CAD programs provide "*a virtual working space where objects can be created and manipulated with the software tools provided by the program. In this virtual work space, the creator can make different kind of shapes and objects; control the mesh and texture of an object, manipulate the object's background, shading and lighting however he or she feels*"[2].

[1] 3DP is a non-technical term to define a group of technologies that, according to the ISO standard terminology, are technically called "Additive Manufacturing" technologies. See ISO/ASTM52900-15, *Standard Terminology for Additive Manufacturing – General Principles – Terminology.*

[2] Redwood; Schöffer; Garret (2017).

It is possible to imaginatively create the design of an object – with different colours, textures, and embedded build information – and then add realistic light effects and shadows in the background. It is likewise possible to add information that is not strictly necessary for manufacturing, such as text notes, labels, views, parts lists, and legends that typically involve modest creativity[3]. A CAD file can also be obtained by scanning an existing product or by means of photogrammetry.

There are many different scanning technologies that enable to capture information, including geometry, colour and texture, from a real-world object. The information so captured is then transformed into a digital mesh made of millions of vertices, which can be modified by using 3D modelling software[4].

Scholarship distinguishes between two main categories of scanners: contact scanners, which require the scanner to physically touch the object, usually with the aid of a tracing pen that is connected to an articulated arm, and noncontact scanners that capture the surface data of the object through the emission of X-rays[5].

If the dimensions of the scanner are substantial enough, almost everything may potentially be scanned, including a car, a building, a person's whole body or even larger items. Yet, most of the times, post-processing activity is needed before the digital model is ready for manufacturing purposes.

Photogrammetry is a photographic technique by which many pictures of an object are taken with a camera from different angles and then uploaded onto specific software that stitch them together, in order to reproduce the object in a full three-dimensional perspective.

The computer program identifies 2D features that are present in various pictures and creates the corresponding 3D points. The software output as such, *i.e.* the photogrammetric mesh, is not suitable for 3DP, but needs post-processing activity.

The second stage in the design process requires exporting the CAD model into a file format, such as the STL, OBJ, AMF and 3MF format, that the printing software can read.

A STL file represents a 3D surface as an assembly of triangles; it merely contains data describing the geometry of the designed object, but does not embed information as to colours, materials and constellations, unlike AMF and 3MF files.

3MF files feature geometry representation similar to AMF files, but they also solve interoperability issues, are expressed in a friendlier format that is readable by a variety of

[3] Osborn (2017), 47.
[4] Vuaghan (2012), 131 et ss.
[5] *Id*.

printers, could work on different devices and operate across numerous platforms[6]. Moreover, besides the digital design, a 3MF file embeds additional content, such as digital signatures, thumbnail images of the model and 3D texture information.

Once the file is saved in a printable format, it must then be converted, with the assistance of specialized software ("Computer-Aided Manufacturing" or "CAM" software), into sliced instructions for the 3D printer ("GCODE" instructions).

More precisely, the third phase of a traditional digital design process sees the file going through two software processes: "slicing" and "sending". The file needs first be processed by CAM software, commonly referred to as "slicer". The latter slices the CAD model into hundreds of thin layers and outputs a GCODE, which contains a list of instructions for the printer to read and follow.

These coded instructions are tailored to a specific type of printer, and determine, for instance, the speed and the path to be followed by the extruder.

GCODE is a programming language that consists of letters and numbers. Typically a line of GCODE begins with letter G, which tells the machine which kind of motion is required. However, all the alphabet letters may appear (for instance, S controls the speed and F defines the feed rate)[7].

Normally, the creation of GCODE is an interactive process, in the sense that a user has to provide CAM software with information, such as the infill, the extruder temperature, the printing speed, the layer thickness, etc.

Accordingly, in most instances the GCODE is not written directly by humans, but automatically generated by software, on the basis of some indications provided by the user. It cannot be excluded, however, that a programmer decides to write GCODE from scratch, without the aid of slicing software[8].

Finally, the GCODE must be translated into machine language (a string of ones and zeros). The last category of software that is run on the host computer is called "host" or "client" software. This software loads the GCODE and sends the specific tool path instructions to the printer over WIFI or USB connection. Moreover, it provides a software interface that enables users to track and control the actual print (i.e. pause or stop the print, modify the temperature of the extruder or accelerate the speed in real time).

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[6] For a more detailed explanation of what is the 3MF format *see*: https://3mf.io/what-is-3mf/.

[7] For an explanation of what is GCOD, s*ee* Victoria (2016), Scan2CAD's blog, available: http://www.scan2cad.com/tips/guide-to-cad-for-cnc-what-is-g-code/.

[8] The question then arises as to whether GCODE instructions deserve copyright protection as computer programs. To this end, see chapter II of the present thesis, dealing with the interface between 3DP and copyright law.

Printers that are designed in "untethered" mode runs without computer connection. In such a case, the client program is unnecessary, since the GCODE instructions are saved on removable media, such as a SD card or USB flash drive, and then plugged into the printer directly[9].

It should also be noted that some client programs, such as Repetier Host or Pronterface, include also a slicer. In such cases, it is possible to use just one interface to generate GCODE from a CAD model, move the GCODE file onto the printer, and control its execution. Ultimately, the firmware – i.e. software running on the printer itself – interprets the GCODE into movement, one command at time.

In order to realize the final print out, 3DP processes use different techniques[10], such as selective laser sintering[11], fused deposition modelling[12] and stereolitography[13]. Although a comprehensive review of all such techniques goes beyond the scope of the present inquiry, it must be noted that they share two fundamental features: first, they owe their origin to a digital file, which is a set of data defining the object to be printed; second, when such file is sent to the printer, the object is created by placing successive layers of material.

2. Historical Roots and Current Perspectives of Three-Dimensional Printing

Although 3DP has received greater attention over the last years, its roots date back to the late 1970s. Since 3DP enables a fast, cost-effective and low volume production, in its early days the technology was primarily used for prototyping purposes.

Today 3DP is also widely applied beyond prototyping, in full-scale production or post-production customization[14]. Estimates predict that by 2020 around 50% of the output of 3D printers will be final products[15].

Currently, 3DP is used across multiple industrial sectors, with applications, *inter alia*, in the automotive, aerospace, military, healthcare, biotech, fashion, and food industries.

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[9] France (2013), chapter 2.

[10] For a more comprehensive overview, s*ee:* Tuomi; Chekurov; Partanen (2017) and Redwood; Schöffer; Garret (2017).

[11] Selective laser sintering is an AM technique that involves the use of a high-energy laser to selectively fuse the particles of powder material into a solid part.

[12] Fused deposition modelling is an AM technique that involves the extrusion of material in filament form trough a heated nozzle.

[13] Stereolitography is an AM technique that uses photopolymerization, i.e. a process by which liquid polymer is hardened when exposed to the light of a UV laser.

[14] 3DP is also used to produce components of end products and for repair purposes.

[15] The Economist (10 February 2011) available at: http://www.economist.com/node/18114221/.

Furthermore, in more recent years the technology has crossed over into the consumer sphere. In fact, the expiry of crucial patents and the development of the open source hardware ("OSH") movement have contributed to the diffusion of the technology at consumer level.

OSH is hardware whose source files are made available for anyone to use. The idea is to democratize hardware production on the model of open source software and circumvent proprietary lock-ins imposed by patent holders.

Hence, traditional open source software licences, such as the GNU General Public Licence and Creative Commons, are transposed to hardware. The specifications of hardware (*e.g.* CAD files, mechanical drawings, diagrams, schematics, printed circuit board layout data) are freely available online for anyone to use, modify and update.

As in open source software, the licence shall allow any derivative work to be distributed under the same terms as the licence of the original works[16].

OSH has been the enabler of a broader social phenomenon called the "Maker movement". Makers form a community of hackers that intersects with the do-it-yourself ("DIY") culture. They are "*bringing the Web's culture and collaboration to the process of making*"[17].

In short, as Anderson observes, key assets of the Maker movements are: people using digital tools to create designs for new products ("digital DIY"); a cultural norm to share those digital designs with other online communities; the usage of common standards for blueprints that allows anyone to send their design to commercial service providers[18].

This movement has been active for the last decade. Its origins date back to 2005, when Tim O'Reilly launched Make magazine. In 2006 the first Maker Fair gathered in Silicon Valley[19]. Another milestone came the year after, when Adrian Bowyer launched the Replicating Rapid Prototyping ("RepRap") project at the University of Bath.

The RepRap project was implemented after some key patents, covering the "fused deposition modelling" technique, had expired. The vision of the research team was to create an OSH 3D printer capable of reproducing its own spare parts. Hence, the digital designs of the printer were made available under a GNU General Public Licence.

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[16] There are many examples of OSH derivatives. In the 3DP community the 3D printer "MakerBot" is a derivative built on the RepRap open source 3D printer.

[17] Anderson (2012), 21

[18] *Id*.

[19] Today, Maker fairs are very important events, where both hobbyists and professionals show their creations. In June 2014, a Maker Fair was held as the White House. Hacker spaces and "Fab Labs" are also proliferating all around the world. A Fab Lab is a "fabrication laboratory" accessible to the public that is equipped with tools necessary to 3D print objects, such as 3D printers, laser cutters, routers, 3DP materials and open source software. For an overview of the Fabfoundation *see:* http://fabfoundation.org/index.php/what-is-a-fab-lab/index.html.

The development of OSH initiatives has contributed to a steady improvement in 3DP hardware, a reduction in cost and a wider range of available materials. After the RepRap project, the first consumer 3D printers, namely Makerbot and Ultimaker, came to light in 2009 and 2010. The community of Makers began to flourish thereon.

Furthermore, the availability of open source digital modelling software that is easy to use, together with the development of 3DP platforms benefiting from networking technologies, have all fostered the creation of a communication infrastructure that is a powerful tool for co-creation.

Internet operators enable hackers, hobbyists, professionals and ordinary people to connect to a vast distributed network where they can upload, download, share, edit, and remix their CAD models.

The number of online 3DP platforms is steadily increasing and include: CAD files' repositories that offer hosting services (Thingiverse and Repables); 3DP marketplaces that host and sell third-party CAD files (Shapeways and Cuboyo); platforms that also provide their own designs and/or offer co-design activities (Sculpteo, iMaterialise and Shapeways); platforms offering crowdsourcing services (Trinkle); platforms offering printing and delivery services on demand (MyMiniFactory, Shapeways and Sculpteo).

Hence, 3DP platforms are diverse and enable users to take an increasing part in co-design, co-manufacturing, up to the distribution stage.

Everyone can now create a digital representation of a physical object, and share it or sell it online. Where products are not capable of being printed by means of personal 3D printer, users can outsource manufacturing to bureau services offering printing and delivery services on demand.

3. Three-Dimensional Printing vis-à-vis Traditional Manufacturing Processes

The main advantages of 3DP, as compared to more traditional manufacturing processes, can be summarised as follows.

First, 3DP facilitates the creation, in a wide range of materials, of more complex shapes and geometries[20], as well as the optimization of products' functionality. Design ideas can be easily developed with the aid of digital modelling software. CAD-based designs are then sent to a

[20] For instance, 3DP enables to produce objects with cavities and internal features that would not be easily fabricated with traditional manufacturing techniques. On this *see* a contribution published on Sculpteo's blog by Bensoussan (2017), available at: https://www.sculpteo.com/blog/2017/01/18/3d-printing-benefits-impossible-designs-and-internal-channels/.

printer and manufactured in one step, with no need for product assembly. This, in turn, may considerably reduce costs and manufacturing time.

Second, 3DP offers an alternative to vertically integrated economies of scale designed for mass-production by centralized factories, to the extent that it enables a cost-effective production in low unit volumes. By way of explanation, traditional manufacturing methods rely on economies of scale to recoup the considerable upfront investment that is made in order to set up a centralized production system.

In economies of scale, the increased total output of a product reduces the price per unit, as the initial high fixed costs are spread across a larger amount of items. By contrast, with 3DP, the price per unit remains stable if one or ten thousand products are manufactured, thus making economies of scale unnecessary.

Third, 3DP presents a new way to incentivize a "decentralized" and "distributed" production system that is driven by local demand rather than by economics of supply. As a result, 3DP can have a profound impact on existing supply chain and distribution channels.

With traditional manufacturing, materials are shipped to a centralized factory that is in charge of product development, including moulding and product assembly. Thereafter, the finished product enters the supply chain, usually being stored in a stockroom before it is delivered to the retailer or directly to the costumer.

With 3DP, production can take place closer to the point of consumption, by printing an item when an order is placed. If products are printed only upon request, the risk to have unsold stock diminishes. Accordingly, 3DP contributes to minimize inventory, while meeting market demand. Smaller inventories require less storage capacities and contribute to maximize profits[21].

Fourth, 3DP allows emergent designers to enter the market, given the possibility to cost-effectively produce things on a small scale. Moreover, 3DP promises to bring about an increased democratization of production processes, through an active participation of consumers not only in product development, but also in the design and manufacturing phases.

In other words, consumers (or "prosumers") are now integrated in the value chain and take part in co-creation activities with firms and with their peers. From time to time, co-creation activities result in user-led *innovation*[22].

[21] Sedhom (2015). An analogy can be drawn with "print-on-demand" (or "POD") in the publishing industry.

[22] Co-creation activities in the 3DP landscape do not always lead to user-led "innovation". Most 3DP platforms enable users to customize their designs, but are not also vectors of innovation, which presupposes successful commercialization of products. On this *see* the case study conducted by Ranya et al. (2015) showing that, out of twenty-two 3DP platforms, only Thingiverse entails innovation on the part of users. *See* also Ballardini (2016).

Fifth, new business models, aimed at making the most out of digitization of physical products and decentralized manufacturing, begin to take shape. Emerging business models tend to focus upon mass-scale customization of products, which may prove extremely beneficial to consumers and society at large. By way of example, companies such as Shapeways, Materialise, Mekieworld, and Nervous enable the personalization of, *inter alia*, household appliances, jewellery, toys, and garments.

In fact, by virtue of digital modelling techniques, the design of an object can be improved or personalized digitally, with no need to create a mould for each product variation. Furthermore, as discussed above, 3D printing a single personalized item may still be cost-effective.

Sixth, 3DP has a low environmental impact, since it makes use of durable, recyclable and non-polluting feedstock. The quantity of raw material that is needed is rather low. Also, if a CAD file is sent directly to a local 3D printer, the transportation of products is not necessary and pollution levels are substantially reduced.

4. Research Question and Methodology

From the considerations made so far it emerges that 3DP technology has evolved in two different directions: the industrial 3DP sector, and the personal or consumer 3DP sector. The latter is the core of the present work.

In fact, the diffusion of this technology among consumers shows the potential for a set of disruptive effects[23]. Some argue that the "fourth industrial revolution" will see manufacturing becoming "digital" and "desktop".

On the one hand, the possibility to convert a digital file into a physical product, by sending the coded instructions to a printer, as well as to digitize a physical product by scanning it, is in itself revolutionary. A first wave of disruption was caused by the digitization of information, whereas a new wave of disruption might be generated by the digitization of physical objects.

On the other hand, individual makers have gained access to powerful tools of design, production and distribution. Although personal 3D printers are still far from being ubiquitous, some commentators suggest that: "*it is just a matter of time until regular people will rip, mix and burn physical objects as effortlessly as they edit a digital photograph*"[24].

[23] Among others, Doherty (2012).
[24] Lipson; Kurman (2013).

At present, consumer 3DP is not sufficiently sophisticated and fast to allow for the manufacturing of a wide array of products in a cost-effective way. The question is whether such technology will or will not mature to the point of becoming potentially "disruptive".

In theory, 3DP may affect established socioeconomic paradigms and pose unprecedented legal challenges. The present contribution unravels the implications that 3DP might have for Intellectual Property law.

The aim of this work is to highlight whether and to what extent 3DP in general, and the blurred line between the digital and analogue dimension in particular, fit into the existing paradigms of Intellectual Property Law. This is the research question guiding the analysis.

More in detail, this work sheds some light on whether the current regulatory framework of different IPRs offers adequate protection to various stakeholders, in an emerging scenario where all real-life objects can be first created as, or later converted into, digital files. Hence, delineating what legal treatment shall be reserved to such digital files becomes of utmost importance.

At the time IP norms were first implemented, 3DP was not on the horizon of the legislature. This work evaluates the potential effects of this emerging technology, envision what kind of repercussions they could have on IP law and investigate whether such repercussions are truly disruptive, as scholarship suggests[25].

Moreover, this research appraises the claim that 3DP may facilitate widespread infringement of all IPRs. In theory, CAD files that are shared through online platforms may embed products protected under one or more IPRs, which could then be manufactured on a decentralized basis by means of 3DP.

This, in turn, is giving serious cause for concern to right owners. Yet, a more careful inquiry into digital-design-file-sharing aims to show that this phenomenon does not pose an immediate threat to right owners.

It must also be considered that IPRs are territorial rights, meaning that they are normally enforced in the territory of the country that has granted the rights in the first place, by virtue of national law. The possibility to distribute CAD files over the Internet, however, clashes with the territorial application of IP law.

This work adopts a comparative perspective, in an attempt to demonstrate the extent to which the current harmonization of IP law at EU level, the existing discrepancies among national

[25] *Inter alia*, Owoeye; Adewale (2016); W. Dagne; Dubeau (2015); Weinberg (2010); Van Overwalle; Brean (2015); Osborn (2014); Manyika (2013).

legislations across the EU, as well as between EU and U.S. legal sources, may impact the 3DP analysis.

The legal framework of each IPR is first delineated, taking as a reference point international, European and national legal systems. Different judicial sources are also reviewed, in order to better define the contours of different IPRs and, where feasible, apply analogically existing case law to potential scenarios in the 3DP context.

Particular attention is also devoted to relevant policy documents. In particular, policy options put forward in the EU Commission's *Legal Review on Industrial Design Protection in Europe*[26] are scrutinized and critically assessed.

Academic scholarship dealing with the intersection between 3DP and IP law is examined within a critical framework. This work questions existing prior inferences of the literature, and adopts a completely different perspective on some fundamental issues, both from the side of protection and of infringement.

This research is interdisciplinary, since it conducts legal analysis in parallel with a more exhaustive and comprehensive investigation into technical aspects. The relevance of combining legal discourses with a proper and deep understanding of 3DP technology is evidenced by the fact that different design, scanning, and printing techniques may well lead to different legal outcomes.

Although this contribution specifically addresses the interface between 3DP and IP law, the next sections provide a more general insight into the socioeconomic implications that 3DP may have.

5. The Implications of Three-Dimensional Printing For Our Economy: Economics of Information v Economics of Goods

It has traditionally been posited that economics of goods is based on "scarcity", whereas economics of information is based on "abundance".

The term "scarcity" is not used in absolute terms, but in relation to demand. Resources that are needed to produce (physical) goods – resources that can be material or non-material, such as money, labour force, machinery, rare materials, services and time – are scarce, whereas the needs and wants of people are endless.

Market equilibrium is achieved when supply equals demand. When the demand of a good exceeds the supply of the same good, leading to scarcity, the price of the good goes up. A rise

[26] Under the contract with DG Internal Market, Industry, Entrepreneurship and SMEs (MARKT2014/083/D), published in April 2016.

in price of a good almost always results in the demand curve sloping down, because financial resources to purchase goods are also scarce.

Information has some peculiar characteristics. Wu describes it as "*a complex abstraction that has been the subject of intense study by scientists and philosophers for more than a century*"[27].

The most relevant features pertaining to information as an intangible, un-owned, and inexhaustible good are "non-excludability", "non-rivalry" and a low marginal cost of production.

Information is non-excludable in nature, since it is almost impossible to stop non-payers from having access to it. Moreover, information is a non-rivalrous good, since more than one person can consume it at the same time. As economist Paul Samuelson puts it "each individual's consumption of such a good leads to no subtractions from any other individual's consumption of that good"[28].

Those who acknowledge that information resources exhibit special characteristics as compared to material things – what Dan Schiller has named the "information exceptionalism" hypothesis –highlight that information is in abundance or, said otherwise, it lacks problems of scarcity[29].

Economists define it as the problem of "public goods" leading to market failures, which can be categorised in terms of underproduction or suboptimal distribution

Underproduction is closely related to non-exclusion[30]. The underpinning idea is that if it is difficult to exclude third parties from freely accessing and consuming a good ("free-riding"), there is no incentive to invest in the provision of such a good in the first place.

The problem of suboptimal distribution of information is tied to the fact that, once created, information can "*be transmitted to others with no loss of quality and at virtually no cost"* (zero marginal cost)[31]: information, therefore, is "infinite in supply".

An important function of IPRs is to artificially create scarcity. IPRs are monopoly rights that prevent the creation of a competitive market for certain works or inventions, thereby raising price above marginal cost.

As competitors are prevented from selling copies of a particular product, fewer people will buy it at a higher price than if it was distributed on a competitive basis[32]. In this way, right

[27] WU (2016), 2.
[28] Samuelson (1954).
[29] Shiller (1997).
[30] WU (2016).
[31] Lemley (2014).

owners have an incentive to produce creative and innovative outputs in the first place, since they know that they will have a return on their upfront investment.

Whether non-excludability and non-rivalry should be considered some intrinsic qualities of information remains an open question.

Lessig, one of the promoters of free and distributed information, believes that it is the nature of the good in question that determines whether it should fall within the "commons" or "markets" category[33]. This division is assumed to be straightforward and constant over time: information is non-rivalrous and, therefore, ill-suited for markets and more adapt for commons, whereas tangible resources are rivalrous and better off organised in a market-based economy[34].

While IPRs are "state sanctioned monopolies" – i.e. a legal construct that does not exist independently of the state – "*private tangible property is grounded in objectively existing limitations in the real world*"[35].

In their study, Söderberg et al. criticize the too simplistic approach that draws a "*once-and-for-all, a priori, demarcation line between informational resources and physical goods*"[36].

In essence, Söderberg et al. question the "information exceptionalism hypothesis", according to which, in a world characterized by the omnipresence of scarcity, non-rivalrous information becomes an anomaly in economic science, to be treated as a special problem.

In their view, what is important to understand is that the notion of scarcity is itself a product of the economics of science, rather than a consequence of the *nature* of information.

In fact, as scholarship puts it, 3DP questions the "*positive existence of scarcity in the physical world*" too: physical goods can almost always be transformed in bits of information, which, some would argue, want to be free[37].

Indeed, some currents running through the extant literature suggest that 3DP is bringing society into a "post-scarcity" age[38], in which "objects are theoretically as abundant as information became as a result of personal computing and the Internet"[39].

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32 Lemley (1997), 9.

33 Lessig (2001), 94; Söderberg; Daoud (2012), 9.

34 Nonetheless, Lessig concedes that markets and commons can coexist side-by-side.

35 Söderberg; Daoud (2012), 10. Many scholars, including Benkler (2006), have underscored the special characteristics of information as compared to physical objects, in order to justify the "information exceptionalism" theory.

36 Söderberg; Daoud (2012), 13.

37 *Id.*, 16.

38 Lemley (2014); Rifkin (2014); Daly (2016), 8.

39 Daly (2016), 9.

The traditional distinction between the real and virtual realm, and by implication between private property and IP, as well as between markets and commons, becomes less self-evident the more the hardware and software technologies converge[40]. Accordingly, every decision on how to treat a particular good – as a scarce or abundant resource – is necessarily political.
In his scholarly work, Rifkin opines that 3DP technologies may exacerbate the "contradiction at the heart of capitalism", which can be described as follows.
The driving force of capitalism is greater productivity. Technological change, in turn, increases productivity, "*allowing the seller to produce more goods at a cheaper cost per unit*"[41]. The increased supply of cheaper goods forces competitors to invest in their own technologies "*in order to sell their goods even more cheaply and win back or draw in new consumers (or both)*"[42]. Hence, the process just described shows that technological development spurs competition.
Competition, in turn, will lead to a point of "extreme productivity", with "near zero marginal cost", that is optimally efficient for attaining the general welfare. Nonetheless, when this point is reached – and goods and services become almost free – profit margins vanish and the logic underpinning capitalism collapses[43].
3DP is hailed as being a game-changer that may cause a significant shift in the current way of producing and distributing goods and lead to a rapid growth in productivity and efficiency.
Lemley describes 3DP as a technology that radically reduces production and distribution costs, contributing towards a "*not too distant world in which most things that people want can be downloaded and created on site for very little money – essentially for the cost of raw materials*"[44].
Costs that are destined to drop substantially by virtue of 3DP include: costs of design, as free and open source programs can be used for product design purposes; costs of building materials, which include inexpensive and recyclable feedstock, such as glass, sand, paper, wood, ceramics, and stainless steel; costs involved in fuel and energy resources; costs related to marketing activities, as advertising is mainly attained through global marketing websites; labour costs, as workforce is largely supplanted by technology, and little human input is needed in the manufacturing process; distribution and delivery costs, as products can be

[40] Söderberg; Daoud (2012), 12.
[41] Rifkin (2014), 11.
[42] *Id.*
[43] *Id.*, 60.
[44] Lemley (2014), 462. Unlike works of authorship, however, 3D-printed products need to assume the form of tangible copies to be enjoyed. The economic bottleneck, then, may lie in the cost and delivery of the raw materials.

manufactured on-site upon request[45]; the expense and time involved in education, as educational programs are flourishing in community centres, such as Fab Labs.

As a result, productivity may soon be boosted to the point where the marginal cost of manufacturing and distributing things is near zero. A world where almost every good and service is nearly free and profit is defunct threatens the grounding principle of capitalist theory. The economic paradigm underpinning capitalism is organized around scarcity, and when things become nearly *free* suddenly scarcity is replaced by abundance.

Moreover, some scholars argue, we are heading towards the "democratization of innovation", from idea generation to the design and fabrication of products. In fact, as the price of computers, software, 3D printing and energy have decreased substantially, we are experiencing an unexpected involvement of users in the innovation process. Even when consumers do not possess a home 3D printer, they can go to a local print shop and continue to play a leading role in the manufacturing process.

In the opinion of Rifkin, the democratization of innovation means that "*anyone and eventually everyone can access the means of production making the question of who should own and control such means irrelevant, and capitalism along with it*"[46].

In light of the foregoing it emerges that – not without fierce criticism – information has been understood as having peculiar properties as compared to physical goods, which are often invoked to justify special legal regimes, such as IPRs.

Traditional thinking within law and economics would argue that the justification for protecting IPRs is to create an incentive for cultural production and innovation, by awarding a monopoly to the creator or inventor.

Clearly, there should be a trade off between the grant of exclusive rights to the original developer and freedom of subsequent improvers. In order to strike a fair balance between the two, IPRs are limited in scope and in duration.

It is worth noticing, however, that in more recent times many commentators have casted doubts on the justificatory rhetoric that has spawned in the pre-digital era, according to which IPRs constitute an incentive means. In other terms, it has been questioned whether the grant of a monopoly right is still necessary as a matter of economic incentive.

[45] Nonetheless, raw materials still have to be transported and delivered. Moreover, not every item can be made with recyclable feedstock.

[46] Rifkin (2014), 77.

Before the digital revolution, creating, producing and distributing creative content required a substantial investment, including the facilities to manufacture hard copies of a work (such as a book, a CD or a DVD) and the commercial network to distribute those copies[47].

Yet, the Internet and digital media more generally have altered this dynamic to a significant extent. While costs associated with intellectual labour in content creation may be considerable, regardless of the medium in which the work is expressed, costs involved in content production and distribution have decreased to a significant extent, with the rise of digital technology.

An authorial work can be created entirely as information, rather than being incorporated into a tangible medium of expression, and then be easily distributed online[48].

Some commentators also argue that, nowadays, the incentive to create works of authorship is more and more independent of any expected profit. In their opinion, there exists increasing evidence that authors are driven by intrinsic motivations – such as an urge to create and gain recognition – making the necessity for strong copyright protection less apparent[49].

To support this argument, it is usually posited that the Internet has opened the doors to a new mass of creators (amateur, professional and non-professional), who could not engage in creative activities before, because of the high costs involved and the difficulty to reach an audience without intermediaries, like record companies, publishing houses or movie studios[50].

A body of literature likewise questions the assumption that "traditional" authors will leave their professions if they do not have the right to exclude others from using their works. It might be, instead, that existing creators become even more productive, since they can build upon a wider range of existing materials[51].

If one follows this line of thinking, one might similarly query whether the advent of cost-reducing technologies, such as 3DP, likewise places in doubt the necessity for strong IP protection, as an incentive means[52].

[47] Lemley (2014), 468.

[48] *Id*., noting that "*once a work could be initiated entirely in information, the copying of that work no longer requires a factory to produce it or a fleet of trucks and stores to distribute it*". Anyone could suddenly copy and distribute content.

[49] Ginsburg (2013) adopts a different perspective, suggesting that adequate remuneration is needed for "traditional" authors to persist in their creative endeavour.

[50] Lemley (2014), 490.

[51] Ginsburg (2013), instead, stresses the importance of vesting authors with the exclusive right to exploit their own works in new markets created by digital technologies.

[52] Yet, one should be careful not to overgeneralize. As Lemley points out, works such as big-budget movies and video games are costly to create even in a digital world. It is unlikely that they will be made without effective IP protection. *See* Lemley (2014), 496.

In the opinion of Lemley, the economics of things will change in a substantial way, given that 3DP, like the Internet, disaggregates *creation* from *distribution*: products can now be created by digital means, similarly to informational resources, and then be manufactured by a third party or intermediary, who may also be in charge of distribution.

Moreover, 3DP is ushering a new era where enthusiastic participants contribute their skill, time and labour to the creation of digital designs to be shared with their peers by means of Creative Commons licences.

As Lemley notes, the digital revolution has also spawned unprecedented piracy. Right owners have attempted to stop this sudden flood of piracy by mainly targeting intermediaries rather than end users. We may expect similar trends in the context of 3DP.

The next section elaborates on whether 3DP shall be healed as a revolutionary technology that will bring about profound social implications.

6. Is Three-Dimensional Printing Socially Transformative?

For the reasons examined in the previous section, 3DP technologies open up new possibilities for creating goods and services at a lower cost or – as some economists suggest – at a "near zero marginal cost".

Bringing this assumption to its logical conclusion, one can imagine a scenario in which productivity is boosted to the point that undertakings do not have sufficient profit margins, causing capitalism to fade away. Social production practices might prevail over an economic paradigm centred on the logic of profit and scarcity of resources.

3DP may also affect the way society is organized for a combination of reasons. The First Industrial Revolution triggered the proliferation of highly populated urban centres. Firms and workforce were concentrated in big cities, within the reach of railway services[53].

Energy resources and rare materials were transported to firms by train. Workers also had to reach their workplace by train or to live in the city centre.

Over the years, production migrated from dense urban centres to suburban areas, which were accessible by trucks and automobile. Economies of scale could be achieved only through the concentration of power in the hands of few industry leaders that could make a substantial initial capital investment, and then rely on vertical integration and the exercise of control.

[53] Rifkin (2014), 76.

Vertical integration is a means of organizing production and distribution of mass-products under the control of a centralized company, in order to considerably decrease expenses, such as transaction and transportation costs[54].

With the emergence of 3DP, economic activity might become integrated across a multitude of scattered communities, leading to a progressive decentralization of the means of production and distribution of goods[55]. In this respect, 3DP practices may also bring about a substantial change to the way society is organized.

Moreover, 3DP may unlock new opportunities in developing countries, since the costs of establishing all the facilities (computers, printers, materials and Internet access) are substantially lower than in a traditional manufacturing process, and products that are suitable for local markets can now be manufactured on-site[56]. Local producers and individual users can potentially play on a level playing field with big companies.

Moreover, 3DP goes hand in hand with sustainable production, since it makes use of recyclable, non-polluting and durable feedstock, if the nature of the good so permits[57]. In addition, as 3DP is an additive manufacturing process, raw material usually does not get wasted.

It is also worth noticing that Fab Labs enable to carry out R&D activities outside universities and companies, thereby disseminating knowledge among communities. For all such reasons, 3DP shows the potential to utterly transform the market in unindustrialized countries.

Insofar as the industrial sector is concerned, 3DP can be assimilated to a new form of automation, which reduces labour inputs, especially those related to product assembly. Insofar as the reduction of assembly and tooling costs makes 3DP a competitive manufacturing method for low production volumes, delocalisation may become a less attractive option.

Hence, 3DP may well contribute to move back into developed countries some jobs that have traditionally been outsourced to low-wage countries.

The impact that 3DP will have on employment, however, is not easily predictable. 3DP might change the categories of workers that are needed in the manufacturing process. A variety of new abilities and expertise is required, as compared to traditional manufacturing processes.

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54 Along with market forces, a factor influencing transaction costs is the balance of power between the parties. Vertical integration makes the balance of power stable, as two companies operate as a single entity, setting the prices at an agreed-upon and non-negotiable rate.

55 Most likely, while factories will remain in charge of the production of large-scale goods, and transportation and delivery costs will not be supplanted for such goods, modestly-sized goods may be increasingly manufactured at consumer level, if consumer 3DP really becomes widespread.

56 Burrows (2014), 118.

57 Rifkin (2014).

Workers should have intellectual, rather than physical skills, and devote considerable effort to develop the competence to run CAD software and design CAD files.

Looking at personal 3DP, in theory it enables consumers to take on laborious tasks in the production process, which were traditionally undertaken by workers in factories. Indeed, consumers can be solely in charge of the manufacturing and distribution stages.

Therefore, 3DP could bring to the elimination of certain jobs, but also create new job opportunities, enhance human creativity and foster user innovation. Individuals can create their own marketplace, where they can share and sell their own creations, supplanting traditional distribution channels.

Hence, 3DP could potentially develop into a new socioeconomic paradigm. It may also be that this 3DP practices will remain the realm of enthusiastic hobbyists, without disrupting the existing system for organizing economic activity and society.

As one can see, many unpredictable options are left open by this surprisingly challenging method of production.

Chapter II

Copyright Implications of Three-Dimensional Printing

Part I

Copyright Protection of CAD files

Part II

Copyright Infringement in the Three-Dimensional Printing Landscape

Part I

Copyright Protection of CAD files

Introduction

Historically, technological changes have contributed to shape the progressive development of copyright law. Conversely, copyright regulation has always exerted a great influence on the emergence and development of new technologies, contributing to the configuration of their design and architecture[58].

Technological development has caused debate about how copyright law should accommodate both new forms of expression of human creativity and new ways of exploiting protected works of the mind.

Over the years, we have seen a progressive expansion of subject matter enjoying copyright and/or *sui generis* protection, both by the legislatures and by the courts. This has determined the inclusion of photographic works, some databases and computer programs into the copyright domain, notwithstanding their perceived “factual”, “technical” or “industrial” nature.

In most instances, protection has been accorded by drawing an analogy with other cultural productions already enjoying the copyright *status*: photographs were deemed to be similar to graphic works, computer programs to texts, databases to other collections of works, such as directories or anthologies[59].

Moreover, with the advent of digital technologies, the subject matter of copyright has been broadened to encompass new genres of works and types of production, such as multimedia works that consist of software, images, texts, and sounds.

In a similar vein, the cornerstone copyright principles, such as the notion of authorship, the criterion of originality and the idea/expression dichotomy, have been revisited to respond to technological challenges.

The discussion about copyright protection of works generated by computer programs is still fierce. If software generates creative output, should copyright be vested in the programmer –

[58] Synodinou (2014), 81.
[59] Van Eechoud (2014), 149.

who has written the source code – or in the user – who has caused the work to be fixed in a tangible medium of expression? Should we qualify the artificial intelligence program itself as an "author" in the copyright sense?

Hence, there seems to be a growing number of situations in which the existence or initial ownership of copyright cannot be easily allocated.

Then, some technologies have impacted substantially on traditional patterns of content creation and distribution, reducing drastically the related costs. With the advent of digitisation, new forms of collaborative productions – not only between humans, but also between humans and machines – have emerged, stretching many of the traditional concepts in which copyright law is rooted.

Digital production techniques and the networked society have empowered individuals, by providing the tools for creating, storing, copying, editing, transforming and accessing creative content. As a result, the role of the end user has changed drastically, from a mere consumer of contents to a "*follow-on creator or a massive distributor of unauthorised works covered by copyright*"[60].

By the same token, digital technologies have facilitated infringing activities on an unprecedented scale.

Hence, a more general issue that copyright raises, which becomes particular acute in the context of 3DP, is how to reconcile the need to foster secondary creativity, and leave sufficient room for follow-on creations, whilst guaranteeing proper sources of remuneration and the absence of economic harm to authors. This, in turn, calls into question the desirability of more flexible copyright norms in a world of rapid technological change.

The observations made so far give a hint of flexibility inherent in copyright law, which has proven to constitute an indispensable legal tool for technological advancement. The reverse also holds true: emerging technologies have played a crucial role in the process of shaping contemporary copyright regulation.

A more accurate reflection on the intricate relationship between law making and the unpredictable pace of technological innovation will be provided throughout this chapter. This sort of inquiry serves the purpose to unfold the following main question: do we need a wholesale rethink of some fundamental concepts in copyright law, in light of technological changes brought about by 3D printing?

[60] Mazziotti (2008), 5.

3D printing has been portrayed as a highly disruptive technology, posing new-fangled challenges to established copyright concepts. This technology shows the potential to further blur the line between the "physical" and the "digital" dimension.

In fact, CAD files can be easily distributed over online platforms and be reproduced by a printer device using a wide range of different materials. The digitisation of physical objects, in turn, may promote unauthorised restricted acts, resulting in large-scale copyright infringement.

Moreover, 3D printing is an illustrative example of new forms of collaborative production. By bypassing traditional means of production and supply chains, 3DP may exercise a broad transformational socio-economic impact. It may trigger the advent of a "democratization" of manufacturing and a mass-scale customization of products. Nonetheless, this may hold true only to the extent that access to both printers and raw materials becomes easy and inexpensive for the masses, which is not the case at present.

This chapter endeavours to clarify whether and how copyright law should apply in the context of 3D printing and what legal treatment should be reserved to CAD files. It queries whether, and to what extent, 3D printing fits comfortably within the conceptual boundaries of current copyright law.

To this end, it purports to untangle the following main questions:

- Is a CAD file eligible for copyright protection *per se* and, if so, under what circumstances?
- Is a CAD file a medium of expression in which a copyright protected work can be embodied?
- What are the requirements for copyright subsistence in the digital design, the literary expression incorporated in the CAD file, and the corresponding 3D-printed output?

International and European norms will be the main point of reference for my analysis. Hence, this chapter endeavours to explore different national approaches to the abovementioned research questions. It considers the legislative framework and judicial decisions of *droit d'auteur* countries, such as Italy and France, and common law countries, such as the United Kingdom, in an attempt to identify possible divergent solutions. Details on U.S. copyright law will also be provided.

1. Three-Dimensional Printing and Copyright Law: a General Overview

As noted in the previous chapter, Additive Manufacturing technologies, including 3DP, can be used to produce a variety of different outputs, *inter alia*, food (i.e. pasta, cookies, candies, chocolate, etc.), human organs, prostheses, guns, toys, action figures, sculptures, works of applied art (i.e. objects of industrial designs, fashion designs, interior designs, decorative arts and architecture) and different types of useful articles (i.e. screws, wrenches and keys).

3D printing intersects with many areas of IP law. We cannot rule out the possibility that the final 3D-printed output is a registered design, a patented invention or include a trademark. It may also very well be that the 3D-printed object is incapable of any form of protection, but rather belong to the public domain.

In a similar vein, in certain instances the items created by means of 3DP may be subject to copyright protection. In the most straightforward example, the 3D-printed output may be a sculpture or a work of applied art to which copyright protection attach.

The ultimate 3D-printed product may also be a chocolate product that, nonetheless, falls into the subject matter of copyright, being an "artistic work" (i.e. a sculpture made of chocolate)[61]. It is also possible that only certain components of a 3D-printed object attract copyright protection. In fact, an item may combine both functional and purely decorative elements, with protection being granted only to the latter.

It is plain that items such as human organs, prostheses, guns, and useful articles in general are not entitled to copyright protection. By contrast, there is a strong possibility that these items fit well within the scope of patent law or design right.

Having made such preliminary remarks, this chapter purports to delineate the contours of copyright with regard to CAD files and 3D-printed items, taking into account the substantive norms that apply at the international, European and national level.

Before getting to the core of the inquiry, it is important to note that, in addressing copyright issues pertaining to physical (i.e. tangible) items, there is no reason to consider a 3D-printed product – which is manufactured through an AM process – any different from a product that has been created through a traditional "material-removing" manufacturing process[62].

In this respect, one should note that digital manufacturing techniques are various, but do not necessarily affect the copyright analysis. By way of example, Computer Numeric Control (CNC) operates by removing material, following the instructions provided by a CAD file, as opposed to 3D printing, where the printer operates by adding material. Whether the output so

[61] On this see Li et al. (2014).

[62] See the responses to ALAI questionnaire: "*Applied Arts under IP law: The Uncertain Border between Beauty and Usefulness*", available at http://www.alai2016.org/.

produced is capable of copyright protection does not depend on the "additive" or "subtractive" nature of the manufacturing process.

The peculiarity of 3DP lies in that every 3D-printed product owes its origin to a CAD file that, once converted into a machine-readable format (GCODE), sends instructions to the printer on how to manufacture the item.

Hence, a question of paramount importance, that has received increased attention in recent years, is whether a CAD file is itself eligible for copyright protection. In fact, whether copyright protection may exist over a CAD file *per se* is not altogether clear yet.

In this respect, it should be noted that what the literature generically categorizes as a "CAD file" in reality encompasses a broad array of digital design files. In fact, the techniques to create CAD models are various (i.e. surface modelling, solid modelling, scanning, photogrammetry, etc.), as well as the digital formats in which design files can be recorded, throughout the whole design process (DWG, STL and GCODE).

As noted by Osborn, there seems to be some puzzlement about the nature of CAD files in the literature: *"currently, the literature is inexact and confused at times and often simply wrong*" and "*the confusion unnecessarily complicates the analysis and leads to multiple errors with downstream consequences*"[63].

As Osborn details: "*although the files themselves have utilitarian aspects, including to depict the object on a computer screen and to provide instructions to a printer or other digital manufacturing device, this is irrelevant under the copyright statute. Copyright law does not protect files per se. It instead protects works*". Accordingly, "*the file is a "copy" of the work, but the file qua file is not the work, just like a canvas is not the work with respect to a painting*"[64].

Thus, in order to dispel the confusion surrounding the nature of CAD files, and properly address the challenges that they pose to copyright law, it is essential to properly understand how the technology functions.

What leads to potential ambiguity is that a CAD file is composed of both a "design drawing component" and a "code component"[65]. The "design drawing" is created either by using a CAD program (i.e. by designing an object on a computer screen from scratch or by combining pre-rendered shapes) or by scanning.

[63] Osborn (2017), 27.
[64] *Id*. at 36.
[65] Dolinsky (2014).

The code is typically generated by software and gives the printer a series of commands on how to build the object (i.e. it tells the printer where to move the print head, how fast to extrude the material, etc.).

As scholarship notes, there are numerous relationships to consider between works of authorship, digital files and 3D-printed objects[66]. The present writer, however, calls into question former existing assumptions of the literature that equate a CAD file to a "work of authorship", as opposed to a "copy" of such a work.

In fact, many commentators, drawing a comparison with technical drawings or computer programs, argue that CAD files are *per se* eligible for copyright protection[67]. It is here suggested that, on a par with other digital files, a CAD file is just a means of recording a work, provided that it incorporates protectable subject matter. A digital design file should be seen as a mere instrument, support or tool that is used to fix an intellectual creation.

An erroneous analysis of CAD files' legal status may have far-reaching consequences, leading to the conclusion that the unauthorized sharing of such files via the Internet will always constitute *prima facie* copyright infringement.

The present analysis, therefore, challenges prior inferences of the literature and adopts a completely different perspective; it opines that a CAD file as a file is just a medium in which a work could be embodied.

Hence, as a first step, the CAD file must be broken down in its components, namely: a computer program (i.e. the set of instructions to the printer or the computer) and, potentially, the copyright protected works (i.e. work of sculpture, work of applied art, work of architecture, graphic work, literary work, etc.).

Starting from the premise that the most appropriate theoretical standpoint is to ask whether copyright attaches to the content of the CAD file – rather than the file *qua* file – the following part endeavours to delineate the legal requirements towards copyright protection.

This, in turn, brings us back to the foundational concept of "work of authorship", the "originality" criterion, and the "the idea/expression dichotomy". In addition, mostly common law countries require fixation in a tangible medium of expression for a work to enjoy copyright.

Against this legal background, the discussion goes on to unfold various copyright issues concerning the protection of (the constituent elements of) CAD files.

[66] *Id.*, 597.

[67] Inter alia, *Id.*, 628-57; Reitinger (2015), 133-34; Rideout (2011), 168; Mendis (2014).

2. Legal Requirements Towards Copyright Protection

In order for a work to attract copyright, it should satisfy the specific requirements that are imposed on it. As a preliminary remark, one cannot disregard an essential feature that copyright shares with other IPRs: territoriality. This principle, enshrined in Article 5 Berne, has been reaffirmed in more recent case law from the CJEU[68].

There is no such thing as a thoroughly harmonized copyright law. At the EU level, works and other subject matter are protected on the basis of national laws regulating copyright and related rights that apply respectively within the territorial boundaries of each Member State. It follows that the legal requirements towards copyright protection may vary depending on the jurisdiction.

The first part of this chapter outlines the following requirements for copyright subsistence: copyright's subject matter, the originality criterion, the idea/expression dichotomy, and the fixation requirement. Hence, the discussion turns to examine whether and under what circumstances CAD files and 3D-printed products may satisfy these requirements.

The peculiarity of 3DP is that a digital file (the input) may contain all the information necessary to create a product (the output). Hence, the preferable approach is to ascertain whether the final 3D-printed output is protectable, in order to evaluate whether the instructions to create it (i.e. the digital design or blueprint and the literary code incorporated in the file) are likewise protectable.

3. The Notion of "Work" in Copyright Law

The concept of "work" lies at the core of any copyright system. It is a concept that informs the entire body of copyright law, insofar as it: defines the subject matter of copyright; determines the object of the owner's exclusive rights; delineates the scope of copyright infringement by substantial similarity; establishes the extent to which follow-on creations should be deemed derivative works deserving copyright protection in their own rights.

As noted by legal scholarship: "*without a 'work' there is no author and there are no exclusive rights. More than any other instrument in the law on copyright ... the notion of work draws the boundary between intellectual productions that are exclusive to their author(s) and those that may be freely used by all*"[69].

Although the term "work" appears in international treaties, EU Directives and national statutes, it has not acquired a stable meaning in the law. The "work" for copyright purposes is

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[68] Case C-192/2004 *Lagardère Active Broadcast v SPRE and GVL* (14 July 2005), [46].

[69] Hugenholtz (2012a), § 2.

an abstract concept, i.e. a legal construct that refers to the intangible intellectual creation or product of the human mind. It is purely incorporeal and malleable thing, namely a cultural production that can take different material forms.

The copyright owner is vested with a bundle of exclusive rights in his or her creation, without necessarily being the proprietor of the material product in which the creation is incorporated. Hence, the "work" constituting the object of copyright is an intangible and immaterial abstraction to be divorced from the material carrier that defines its external boundaries. In other terms, the law's primary focus of concern is the "intellectual creation", irrespective of the vessel in which such a creation is reified[70].

In order to keep pace with technological development, the concept of work has undergone a substantial revision, showing an inherent flexibility and enabling new forms of expression to attract protection under copyright law.

As noted at the outset, technological change has acted as a driving force behind the expansion of copyright protected subject matter to include new types of works, such as computer programs, databases, videogames and other multimedia products. Therefore, nowadays copyright attaches to a wide array of creative outputs.

Establishing in the first place whether a borderline creative work comes within protectable subject matter is not always straightforward. It is usually when copyright owners enforce their copyright, through infringement proceedings, that the judiciary defines whether and to what degree copyright attaches to a given work.

As scholarship notes, the expanded reach of copyright protection presupposes a gradual conceptual shift: the categories of protected works are not necessarily linked to a certain form of material artefact[71]. In fact, over the last decades we have experienced a progressive dematerialization of protected forms of creativity. The latter have lost their tangible form to become "virtual".

While in the analogue world works are bounded with their tangible carriers (books, DVDs, CDs, etc.), in the digital world works are expressed in binary format. Hence, in the context of digital products, the traditional distinction between the work's recorded form and its immaterial essence takes on a new significance[72].

As noted by legal scholarship: "*for an analogue copy of a work, the distinction between the work and the copy is the distinction between thoughts and atoms. Physics determines the*

[70] Griffiths (2013), 771.
[71] Griffiths (2013), 776.
[72] *Id.* at 770.

identity of the copy, for a person can touch the copy. For a digital "copy", the distinction between the work and the copy is the distinction between thoughts and bits. That is elusive at best and arbitrary at worst, because for all practical purposes, the copy cannot be touched"[73].
Making this acknowledgement is crucial for a correct understanding of copyright issues relating to 3DP. As noted at the outset, it seems that some commentators were led astray by a wrong evaluation of what is a "work", as opposed to its medium of fixation, when arguing that a CAD file is itself capable of copyright protection.

3D printing is suggestive of the complexity of drawing a clear line between the work and a copy thereof. As every 3D-printed item originates from a digital file, identifying the boundary between the work or the content, on the one hand, and the carrier or the form of expression, on the other, is not always an easy task.

In a similar vein, 3DP exemplifies how the author's creation – i.e. the abstract and intangible product of the mind – is not necessarily bound to one sole vehicle of expression. The same holds true for 2D printers too.

A work may first come into existence in some digital (i.e. fixed and *material*) form and then be reproduced in altered (i.e. *tangible*) form. In other terms, the same creative endeavour can be recorded in a CAD file and then be converted into atoms, by means of a 3DP manufacturing process, without changing its nature of "work" in a copyright sense.

By the same token, if a CAD model is created simply by scanning a pre-existing 3D object, the resulting scan is merely a "copy", rather than a work of authorship in its own right[74]. Shifting the work from one medium to another does not render it any less than a copy, and the person who created such a copy would have no copyright in the resulting (scanned) model file.

Therefore, a correct application of copyright law to CAD files imposes a theoretical shift from the digital design file as the work for which copyright may be secured, to the digital file as both a means of recording a work and a copy thereof.

An attentive analysis of copyright in CAD files suggests that the file as such should be perceived as the digital referent of the "work", which can be easily transmuted into the corresponding material and tangible referent, i.e. the 3D-printed output. The conversion from digital to analogue does not alter the type of work, and the reverse also holds true.

[73] Madison (2012), 347.
[74] U.S. response to ALAI questionnaire concerning "*Applied Arts under IP Law: The Uncertain Border Between Beauty and Usefulness*", available at: http://www.alai2016.org/.

The next part examines the extent to which the subject matter protected by copyright has been harmonized at the international and European level. In this respect, it is first necessary to outline the most relevant norms enshrined in the Berne Convention[75]. Then, the analysis moves on to address the EU harmonisation of the concept of "work" through recent case law of the Court of Justice.

It is apparent that the notion of "work" and the "originality" criterion are now closely intertwined in the EU copyright law. This chapter reviews existing scholarship that has analysed this issue at length.

It here suffices to note that some legal scholars have given a critical reading of the CJEU's construction of a EU-wide notion of "work" suggesting that, by conflating the originality standard with the work standard, the Court has dodged the more difficult "domain question", i.e. what contributions fit within the domain of art, literature and science that copyright law protects[76].

This issue is of particular relevance in the context of 3D printing, insofar as most digital designs arguably do not deserve the "work" *status*.

Hence, the discrepancy between an "open-list" and "closed-list" approach to copyrightable subject matter is portrayed. The final part explores specific subject matter, which may be relevant to 3DP, such as artistic works, technical drawings, computer programs and databases.

4. The Subject Matter of Copyright at the International Level

4.1. Fundamental Principles Enshrined in the Berne Convention

In considering the subject matter of copyright, it is first necessary to make a concise reference to international legal sources and, particularly, to the Berne Convention.

Three main principles underpin the Berne Convention: a) the principle of national treatment; b) the principle of minimum rights; and c) the principle of no formalities (or the principle of automatic protection).

The principle of national treatment stipulates that a Union country is obliged to confer the same rights on authors from another Union country as it confers on its own nationals[77]. As noted by Goldstein and Hugehnoltz, *"national treatment is a rule of non-discrimination, promising foreign creators who come within the treaty's protection that they will enjoy in the*

[75] See the EU's obligation to comply with Berne pursuant to Article 9 TRIPS and Article 1(4) WCT.
[76] Van Eechoud (2014), 162.
[77] For a detailed analysis of national treatment *see*: Rickeston; Ginsburg (2006).

protecting country no less favourable treatment for their creations as the protecting country gives to its own nationals"[78].

Hence, "national treatment" removes any difference between national and foreign authors. The main practical advantage is that courts apply the law of the country where protection is claimed – rather than foreign law – without any condition of reciprocity.

The principle of "minimum rights" requires a Berne country to accord the minimum standards of protection to authors of all Union countries, except to authors of its own country[79].

Finally, pursuant to the no formalities principle, copyright protection shall arise automatically throughout the Union, upon the creation or first publication of an original work of authorship. In fact, Article 5(2) Berne expressly mandates that the enjoyment (i.e. initial attachment of copyright protection) and the exercise (i.e. the enforcement) of the corpus of rights granted by the Convention and by Berne Member States, pursuant to the rule of national treatment, shall not be subject to any formality.

Pursuant to Article 2(2) Berne, individual Member Nations may implement a fixation standard[80]. Accordingly, most common law regimes, such as the U.S. and the UK, impose a fixation requirement, providing that a work shall be fixed in a tangible medium of expression in order to attract copyright.

For example, in the U.S. "*it makes no difference what the form, manner or medium of fixation may be*"; a work may be recorded "*in written, printed, sculptural, punched, magnetic or any other stable form whether it is capable of perception directly or by means of any machine or device"*[81].

It is worth noticing that the above-mentioned principles (national treatment, minimum rights and no formalities) apply only in respect of subject matter for which protection is granted under the Convention, i.e. "literary and artistic works" within the meaning of Article 2(1).

It is also important to stress that recent case law from the CJEU has been criticized for extrapolating a generalized notion of "work" from Article 2 Berne: by making reference to such a provision, the Court upheld the far-reaching conclusion that the protection of certain

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[78] Goldstein; Hugenholtz (2013), 101.

[79] The minimum rights include both economic rights – which may be subject to certain allowed reservations, limitations and exceptions – and moral rights. The duration of protection is 50 years after the author's death.

[80] Article 2(2) Berne expressly states that it "*shall be a matter for legislation in the countries of the Union to prescribe that works in general or any categories of works shall not be protected unless they have been fixed in some material form*".

[81] H.R. Rep. No. 94-1476, 94th Cong., 2d Sess. 52 (1976).

"works" within the European copyright framework presupposes that they are "the author's own intellectual creations"[82].
For all such reasons, Article 2 Berne will be the main focus of attention in the next section.

4.2. The Subject Matter of Copyright Under the Berne Convention

Article 2(1) Berne identifies the subject matter of copyright protection in "*literary and artistic works*", meaning every *production* in the literary, scientific and artistic domain, whatever may be its mode or form of its expression. The same provision further provides an illustrative, and not exhaustive, list of examples of "literary and artistic works", i.e. "*books, lectures, dramatic works, musical compositions, cinematographic works, paintings and sculptures, photographic works and works of applied art*".
Moreover, the Berne Convention enumerates "translations, adaptations, arrangements of music and other alterations of a literary or artistic work" (Article 2(3)), as well as "collections of literary or artistic works" (Article 2(5)), among the works that qualify for protection.
It is apparent from the wording of the Convention that the expression "literary and artistic works" does not refer to two mutually exclusive categories; rather, it must be taken to include all "productions" in the literary, scientific and artistic domain[83]. The Convention provides an all-embracing protection for all works, without any further requirement of classification and/or categorization.
It is also worth noting that nowhere in the Convention is explained what is meant by "work". Yet, the general tone of the Convention suggests that works protected by copyright must be "intellectual creations"[84].
In particular, such a conclusion can be inferred from Article 2(5) Berne that uses the expression "intellectual creations" to describe collections of works. It is also clear from Article 2(6) of Berne that Union Members shall protect intellectual creations that come within the scope of the Convention.
As the Convention merely sets minimum standards, it permits different national approaches to copyright subject matter[85]. The latitude given to the Union Countries is broad: the Convention allows national laws to go further and treat other productions, not expressly included in Article 2 Berne, as protected works.

[82] As better explained below, the CJEU has lifted out the expression "intellectual creations" from Article 2(5) Berne, dealing with "collections of literary or artistic works".
[83] WIPO Guide to the Berne Convention (1971), 2.5.
[84] WIPO's Guide to the Berne Convention, 17, § 2.8.
[85] Aplin (2013), 63.

As new technologies proliferate, the question remains open whether new categories of works fall within the scope of Berne and, consequently, are subject to national treatment, minimum rights, and the prohibition on formalities.

The history of sound recordings, broadcasts, computer program and databases offers strong evidence of the difficulty of determining whether a new form of creation constitutes a Berne Convention "work"[86].

It is also worth noting that, on the basis of national treatment, the Convention concerns only the protection of foreign – and not also internal – works and authors. In practice, however, this principle has exerted a profound harmonizing effect on national copyright laws, insofar as Union Members tend not to reserve a worse treatment to their own nationals as compared to foreign authors.

Two main approaches to protected subject matter have been developed, in order to implement Berne minimum standards. A first approach implemented in countries of continental Europe – which can be best defined as an "open-list approach" – is consistent with the terminology used in Berne and does not require prior classification[87].

At the other end of the spectrum is the "closed-list approach", according to which the scope of copyright subject matter is statutorily defined and limited to specific work categories. Hence, copyright protection can attach only to creations falling within one of the enumerated categories of protected works.

5. National Approaches Towards the Subject Matter of Copyright

The concept of "work" has proven to be a more flexible and open-ended concept in those national legal regimes that adopt an "open-list" – as opposed to a "closed-list" – approach to protected subject matter.

The French *droit d'auteur* system offers an illustrative example of the "open-list" approach, prescribing that all works of the mind (i.e. the author's *ouvre de l'esprit*) shall gain protection, whatever their kind, form or expression, merit or purpose, and then providing an "illustrative" and not exhaustive categorization of copyright subject matter[88].

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[86] Aplin (2009). Phonograms, broadcast and performances do not fall within the scope of Article 2(1) Berne, but are subject to a separate international regime. Computer programs' protection as "literary works", within the meaning of Article 2 Berne, is now entrenched, at the international level, in both Article 10(1) of the TRIPS and Article 4 of the WCT. Moreover, the TRIPS Agreement and the WCT both contain the obligations to protect compilation of data "*which by reason of the selection or arrangement of their contents constitute intellectual creations*" (TRIPS, Article 10(2) and WCT, Article 5).

[87] On this see Aplin (2009), 54.

[88] Article L 122-1 Intellectual Property Code 1992.

German and Italian copyright laws also use generic formula, such as "personal intellectual creations"[89] and "works of the mind having a creative character"[90] respectively, and then provide some guidance as to the scope of qualifying subject matter, through a non-exhaustive list of examples.

Therefore, the approach that has traditionally been followed in jurisdictions of Continental Europe allows extending the coverage of copyright law to almost every product of human creativity, subject to the requirement of originality.

On the contrary, in jurisdictions such as Canada, the UK and Austria the universe of intellectual productions to which copyright law applies is identified in an exhaustive (and "closed") list of work categories[91]. Because the list is all embracing, this approach does not allow copyright protection for new classes of works, falling outside the statute's enumerated categories.

As noted by Bently, if the list of copyright protected works is to be regarded as closed and exhaustive, "*there is little opportunity for the courts to recognize new forms of subject matter, other than through the creative interpretation of the existing categories*"[92]. Hence, if an intellectual production does not fit neatly within the scope of an explicitly named category, it is useful to draw an analogy with other works belonging to the same category.

It follows that new genres and forms of creative expressions, not expressly contemplated in Berne – such as a perfume[93], a fashion show or a culinary dish – have been recognised as falling within copyright's subject matter in certain countries but not in others.

The U.S. Copyright Act describes the subject matter for which copyright may be secured as "works of authorship", without further defining the latter. Section 102(a) of the Act goes on to provide a list of examples of "works of authorship", which shall *include* eight specific categories listed therein. Hence, the statutory term "include" is suggestive of an illustrative, open-ended and non-exhaustive list of work categories.

6. Harmonized Concept of "Work" at the EU Level

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89 Sections 1 and 2 Copyright and Related Rights Act 1965.

90 Article 1 Copyright Act 1941.

91 In the U.K., the subject matter of copyright is identified in an exhaustive list of eight categories of works, under Section 1(1) of the CDPA. In Canada, copyright can subsist in every "original literary, dramatic, musical and artistic work". These categories of works are then further defined. On the contrary, in the U.S., the list of works set forth in Section 102(a) is non-exhaustive.

92 Bently (2014), 60.

93 The Dutch Supreme Court found in *Kecofa BV v Lancome Parfums* [2006] E.C.D.R. 26 held that a perfume can be a copyright work, whereas the French Cour de Cassation held the opposite in *Bsiri-Barbir v Haarmann & Reimer* [2006] E.C.D.R. 28.

Up until relatively recently, the concept of "work" was not part of the European *acquis.* A truly harmonized notion of what constitutes a copyright protected "work" was only accepted with respect to computer programs, databases and photographs.

The InfoSoc Directive, instead, falls short of defining what the subject matter of copyright is, throwing up room for uncertainty as to the types of productions that fall within the copyright domain. Through a series of subsequent rulings, in the aftermath of *Infopaq*, the CJEU has constructed a EU-wide notion of "work".

The Court has first generalized the criterion of originality applicable to software, databases and photographs (i.e. "the author's own intellectual creation") for all work categories. Then, making a step forward, it has conflated the originality threshold for copyright subsistence with the notion of "work"[94]. Hence, what is a "work" for the purposes of EU copyright law has now acquired a harmonized and uniform meaning: "the author's own intellectual creation".

The CJEU's judicial activism has been criticised at length[95]. A first line of criticism concerns the CJEU's increased reliance on the principle of autonomous interpretation, in order to justify a *de facto* harmonisation of various aspects of copyright law[96].

In interpreting a provision of the InfoSoc Directive, the Court tends to consider both its wording and context, in the light of the overall objectives of that Directive and international law[97]. The principal objective of the InfoSoc Directive takes as its basis a harmonized legal framework, through increased legal certainty and a high level of protection of copyright and related rights (Recitals 4, 9 and 11 InfoSoc).

With these general points in mind, the fact that the Court embarked on the ambitious task to give an autonomous interpretation to a concept (i.e. that of "work") that is not within the scope of the InfoSoc Directive draws most of the criticism.

The Court has shaped an autonomous and uniform notion of "work" borrowing the "author's own intellectual creation" terminology from earlier Directives and from the Berne Convention. By doing so, some scholars argue, the Court has disregarded the historical reasons why the "work" concept had, up until then, acquired a uniform meaning only with

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94 Case C-5/08 *Infopaq International A/S v Danske Dagblades Forenig* Case [2010] FSR 20; Joined Cases C-403\08 & C-429\081, *FA Premier League et al. v. QC Leisure et al. & Murphy v. Media Protection Services Ltd* C.M.L.R. 29 (2011); Case C-393/09 *Bezpecnostni softwarova asociace v Ministerstvo kultury* [2011] ECDR 3; [2011] FSR 18; Case C-145/10 *Painer v Standard Verglas GmbH* [2012] ECDR 6; Case C- 604/10 *Football Dataco v Yahoo! UK Ltd* [2013] FSR 1.

95 *See* van Eechoud (2012).

96 *Id.*, 83.

97 Case C-467/08 *Padawan SL v Sociedad General de Authores y Editores de España* (SGAE), EU:C:2010:620, [34].

respect to very specific subject matter (such as computer programs, databases and photographs) involving significant industries.

On the one hand, arguably the autonomous interpretation of what is a "work" provides (indispensable) judicial gap filling. On the other, one may posit that the Court has overstepped the legislature's intention not to pursue harmonisation with respect to copyright subject matter. In fact, the InfoSoc Directive is purposely silent on this last point[98].

Moreover, the CJEU has now envisaged – in line with Article 2 Berne – an open-ended system of copyright subject matter, covering all conceivable products of human creativity. Whether a particular work is "the author's own intellectual creation" is now the *sole* precondition for obtaining copyright protection at the EU level.

This result has attracted fierce criticism for two main reasons. First, it is argued that, by mingling the originality standard with the work standard, the Court has dodged the more difficult "domain question", i.e. what productions fit within the domain of art, literature and science that copyright law protects[99].

In fact, in accordance with Berne, the putative intellectual creation must first be a "literary, scientific or artistic work" in the Berne sense, in order to be a work in itself, and secondly be sufficiently original.

Hence, originality should not be treated as the sole condition for copyright subsistence; rather, it is only one factor to take into account. Whether a work can be classed in the domain of copyright, as broadly portrayed in Berne, should remain the starting point for any claim to copyright.

In *SAS*[100], Arnold J made this point: to say that a certain production (i.e. a computer language) is an "intellectual creation" and, therefore, it is a work is not correct. In his view, that is not a *sequitur,* as "*there are many intellectual creations which are not works*"[101]. By way of example, a scientific theory is an intellectual creation, but *per se* is not a work (only the literary expression that describes the invention may constitute a work)[102].

Furthermore, many commentators have elaborated on the practical significance of the post-*Infopaq* case law, stressing that it causes huge disruption to those jurisdictions that have

[98] On this see Van Eechoud (2014), 98-100, explaining that the discrepancies among various Member States on protectable subject matter were not deemed to substantially affect the internal market, with the exception of certain categories of works (such as computer programs and databases), for which industries were actively lobbying.
[99] Van Eechoud (2014), 162.
[100] *SAS Institute Inc. v World Programming Ltd* [2013] EWHC 69 (Ch).
[101] *Id.*, [34] per Arnold J.
[102] *Id*.

traditionally applied other criteria to determine eligibility for copyright protection, such as subject matter categorization and fixation[103].

Finally, a common criticism towards the CJEU's case law concerns the interpretation given to international norms, such as the Berne Convention, in the context of the preliminary reference procedure. As far as the "work" concept is concerned, the CJEU in *Infopaq* reached the conclusion that "*it can only be subject matter which is original in the sense that is its author's own intellectual creation*" drawing upon Article 2 Berne. Whereas the latter provision contains an express reference to "intellectual creations", it does so only with respect to "collections of works", and not to all types of works.

Arguably the Court did not take into due account that the Convention merely provides a requirement for minimum standards, leaving Union Members with a certain degree of flexibility in defining the contours of protected subject matter.

On the other hand, one may argue, the existence of minimum standards does not preclude the CJEU from harmonizing protectable subject matter more tightly.

7. CAD Files: Drawing an Analogy with Protectable Subject Matter

Having laid the statutory foundations of what constitutes the subject matter of copyright, the following discussion endeavours to draw an analogy between (the content of) CAD files and existing categories of works. In this respect, the discrepancy between "closed-list" and "open-list" systems takes on particular significance.

As noted in the previous section, countries that adopt a "closed-list" approach to protected subject matter require categorization before copyright protection can arise: the question of whether or not the work falls within enumerated subject matter is a precondition for copyright subsistence.

That is, determining the extent to which CAD files' content warrants protection calls for an inquiry into existing and stipulated forms of expression. Protection will be granted only to the extent that the CAD file's content fits into one (or more) of the prescribed categories of works over which copyright can subsist.

By contrast, in view of the newly crafted EU-wide notion of work, when determining whether the content of a CAD file qualifies for copyright protection, the first (and only) issue to be addressed is whether it constitutes "the author's own intellectual creation", without further categorizing it within an exhaustive list of protected subject matter.

[103] Griffiths (2011).

When viewed through the copyright lenses, CAD files are usually assimilated to artistic works (much like a sculpture, a drawing or a work of applied art), technical drawings, computer programs or databases. In order to fully grasp the complexity of such a categorization, it is first necessary to untangle the meaning of what the literature generally refers to as a "CAD file".

7.1. Various Categories of "CAD files"

The confusion that reigns over 3D printing starts with an inappropriate and at times deceptive inquiry into the very notion of "CAD file"; one must consider that the latter is an all-embracing term, which is also inclusive of digital design files that are not unique to 3D printing[104].

In fact, as noted in the first chapter of this thesis, CAD software can be used to create files – embedding, *inter alia*, architectural and engineering projects, 2D drawings or 3D models and designs – that are not specific to digital manufacturing, but need to be converted into STL or GCODE files in order to become "printable".

In order to unravel CAD files' nature, it is important to recapitulate the various steps that one should follow in order to generate a code that the 3D printer can read.

The first stage of the process consists in digital modelling, i.e. using CAD software to create the product geometry. The digital design so created may be used for various purposes, which go beyond 3DP. For example, a CAD model may be a realistic representation of an object, with the addition of light effects and shadows, to be used for rendering purposes or to be included in a videogame.

Only if the digital model is saved in a specific format, such as STL and AMF, it may then be used for printing the object embedded therein.

A STL file represents only the surface geometry of the object to be printed as a series of small triangles (facets). This is particularly pertinent for the present analysis. When the original design file is converted into the STL format, many features, such as colours, textures, build information and construction data, shadows and lighting – disappear.

Specifically, the surfaces of a solid model, as well as curved shapes, are transformed into triangular facets[105]. Hence, all information that is not necessary to manufacture the object just vanishes, owing to the file's conversion.

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[104] Osborn (2017).
[105] Antikainen; Jongsma (2017), 260, § 12.02[c].

Interestingly enough, the fact that most of the creative content embedded in the original design file is not reproduced, when the file is saved in the STL format, may have an impact on our copyright analysis[106].

Typically the conversion from one file format to another (i.e. from Word to PDF) does not change the file's content and the copyright inquiry in relation to it. The original expression contained in the file – which is the object of the copyright's coverage – remains unaltered and so does the copyright attaching to it.

In the specific case of file conversion throughout digital design processes, the considerable removal of creative expression may eventually deprive the file's content of copyright protection. In Professor Osborn's opinion, this process invites comparison with the removal of "*words from a sonnet until nothing is left but one word*" [107]: the systematic subtraction of creative content eventually would deprive the work at stake of protection.

Such printable file must then converted into GCODE instructions for the printer to follow, thanks to the assistance of apposite CAM software. The user has to provide the software at stake with some information about the hardware to be used and specify other settings, such as layer height and thickness, in order to generate the GCODE to be sent to the printer.

It is worth noticing that the overall shape of the object changes substantially during the conversion from a CAD model into a STL file, whereas it remains unchanged when the STL file is converted into GCODE instructions. In the latter instance, the shape does not contain features or elements that are unnecessary for printing purposes.

It follows that more than just one file comes to existence in a typical digital design process. Accordingly, one should group "CAD files" in, at least, three sub-categories: a) digital design files, typically created with CAD programs, that cannot be used directly for 3D printing, but need first to be converted into a printable format (such as DWG files); b) files that have been converted into a format that is specific to 3D printing, such as the STL, OBJ, 3MF, and AMF file types; c) files that send instructions to the printer, since they have been converted into the GCODE format.

If one endorses the classification made by Osborn, the first group of files should be referred to as "design files", the second group as "manufacturing-ready files", and the third group as "machine-instruction files"[108]. The present writer prefers to label the first category as "CAD

[106] Osborn (2017), note 115.
[107] *Id.*
[108] Osborn (2017), 32.

drawings" or "CAD models", the second category as "3D printable files" and the third category as "GCODE files".

In reality, CAD files defy classification, as files potentially belonging to the same category may, nonetheless, show substantial differences. As noted in the first chapter of the present thesis, AMF files – on a par with 3MF files and unlike STL files – contain information as to colours, materials and constellations. 3MF files, however, embed additional content, such as digital signatures, thumbnail images of the model and 3D texture information.

As Osborn details, the term "CAD file" is usually broad enough to include all such files[109]. Arguably legal scholars commit a grave error in omitting any reference to different modelling techniques, file formats and files' constituent elements.

The present writer entertains the idea that making legal assessments in relation to a supposed macro-category of "CAD files" may prove misleading. Properly understanding digital design files makes the copyright inquiry easier to conduct.

Hence, only a case-by-case analysis may reveal whether a given file type incorporates protectable subject matter. With this approach in mind, one must dissect the various components of digital design files, in order to address whether each of them fits or not within the copyright domain.

Suffice here to note that, regardless of how it is created, each category of files includes a code component, beside a design drawing component. Hence, as Osborn puts it, "*each file type can be displayed as lines of computer code and as an imagine on a computer screen*"[110].

In theory, therefore, CAD files can be created trough "coding", meaning that shapes can be created directly by writing code, rather than by drawing them. Each line of code corresponds to a piece of the design drawing.

In general terms, the constituent elements of a CAD file may fall within the following work categories: sculptures; pictorial and graphic works; works of applied art; computer programs; and databases. The just mentioned categories of works deserve deeper scrutiny.

The next section addresses the issue of whether CAD files for creative objects, such as sculptures, constitute "copies" of artistic works[111].

The definition of what constitutes a copy according to the U.S. copyright statute may provide useful guidance: copies are "*material objects ... in which a work is fixed by any method now*

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[109] Osborn (2017), 37.

[110] *Id.*, 34.

[111] *Id.*, 37, noting that if the CAD file is aimed at manufacturing a building, rather than a sculpture, then it can be considered as a "copy" of an architectural work.

known or later developed, and from which the work can be perceived, reproduced or otherwise communicated, either directly or with the aid of a machine or device"[112].

A CAD file is a means of fixation of a work, which enables reproducing and perceiving the work with the aid of a machine or device (i.e. the 3D printer). Similarly, sound recordings are copies of the works they incorporate[113].

Besides enabling the actual print of, for example, a sculpture, a CAD file can also enable to see the same sculpture on a computer screen, thus constituting a copy of a pictorial or graphic work. Finally, as the CAD file includes also a code component, arguably it constitutes a copy of a literary work, noting, however, that not everything in the code is a computer program, but only the lines of code that instruct the printer or computer to bring about a certain result.

The discussion goes on to illustrate the definition of a "computer program" within the European and U.S. regulatory frameworks. Hence, it scrutinizes whether the CAD file's code component fits or not within such a definition. Finally, the subject matter category of "databases" is examined, in order to ask whether a CAD file can be seen as a collection of pre-existing materials and data that are systematically arranged together.

7.2. The "Works" Embodied in a CAD file

As suggested above, CAD files do not constitute copyright protected "works" themselves. Nonetheless, if the object represented in the CAD file qualifies for protection as a work (such as a sculpture, a work of applied art or an architectural work), then the CAD file can be regarded both as a medium of fixation and as a copy of such work.

Likewise, as the CAD file displays a two-dimensional image of an object, it may qualify as an instrument to record and as a copy of a pictorial or graphic work. Finally, the computer code embedded in the file may qualify as software, since it enables a computer or a printer to perform a task and bring about a certain result. The code may serve to portray the design drawing on a computer screen or to instruct the printer and control the printing process.

It follows that, in the example of a sculpture, the CAD file incorporating a sculptural work may also serve as an instrument of fixation of at least two additional works: a graphic work and a literary work (i.e. software).

The distinctive traits of CAD files remind us of multimedia works, such as videogames[114]. As the CJEU made clear in *Nintendo*[115], videogames are not just software but constitute

[112] 17 U.S.C. § 101.
[113] Antikainen; Jongsma (2017), 268.

"*complex matter comprising not only a computer program but also graphic and sound elements, which although encrypted in computer language, have a unique creative value" and must be regarded as intellectual creations under the InfoSoc Directive*[116].

Noteworthy, the type of CAD file at stake (i.e. the CAD model, printable file or GCODE file) in part determines the work categories that are implicated[117]. For instance, whether the CAD file can be regarded as a copy of a sculptural work largely depends on the nature of the digital file. This last point invites deeper scrutiny.

A CAD file may qualify as a "copy" of a sculptural work insofar as the sculpture can be perceived as a sculpture (i.e. as a physical object) simply with the aid of a machine or device such as a 3D printer. Both printable files and GCODE files enable doing so: a sculpture can be reproduced and perceived once the 3D printing process is over.

In this respect, the only difference between a printable file and a GCODE file lies in that the former requires an additional step before the item can be printed: the STL file needs be converted into GCODE instructions.

Having noted that, the two categories of CAD files under scrutiny both contain the manufacturing information that is needed to print the item. CAD models, instead, do not enable manufacturing the item directly; sometimes, they undergo substantial modifications to become "printable".

As Osborn notes, in cases where such modifications require "*extensive human intervention*", the CAD model "*would no longer constitute a copy of the physical sculpture because a human cannot perceive the sculpture simply with the aid of a machine*"[118]. Most likely CAD models will be regarded as copies of pictorial or graphic works, since they enable perceiving a two-dimensional picture of the sculpture on a computer screen[119].

Printable and GCODE files may likewise be seen as copies of "pictorial or graphic works". Yet, it is likely that most aspects of the drawings would be present only for practical and functional reasons. Especially drawings that are used for manufacturing purposes (i.e. those

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[114] In the U.S. a videogame may gain protection as a literary work (in the written code) and an audio-visual work (in the game's output on the computer screen).

[115] Case C-335/12 *Nintendo v PC Box Srl and Others* (23 January 2014), ECJ Fourth Chamber, [23].

[116] Because videogames do not fall entirely within the scope of the Software Directive, the latter should not apply exclusively (notwithstanding its nature of *lex specialis*).

[117] See the above discussion about the CJEU's construction of a EU-wide notion of work, according to which subject matter categorization is superfluous.

[118] Osborn (2017), 39.

[119] *Id*.

recorded in printable or GCODE files) hardly contain creative elements, but rather resemble "technical drawings"[120].

By contrast, CAD models usually display additional elements that are not used by the printer but are just meant for human viewing (such as use of colour, shading, lighting, etc.), which are possibly creative enough to attract copyright.

Like a painting or a photograph, the CAD-based image may be protected as an artistic work because it displays an object in an original manner, due to the creative choices that are made, and regardless of whether such object is itself eligible for copyright protection[121].

In case of printable and GCODE files, instead, there is usually no choice in regards to creative elements such as colour, shading and lighting. This, in turn, leads us to examine the way copyright law protects technical subject matter, namely "technical drawings".

Among the works eligible for copyright protection, the Berne Convention does not mention technical drawings, but refers to "maps and plans" relative to architecture[122]. The list is not exhaustive and national rules will determine whether technical drawings or plans other than the ones referred to in Berne can enjoy protection.

As a body of literature suggests, although in the EU *acquis* there is no explicit recognition of copyright in technical drawings, nothing in principle prevents contributions of a more technical nature to qualify as "works", provided that they are the author's own intellectual creations[123].

Having noted that, technical drawings will have to pass the functionality bar and the originality hurdle, in order to qualify for protection. Some contain only the minimum technical information that is necessary to manufacture the item, some lack sufficient originality because of their banality.

According to French case law, for example, technical drawings or images of industrial pieces could attract copyright protection under the condition that the placement of the pieces, dimension of the images and lines of shadow thickness are not only dictated by the technical necessity of exact reproduction[124].

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[120] In the U.S. technical drawings fall within the category of "pictorial, graphic and sculptural works" explicitly listed in Section 101 of the Copyright Act.
[121] Antikainen; Jongsma (2017), 264, § 12.03[B].
[122] Article 2(1) Berne.
[123] Antikainen; Jongsma (2017), 265, § 12.03[B].
[124] Jasserand (2011).

As for the originality requirement, the German Federal Supreme Court held that drawings representing screws display sufficient creativity in things such as the drawing lines, the shadowing, the hatching, the angular position and the choice of perspective[125].

The CAD drawing that is intended to replicate reality most likely will not entail creative choices. In the opinion of Osborn, however, CAD-based technical drawings may display a modicum of creativity in additional elements, such as in the way they display technical information as measurements and tolerances[126]. Lacking such information, most likely CAD-based drawings will not meet the originality threshold for copyright subsistence.

Interestingly, the U.S. statute (§ 113(b)) specifies that, even when a technical drawing is protected, copyright does not extend to the useful article the drawing represents[127]. If technical drawings were analogized to CAD files' content, copyright would not extend beyond the digital design drawing itself, and manufacturing the useful object embedded in the CAD file would be permissible[128].

Thus, copyright protection of CAD drawings in the U.S. would not be dependant on, or correlated to, the protection of the underlying object. According to Dagne, this would be an appropriate treatment of CAD files, as the design would qualify for protection regardless of whether the final 3D-printed output is a functional object or not[129].

Under UK copyright law, technical drawings are included within the category of "artistic works"[130].

As discussed below in the part dealing with copyright infringement, the artistic copyright in the digital design does not confer protection against the act of making the physical products if what is created is not an artistic work. In other terms, the CAD model incorporating the design can be used to output anything else than an artistic work, without the owner's authorization[131].

The other subject matter category that comes under scrutiny is that of "literary works". An existing strand of literature suggests that a CAD file qualifies as a copyright work in its own right, since it falls within the definition of "computer program".

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[125] Antikainen; Jongsma (2017), 266, § 12.03[B],

[126] Osborn (2014), 829.

[127] On this see Reitinger (2015); Simon (2013), 82; and Dasari (2013), 291.

[128] 17 U.S.C. § 113(b), stating that the owner of copyright in a work that portrays a useful article as such does not have the right to make, distribute or display the useful article so portrayed. On the contrary, if the object that the CAD-based drawing represents is copyrightable, the making of the artefact without the owner's permission infringes copyright.

[129] Dagne; Dubeau (2016), §121.

[130] Section 51(1) UK CDPA.

[131] The decision in *Lucasfilm Ltd v Ainsworth* [2011] 3 WLR 487 supports the argument that physical products that come into existence from a CAD file do not infringe. Mendis (2014), 273; Mendis; Secchi (2015), 11.

As suggested above, such a claim is wrong to the extent that it qualifies a file as software. It is the code component of the CAD file, rather than the file *qua* file, that may be capable of copyright protection as a computer program, since it performs the specific task of displaying an item on a computer screen or enabling and controlling the actual print of the object.

This assertion, however, is not without relevant consequences. In fact, applying copyright law that governs computer programs to CAD files conflates computer programs with the works expressed in digital form. In practice this would also mean to extend protection to all CAD files (provided that the conditions for protection are met) regardless of the artefact that the design file can produce.

The following discussion reviews existing scholarship focussing on the intersection between CAD files and copyright law. It seems that most commentators tend to agree with the finding that, while in theory the code component of a CAD file may fall within protectable subject matter, in most instances it lacks the intellectual creativity required for copyright subsistence.

It is here argued that, when a computer program translates the digital design file into coded instructions for the printer to follow, the originality standard will not be met (i.e. the code does not "originate from the author", hence it is not a copyrightable literary work)[132].

In fact, the human input in producing the GCODE is nothing more than requesting a computer program to generate a literary output, on the basis of a pre-made design drawing and, most of the times, in response to the entry of technical information about the manufacturing process (i.e. infill, temperature, speed and thickness, etc.).

On the other hand, it is not beyond the realm of possibility that a user endeavours to write the code himself or herself. Hence, the question that arises is which part of the coded instructions is protectable. Arguably, the way in which the code is written is predominantly dictated by functional considerations. Whether the code contains elements that are severable from its functionality clearly remains highly problematic.

Thus, in order to cast some light on the legal status of CAD files, and fully appreciate the consequences of considering these files in terms of literary copyright, it if first important to define what constitutes a "computer program" at the international and European level. Then, the discussion addresses the same issue from the U.S. perspective, focusing on U.S. law and case law on software copyright. To conclude, the discussion illustrates the application of the idea/expression dichotomy to software.

[132] In order to obtain the code, the user has to provide a computer program with a set of information about speed, thickness, filaments, etc. As discussed below, arguably the human contribution in the computer's output, which consists in the entry of basic and technical criteria, does not constitute authorship.

8. CAD files as Computer Programs

8.1. Protection of Software at the International Level

At the international level, the question of what is the most appropriate vehicle for protecting software was first considered by WIPO at the end of the 1970s. Viable options ranged from conferring legal protection to computer programs through copyright law, through the patent system or through a regulatory framework specifically devised for this new form of modern technology.

The original position of WIPO was to recognize *sui generis* protection to three elements of a computer program: the source code, the object code and its documentation. In 1978 this proposal was first published in the WIPO's Model Provisions on the Protection of Computer Software[133].

At the same time, some doubts about granting patent protection to software were expressed. In short, three lines of arguments were put forward. First, it was stated that this option is not compliant with Article 52(2)(c) of the European Patent Convention, containing an express provision to that effect.

Second, patent protection would cover only those few exceptional cases in which software shows sufficient inventiveness and novelty. Moreover, additional practical difficulties, such as the expertise required to examine the state of the prior art and the risk of misappropriation as a result of patent disclosure, were taken into account[134].

Objections were likewise raised to the argument that copyright is an effective legal tool for protecting computer programs. A first line of arguments was that only "source code", and not also "object code", is readable by human beings and therefore analogous to a literary work[135]. Further, software – which consists of a set of instructions whose final addressee is a computer – has a technical nature and fulfils a practical purpose. In this respect, it diverges from more "traditional" authorial creations, such as literary and artistic works, which stimulates the human senses[136]. Accordingly, computer programs should be banned from enjoying copyright protection.

Finally, it was argued that the duration of protection (50 years *post mortem auctoris*) is too long for such types of creations, having a short life cycle[137].

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133 Rickeston; Ginsburg (2006) § 8.93; Aplin (2009), 51.
134 Geneva, November 27 to 30, 1979.
135 *Id.*
136 *Id.*
137 *Id.*

Nonetheless, the idea of treating computer programs as literary works, to which copyright protection applies, readily began to take form. Hence, in the early to mid-1980s, various countries, including the U.S., the UK, France and Germany, dismissed the *sui generis* regime formulated in the Model Provisions, taking the avenue of copyright protection[138].

As Aplin details, this was the result of successful lobbying by software manufacturers, wishing to obtain quick and effective protection, by means of the 'ready-made' solution offered by copyright law[139].

Ultimately, Article 4 of the WIPO Copyright Treaty 1996 and Article 101(1) of the TRIPS Agreement 1996 made clear that computer programs shall be protected as literary works, within the meaning of Article 2 Berne[140].

International copyright treaties do not offer a comprehensive definition of what constitutes a computer program. Such definition, however, is set out in the above-mentioned WIPO's Model Provisions, according to which a computer program is "a set of instructions capable, when incorporated in a machine-readable medium, of causing a machine having information-processing capabilities to indicate, perform or achieve a particular function, task or result".

The categorization of computer programs as literary works is also ingrained in the European copyright legislation on software, as the next paragraph illustrates.

8.2. The EU Software Directive

At European level, software finds protection under the Software Directive 2009/24/EC. The Directive does not set forth any express definition of "computer programs". This reflects the EU legislature's choice not to make any definition obsolete in the light of technological change[141].

Article 1 of the same Directive, however, provides some key requirements: 1) Member States shall protect computer programs as "literary works", within the meaning of the Berne Convention; 2) protection in accordance with the Directive shall apply to the expression in any form of a computer program, and not the underlying ideas and principles; 3) the term "computer program" shall also include its preparatory design material; 4) a computer program

[138] Aplin; Davis (2014), 71.
[139] Aplin (2009), 51.
[140] Article 2 of the WIPO Copyright Treaty and Article 9(2) of the TRIPs Agreement provide that copyright protection extends to expressions and not to ideas, procedures, methods of operation or mathematical concepts as such.
[141] See Advocate General's opinion in *BSA*, [46].

shall be protected if it is original, in the sense that it is the author's own intellectual creation[142]. No other criteria shall apply to determine its eligibility for protection.

The Software Directive further specifies, under Recital 7, that the preparatory design material that is capable of being protected shall be such that a computer program can result from it a later stage[143]. This, in turn, means that the object of protection under the Directive includes preparatory material leading, respectively, to the reproduction or subsequent creation of software, such as flow charts and system analysis.

Moreover, whenever it is not possible to make recourse to protection accorded by the Software Directive, as in the case of subject matter that does not qualify as a "computer program", the ordinary law of copyright can still apply.

It is a common ground that, in order for a work to be protected by virtue of the InfoSoc Directive, the expression should not be entirely dictated by technical function. In such a case, the originality standard is not met, as the author is not free to express his creative choices in an original manner.

In an attempt to better define what constitutes a computer program for copyright purposes, particular attention should also be devoted to recent case law from the CJEU. In *BSA*, the CJEU has clarified that protection in accordance with the Software Directive shall apply to the "*expression in any form of a computer program*", from the moment when its "*reproduction would engender the reproduction of the computer program itself, thus enabling the computer to perform its task*"[144].

It follows that the source code and the object code are among the forms of expression of a computer program entitled to copyright protection by virtue of Article 1(2) of the Software Directive[145]. Quite the reverse, elements of a computer program – such as GUIs or "mere data" – which are not expressed in the code and do enable the computer to perform its task, are not entitled to protection.

A GUI is not a "form of expression of a computer program"; it merely constitutes an interaction interface by means of which users make use of the program's features and communicate with a computer program[146].

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[142] Derclaye et al. (2012), 97 et ss.

[143] *See* Recital 15 of the Software Directive, read in conjunction with Article 4(b) of the same Directive, stating that the rights vested in the author of a computer program include the translation, adaptation, arrangement and any other alteration of a computer program. Preparatory design material can be protected since all subsequent stages can be considered adaptations of it.

[144] *BSA*, [38].

[145] *Id*., [35].

[146] *Id*., [40]-[42].

It is also apparent, from both the CJEU's decision and the Advocate General Bot's opinion in *BSA*, that protection of GUIs is indeed possible under the InfoSoc Directive, but that the originality criterion will hardly be met.

In fact, the majority of elements that a GUI comprises have a functional purpose, "*since they are intended to facilitate the use of the computer program*"[147]. Accordingly, "*the manner in which those elements are expressed can only be limited, since the expression is dictated by the technical function which those elements fulfil*"[148].

Moreover, as the Court has clarified in *SAS*[149], the functionality of a computer program (or indeed the combination of several functionalities) "*continues to be comparable to an idea and cannot, therefore, be protected as such"*[150].

Both the AG and the CJEU in *SAS* reasoned that allowing the functionality to be protected by copyright would amount to making it possible to monopolize ideas, which is detrimental to technological progress and industrial development[151].

Likewise, the Court concluded that the programming language and the format of data files are not forms of expression protected by the Software Directive[152]. Nonetheless, this is without prejudice to the protection available under the InfoSoc Directive, whenever these elements constitute the author's own intellectual creation[153].

For the sake of completeness, it is worth noting that the European Commission has likewise offered helpful guidance on what constitutes a computer program for the purposes of EU copyright law. In the Commission's Green Paper of 1998 a computer program is described as "*a set of instructions that are aimed at letting an information processing device, like a computer, perform its functions*" [154].

8.3. The CAD file as a Copy of a Literary Work

As noted above, there appears to be little agreement among scholars regarding the legal status of CAD files. A first view qualifies CAD files as artistic works protected under the InfoSoc

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[147] AG's Opinion in *BSA*, [75]- [76].
[148] *Id.*
[149] Case C-406/10 *SAS Institute Inc. v World Programming Ltd* [2012] 3 CMLR 4 (Grand Chamber).
[150] *Id.*, [39]. The functionality of a computer program can be defined as "the set of possibilities offered by a computer system" or "the service which the user expects from it". *See* the Advocate General's Opinion in *SAS*, [52].
[151] *SAS*, [39].
[152] The 14th Recital in the preamble to the Software Directive confirms, in this respect, that logic, algorithms and "programming languages" comprise ideas and principles that are not protected under the Directive.
[153] *SAS*, [45].
[154] EC Green Paper on Copyright and the Challenge of Technology, Copyright Issues Requiring Immediate Action, COM (88) 172 final (7 June 1998), § 5.1.

Directive. A second line of thought qualifies CAD files as computer programs within the meaning of the Software Directive, being a set of literary instructions to the printer.

It is likewise possible to qualify the literary instructions contained in the CAD file as an intellectual creation under the InfoSoc Directive, provided that such instructions pass the functionality bar.

The categorization of CAD files in terms of artistic or literary copyright bears particular relevance in countries that adopt a closed-list approach to protected subject matter, such as the UK. In the EU, what counts is that the creative expression embedded in the CAD file is the author's own intellectual creation.

Noteworthy, the legal qualification of a CAD file in terms of software will have the set of consequences aptly illustrated by Antikainen and Jongsma[155]: the exclusive rights granted to the author would be subject to a different set of exceptions, and the general private copying exception would not be applicable; the exhaustion doctrine would need to be applied following the CJEU's decision in *UsedSoft*[156]; and rules on ownership of CAD files in case of employment relationships may also vary (i.e. with the employer being automatically vested with the copyright in the CAD file).

A review of existing literature, however, shows that only a minority of academics is in favour of equating CAD files to computer programs[157]. Mendis and Secchi tend to agree on this last point, although from a UK perspective. The authors refer to Sections 3(1)(b) and (c) of the UK CDPA 1988 to affirm that a computer program and "*its embedded data*" can be protected as a literary work under the statute. In the authors' view, the inclusion of the term "embedded data" in the statutory definition of computer program suggests that the latter encompasses also an object design file or CAD file.

On closer inspection, however, it appears that the provisions recalled by the authors make no reference to "embedded data" of a computer program. By contrast, on a par with the Software Directive (Article 1 and Recital 7), the wording of the UK CDPA 1988 merely provides protection, in terms of literary copyright, to a computer program (Section 3(1)(b)) and its "preparatory material" (Section 3(1)(c)).

[155] Antikainen; Jongsma (2017), 262, § 12.03.

[156] Case C-128/2011, *UsedSoft GmbH v Oracle International Corp.* ECR 2012 I-0000. Following *Usedsoft*, if CAD files were equated to software, their distribution online would give rise to exhaustion, given the *lex specialis* nature of the Software Directive. On the contrary, following Case C-419/13 *Art & Allposters International BV v Stitching Pictoright* [2015] ECDR 8, exhaustion remains tied to the distribution of physical copies of the work under the InfoSoc Directive. *See* infra.

[157] *Inter alia*, Mendis; Secchi (2015); Mendis (2014), 271; Simon (2013); Bradshaw et al. (2010), Dagne and Dubeau (2016), 119-120; Dolinsky (2014), 646-650; and Rideout (2011). See Antikainen; Jongsma (2017), 261, note 26.

As pointed out by Jacob LJ in *Nova Productions*: "*the EU legislation appears to contemplate just one copyright in a computer program, not two, one in the preparatory work and the other in the program itself*"[158]. The UK CDPA opens up a certain degree of ambiguity when it states that "a computer program" and the "preparatory design work for a computer program" are protected, as if they were completely separated types of work, in which literary copyright can subsist[159].

This "*traditional, but wholly unhelpful way of re-wording the Directive*", causes some uncertainty"[160]. It seems preferable to consider, for the purposes of copyright law, the program and its preparatory design material as supposing only one copyright, not two (one in the preparatory work and the other in the program itself)[161].

Hence, all phases subsequent to the preparatory design work, including the development of the computer program itself, can be regarded as adaptations, constituting infringement, unless these acts fall under a stipulated exception.

Rejecting the approach followed by some commentators, it is here argued that preparatory design material is not the same sort of thing as a CAD file; rather, it includes flowcharts and other material whose purpose is the creation of software. CAD files contain coded instructions that are not aimed at the creation of a computer program, but at manufacturing the final object[162].

In light of the above, in the opinion of the present writer, Mendis and Secchi's finding is at odds with the letter of the law. In the same vein as in European legislation, the object of protection of software under UK law is not inclusive of any "embedded data", which is what a CAD file encompasses[163].

In fact, as observed below in more detail, a CAD file can be seen as a string of data, which cannot, by itself, give instruction to the printer on how to perform its task. It is the CAD file's code component, expressed in the form of GCODE, which fulfils such a function. The function of the CAD file *qua* file is that of "being communicated" rather than "actively communicating" and controlling the process[164].

Again from a UK perspective, Bradshaw proposes that a CAD file is "*an original work of authorship that may be protected in the same manner as computer software (which, as a*

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158 *Nova Productions Ltd v Mazooma Games Ltd* & Others [2007] EWCA Civ 219, per Jacob LJ [28]
159 *Id.*
160 *Id.*
161 *Id.*
162 He (2017), 244, § 11.03.
163 Phillips (2015).
164 Antikainen and Jongsma (2017), 267, §12.03[B]. *See* also: Dobbelaere (2015-2016).

series of instructions, it resembles)"[165]. In the author's view, that is in accordance with Laddie J's finding in *Autospin v Beehive*[166].

This last decision was handed down before the advent of 3DP in an action for copyright infringement relating to the design of oil seals. The claimant created some charts that included some critical dimensions used in the manufacturing process of these seals.

The defendant began manufacturing oil seals that allegedly infringed copyright in the claimant's compilation of measurements in the form of a chart (a literary work). Thus, Laddie J had to consider whether copyright in a literary work might be infringed by reproducing it in a three-dimensional article.

For the purposes of the present analysis, it is worth noting that, in a very interesting passage, Laddie J found that a design could be defined accurately either in graphic symbol or in words and letters (i.e. non-graphic notation). This is borne out by the fact that "*many three-dimensional articles are now designed on computers*".

In such a case, "*a literary work consisting of computer code … represents the three-dimensional article*"[167]. Accordingly, "*it may well be sensible to say that making a three-dimensional article from a data file in a computer (a literary work), which precisely defines the shape of the article, is to reproduce it*"[168].

Nevertheless, on the facts, Laddie J found that the defendant had not reproduced the claimant's literary work, as the chart did not give any indication of the shape of the seal, but merely indicated some critical dimensions used in the manufacturing process.

Following the decision in *Autospin,* one may argue that the person who writes the GCODE instructions from scratch is vested with copyright in both the literary work and the artistic work embedded in the CAD file. Hence, a single creative endeavour could give rise to two distinct works of authorship. This conclusion appears to be in line with UK case law holding that engineering drawings for circuit diagrams enjoy both literary and artistic copyright[169].

In the opinion of the present writer, however, it is fair to argue that the copyright attaches to the original work of authorship embedded in a CAD file, i.e. the design. Whether such design is expressed in graphic symbols or in coded language does not alter its nature of work.

This does not mean, instead, that two copyrights must necessarily subsist, one in the literary work and one in the artistic work. In fact, the UK closed categorization of subject matter

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[165] Bradshaw (2010), 24.
[166] *Autospin (Oil Seals) Ltd v Beehive Spinning* [1995] RPC 683, per Laddie J at pp. 697-700
[167] *Id.*
[168] *Id.*
[169] *Anacon Corp Ltd v Environmental Research Technology* Ltd [1994] FSR 659.

could lead to the wrong conclusion that the same creative endeavour (i.e. making the design of an object, by writing the underlying code, rather than by drawing the CAD model) creates more than one copyright[170].

If this line of argument is followed, the creator of a digital design could in principle assert copyright in it as a species of literary work so as to protect the appearance of the object[171]. Arguably, whilst Laddie J correctly took the view that the appearance of an object can be detailed with literary expression, as well as with graphic notation, he caused general confusion by holding that the data file could be protected as a "literary work".

Instead, it is here suggested that the person who is able to describe a product design by writing the coded instructions to print it gives birth to a single piece of (artistic) work, since the creative effort at stake is not in the sequence and choice of the code, but in the visual aspect of the resulting design.

Arguably, it is possible to conceive a CAD-based code as a literary expression that describes a 3D thing, and the final 3D-printed output is made to the description[172]. Accordingly, the computer code is a two-dimensional, faithful, complete and sufficiently detailed description of an object. If the latter is copyright protected, so it is its reproduction in literal form.

The code component may be seen as a copy of the original design, which is expressed in literary terms. Accordingly, copyright protection attaches to such code in the same way as it attaches to the digital design and the final printed object: these are all copies of the same authorial work. It follows that copyright shall cover only those codes that correspond to copyright protected designs, keeping in mind, however, that codes that do not enable to print a protected work of authorship may nonetheless be eligible for protection on other basis, i.e. as computer programs under the Software Directive.

In fact, it is not possible to address separately the legal nature of CAD files (and their code component) from the legal nature of the object they represent. Copyright protects creativity in the artistic work embedded in a CAD file, not the manufacturing process itself that is expressed through code.

Following a second line of thought, the literary expression contained in the code shall be protected as a work in its own right, irrespective of whether the underlying article is protected or not. The set of worded instructions on how to manufacture an item – if human-authored, written from scratch and not generated by software – constitute a protected literary work.

[170] A separate issue is whether the code component should be regarded as software protected under the Software Directive.

[171] Wei (2012), 3.79 et ss.

[172] Bently (2014), 146.

Upon closer inspection, however, it emerges that such form of literary endeavour is mainly dictated by functional considerations. In this respect, it is possible to draw an analogy with a recipe: the ingredients as such are not eligible for copyright protection, being a mere statement of fact, whereas the instructions on how to mix up the ingredients in order to bring about a certain result may be functional, being a "procedure"[173].

As opposed to a recipe, which may contain substantial literary expression, besides a mere listing of ingredients and a set of functional instructions (for example, if it is a poetic description of a dish), the coded instructions in a CAD file most likely will be regarded merely as a procedure, lacking creative elements besides functional elements.

Moreover, in the unusual case where the literary expression is not functional and contains sufficiently original expression, it will be protected only against (almost) literal copying: i.e. if the defendant had access to the instructions and copied them verbatim, thereby reproducing the creative elements of the literary work.

It is not possible to prevent the actual making of an object by following the instructions, as the instructions themselves are excluded from protection, being functional. Only to the extent that the instructions also serve to fix a protected work of authorship, then following the instructions in order to make (reproduce) the object would not be permitted, absent an applicable exception.

To recapitulate, the preferable view is to consider the (literary) coded instructions within the CAD file as a medium of fixation of a protected work of authorship (a work of art, architecture or applied art), in the same way as literary notation may serve to record a choreographic work in tangible and durable form[174].

When the choreography is fixed in a material form, there might be separate copyright in the literary work (the notation) and in the motion picture. In a similar vein, the instructions contained in the CAD file may be regarded as an intellectual creation under the InfoSoc Directive; yet, most likely such instructions will rather fall within the exclusion for functional matter, such as processes, methods or procedures.

Therefore, if the code does not serve as a means for recording an intellectual creation, it should be free for anyone to use, being the mere description of a manufacturing process.

[173] For a comparison with U.S. law, *see* the Seventh's Circuit decision in *Publ'ns Int'l, Ltd v Meredith Corp*. 88 F.3d 473.

[174] The U.S. Copyright Office: "fixation of a choreographic work is now possible in several ways by a detailed textual description of the dance movements, by dance notation or by making a motion picture". On this *see* the Copyright Law Revision Studies 26-28 of the Committee on the Judiciary U.S. Senate, available at: https://www.copyright.gov/history/studies/study28.pdf, 102. When the choreography is fixed in a material form, there might be separate copyright in the literary work (the notation) and in the motion picture.

In theory, the coded instructions may also qualify as a computer program (literary work) under the Software Directive, since they enable the printer or the computer to perform a given task. Not everything in the code, however, is a computer program: one must extrapolate the part of the code that instructs a computer/printer to bring about a certain result, i.e. either the display of the design drawing on a screen or the actual manufacture of the object.
If the code were examined through the lens of software protection, it would not receive the same protection as the physical printed-out object. As noted by Ballardini, if "*we were to decide a priori that CAD files are always to be considered "software" in the view of the law"*, not only the specific rules of the Software Directive would apply, but also "*this might mean that the CAD file (i.e. a software work) would attract copyright protection almost automatically*", irrespective of whether the final 3D-printed output meets the requirements for copyright protection or not[175].
An element to take into account when addressing the copyright status of CAD-based code is that, most of the times, such code is generated by CAD software and, therefore, is not the "author's own intellectual creation", for the purposes of the Software Directive.
Moreover, if the code were seen as software, functionality would deprive most lines of code of protection. The GCODE describes a process to print out an item and most of its tool path instructions can be expressed only in one way. Therefore, one can hardly conceive how the originality threshold for copyright subsistence would be met.
It is also clear from the CJEU's case law that both the programming language (the GCODE language) and the data files' format (i.e. STL or 3MF) are not forms of expression of the computer program, but are used by the computer to perform its functions; although they are not eligible for protection as software under the Software Directive, they can still enjoy protection under the InfoSoc Directive, provided that they are the author's own intellectual creation.
It is here argued that the best way of dealing with CAD-based code is to acknowledge that creativity lies in the original design, not in the coded process that has an automated algorithmic nature and is mostly dictated by practical considerations. One should always ask what is the intellectual creation that we aim to protect: in case of CAD files it is not a code, but the original design of an object.

8.4. A CAD File is Just a String of Data

[175] Ballardini et al. 2016, 43-44.

On the basis of the considerations made so far, it appears plain to the present writer that the claim that a CAD file *qua* file fits within the definition of "computer programs" suffers from major drawbacks.

The first, and perhaps most problematic, element to consider is that a CAD file is just string of electronic data defining the appearance of a product, which needs to be imported into specialized software in order to render it into coded instructions.

The CAD file is not *per se* a list of commands for the 3D printer to read and follow. The same holds true if a person wants to visualize a CAD model on a computer screen; she needs the assistance of a computer program.

It is here suggested that a CAD file is not much different from a Photoshop "PSD file", i.e. the file format that Photoshop uses for saving the header, layer and mask data, colour data, image data, and all other information in the image. The PSD file also serves as a working document, since the user can re-edit it at a later stage and record all the alterations made in the course of the editing process. Finally, in order to be easily shared online, a copy of the image can also be saved in a common file format, such as JPEG and PNG, which cannot, however, be opened in Photoshop[176].

As noted by Phillips, a CAD file can also be compared to a video file. The latter "*stores data covering three basic dimensions – x and y axes, and time – plus a soundtrack, and occasionally such things as sub-titles and alternative camera angles*"[177]. However, "*not until is placed in the correct player will the video be perceptible to human senses*".

According to Phillips the same principles apply to a CAD file: in order to make the design visible, you need to load the file into a suitable computer running the requisite software. Therefore, on a par with other electronic files, a CAD file embeds a string of data; it merely defines the CAD model and its specifications. A file should not be seen, instead, as a set of instructions capable of causing a 3D printer to perform its function.

As all digital data stored in a computer system, data embedded in CAD file consists of binary information, i.e. strings of 0s and 1s. This, however, does not turn the file into a literary work[178]. Likewise, the conversion of a printable file into a GCODE file does not alter the nature of the protected work. One consequence of this line of argument is that the code will be protected only if the underlying design is protected.

[176] *See* https://github.com/layervault/psd.rb/wiki/Anatomy-of-a-PSD-File.
[177] Phillips (2015).
[178] *See* http://study.com/academy/lesson/binary-language-of-computers-definition-lesson-quiz.html.

Having made the preliminary remark that the CAD file qua file is not software, the CAD file's *code component* can qualify as a literary work (i.e. as a computer program), whereas the CAD file can be seen as a copy of a literal work.

A copyright hurdle that we encounter, in the attempt to draw an analogy between such code and a computer program, is the requirement of originality. As noted above, a computer program shall be protected if it is original, in the sense that it is the "author's own intellectual creation". CAD files create challenges in relation to the originality threshold because the designer of the CAD model does not himself/herself create the GCODE, at least not directly.

The latter is generated automatically by software, although the exact code that the computer program produces is determined by the specific design that the user creates[179]. In other terms, as explained above, the digital design created by a user, once processed by software, is converted into computer code that is used to give commands to the printer.

At maximum, in order to generate the GCODE, the user may be required to give specific commands, like speed and thickness, which belong to his or her technical know how. Hence, this kind of user's input does not constitute authorship in a copyright sense.

In a way, the code in a CAD file resembles the output that a computer program such as Google Translate generates on the basis of the user's input. In fact, the code is created on the basis of the design drawing that the user makes (and potentially additional technical information that is not relevant for copyright purposes).

Therefore, the problem is that, as noted by Dolinsky, "*the designer of a CAD file does not write the file's code – at least, not in the sense that the programmer of the CAD software does*"[180]. In fact, it is the programmer of the CAD software that has already predetermined what is the code associated to every piece of the design. Dolinsky makes a comparison with a Microsoft Word document, suggesting that the author of such document is not also "*the author of the code that her computer sends to a traditional 2D printer"*[181].

Therefore, if a CAD file's code is not "the author's own intellectual creation", the originality requirement for copyright subsistence is not fulfilled. It is well settled that EU copyright law does not protect computer-generated works, meaning works that are created with no authorial input, but entirely by a computer program.

A delicate issue that is currently under a fierce discussion is the extent to which "computer-assisted" works, i.e. works generated through the assistance of software, with a, at times,

[179] Dolinksy (2014), 638-639.
[180] *Id.*
[181] *Id.*

minimum contribution of the part of a human author, shall deserve protection under copyright law.

On the other hand, if the user writes the code himself/herself, at best such code will gain very thin protection under the law of copyright, since it is largely dictated by functional considerations. The code's expression is predominantly necessitated by the intended purpose, i.e. providing instructions to the printer of how to build each layer of the design.

In fact, after recognizing GCODE as copyright subject matter, a major problem is separating the protected elements of the program from the purely functional or utilitarian aspects, and from those elements that are part of the public domain.

In other terms, it is important to distinguish the function or idea of the software from the computer code or expression. Copyright applies only to the latter.

Arguably, most constituent elements of the code are commanded by the intended task of building the object and incidental to efficiency concerns, making only one or two forms of expression workable options.

For example, the machine tool path indicating the direction that the nozzle should take (i.e., move from the right side to the left side or from the bottom to the top) may be dictated by functional considerations and capable of only one expression. If there is only one or a few ways to attain a certain function, a second user could come and freely use the same expression.

Osborn suggests that the programmer who writes in GCODE "*can write a program in slightly different ways to make the exact same utilitarian device*"[182]. In fact, in some cases the order of the manufacturing process is *immaterial*[183].

For example, if the aim of such process is to drill two holes, it makes "*no difference whether the left or right hole is drilled first*"[184]. The program can instruct the printer to start manufacturing on the left or right side of the object and still obtain the same end result[185]. Hence, there is not just one way of expressing a thing. If the code internalizes the programmer's creative choices, it may pass the originality hurdle for copyright subsistence.

In the opinion of the present writer, the preferable approach is to consider the code component of the CAD file as a means of recording the design: if the design is eligible for protection, the literary instructions for manufacturing it should be treated as a reproduction of the work they incorporate.

[182] Osborn (2017), 53.
[183] *Id.*
[184] *Id.*
[185] *Id.*

On the other hand, the code embedded in a CAD file must be free for anyone to copy if it describes the process for displaying on a screen or for 3D printing an article to which copyright does not attach.

8.5. Software Protection Under U.S. Copyright Law

Some of the rules expressed above that regulate computer programs in Europe are shared by the U.S. legal system. This paragraph discusses the scope of copyright protection for software under U.S. law, without, however, any claim to completeness.

Computer program is defined in Section 101 of the Copyright Act 1976 as: "*a set of statements or instructions to be used directly or indirectly in a computer in order to bring about a certain result*". Furthermore, like under EU law, computer programs enjoy protection as literary works in the Act.

It should also be noted that, under U.S. copyright law, the output of a computer program is subject to distinct copyright as an audio-visual work (for instance, the images that appear on the screen and accompanying audio).

In fact, in *Stern Electronics*[186] the Second Circuit took the view that the repetitive sequence of images and sounds of a videogame could qualify for copyright protection, "*even though the underlying written program has an independent existence and is itself eligible for copyright*"[187].

The Court also determined that the creator of the game still holds a valid copyright in the game outputs, "*although the entire sequence of all the sights and sounds of the game are different each time the game is played*", given that they depend on the player's contribution[188]. Nevertheless, many visual or aural aspects of the game remain constant during each play, thus, attracting copyright protection.

Thus, both the audio-visual display and the underlying computer program are protectable works under U.S. law[189]. Elements of the program that gain copyright protection include literary elements, such as the source code and object code, and non-literal elements, such as the "*structure, sequence, organization, user interface, screen displays, and menu*

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[186] *Stern Electronics Inc. v Kaufman*, 669 F.2d 82 (2nd Cir. 1982), aff'g 523 F. Supp. 635 (EDNY 1981).
[187] *Id.*, [586].
[188] *Id.*, [855]-[857].
[189] See Dolinsky (2014), 640 et ss., distinguishing a CAD-based design and the code portion of the CAD file from a program output.

structures"[190] to the extent that they "*incorporate authorship in the programmer's expression of original ideas, as distinguished from the ideas themselves*"[191].

Courts have developed complex tests to draw the line between unprotected ideas and their expressions in computer software. A first approach was followed in *Whelan*[192], which can be summarised as it follows. The first step consists in identifying the program's ultimate function or desired purpose, such as "the efficient management of a dental laboratory"[193] or "the maintenance of a business ledger"[194]. The purpose or function of the program constitutes the work's idea.

If there are different means for achieving the same purpose, then "*the particular means chosen is not necessary to the purpose*"[195]. Hence, everything that is not necessary to the work's purpose or function is protectable expression, not idea.

The main criticism that has been raised against the court's reasoning in *Whelan* is that "*it assumes that only one "idea", in copyright law terms, underlies any computer program and that once a separable idea can be identified, everything else must be expression"*[196].

By contrast, a computer program is made up of various component elements, such as subroutines or modules, which can be broken down in further sub-subroutines, and be organized in flow-charts. Each constituent of a computer program is aimed at achieving a certain function or purpose, which may be different from the program's ultimate goal.

Noting the flaws in the *Whelan*'s decision, the Second Circuit in *Altai*[197] developed the so-called "abstraction-filtration-comparison" test[198].

The latter separates the constituent components of the program, at different levels of abstraction (the "abstraction" phase), i.e. from the code to program's ultimate function.

After abstraction, the test purports to filter out unprotected elements, which are incidental to the program's function or purpose (the "filtration" phase).

This may be the case if the expression is: necessitated by considerations of efficiency, so as to be necessarily incidental to the idea; required by external factors (such as computer

[190] *Gen. Universal Sys., Inc. v Lee*, 379 F.3d 131, 142 (5th Cir. 2004).
[191] *Computer Associates Int'l v Altai inc.*, 982 F.2d 693 (2nd Circ. 1992), [703].
[192] *Whelan v United States*, 11 U.S. 112 (1812).
[193] *Id.*, [1236].
[194] This example is taken from the Second Circuit's decision in *Altai*.
[195] *Whelan*, [1238]-[1239].
[196] *Whelan*, [1240].
[197] *Altai*, [707]-[710].
[198] Note that this three-step test is used to assess (non-literal) software copyright *infringement*, whereas this section deals with copyright *protection*. Having noted that, the first two steps of this test serve to understand which parts of the code may be eligible for protection, before the comparison with the pre-existing program takes place.

specifications, compatibility with other programs or the speed and power of the software that is used); taken from the public domain[199]. After filtration, the remaining protectable material is then compared for assessing similarities (the "comparison" phase) in an action for copyright infringement.

Arguably scholarship commits an error in applying the *Altai* test to CAD files as files. In fact some commentators seem to dissect the CAD file, rather the embedded code, in its constituent parts, to conclude that the code component can be filtered out from the file[200].

It is here argued that there is no need to apply the *Altai* test in order to disentangle the CAD file's components: the file and the code are two separate elements in any case. It is the code component of the CAD file that must be dissected into its constituent parts. Hence, the abstraction-filtration-comparison test applies to each portion of the code (i.e. the work), not of the CAD file *qua* file.

Once the dissection has been completed, the court would need to filter the non-protectable elements out of the program, at each level of abstraction. As suggested, the CAD file's code component most likely will be necessitated by technical function.

The coded expression in the program will likely merge with the uncopyrightable idea of describing a process on how to print an item. In fact, others will have to describe the process using exactly the same line of code that any other programmer would have to use. Hence, expressive elements that merge with the function of the program will need to be filtered from the code's wording in assessing its overall copyrigthability[201].

What eventually remains is a "core of protectable elements" [202]. Hence, the scope of protection eventually recognized to the CAD file's code would be very narrow.

9. CAD Files as Databases

9.1. Legal Protection of Databases Under EU Law

Legal scholars have adopted different perspectives on the legal status of CAD files. One school of thought posits that CAD files should be qualified as databases. The full consequences of such approach must be properly addressed.

In fact, a specific set of legal rules applies in respect to databases at the EU level. As noted in more detail below, the Database Directive confers cumulative protection under copyright and the *sui generis* database right.

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[199] *Altai*, [707]-[710].

[200] Dolinsky (2014), 638, suggesting that it is easy to filter the code out of the CAD file.

[201] Grimmelmann (2014), 692.

[202] Lemley (1995), 12 et ss.

A long-standing principle is that raw data or basic information is not protected under copyright law. Copyright attaches to the original selection and arrangement of data, whereas the *sui generis* right covers the aggregate data or works.

This section aims to untangle the following main issues: 1) the scope of protection under the Database Directive; 2) the historic roots of the *sui generis* right; 3) the legal nature of the database right; 4) and the main differences between the *sui generis* database right and copyright/other neighbouring rights.

9.2. The Definition of a Database

The definition of a database is common to the legal protection conferred by both copyright and the *sui generis* right. Pursuant to Article 1 of the Directive, "database" shall mean "*a collection of independent works, data or other materials arranged in a systematic or methodical way and individually accessible by electronic or other means*". Hence, the Directive covers a wide variety of information products, which can be stored in electronic, non-electronic and yet unidentified form[203].

While it is not necessary for the systematic or methodical arrangement of materials to be "physically" apparent, it should nonetheless be contained in a fixed medium of some sort, and provide the technical means or other means (such as an index, a table of content or other methods of classification) to allow the retrieval of the material contained therein[204]. It follows that "*a collection of unorganised data fixed on a hard disk would qualify as a database if combined with database management software enabling retrieval of the data*"[205].

The term "collection" does not require a large number of data, works or materials to form the database; rather, few elements are sufficient to give rise to protection. Furthermore, nothing in the Directive suggests that a database must originate from the same person/s who created the data and materials making up the collection[206].

Moreover, classification as a database derives, first of all, from the presence of a collection of "independent" materials, that is to say works, data or other materials that can be independently accessed and "*are separable from one another without their informative, literary, artistic, musical or other value being affected*"[207].

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[203] As clarified by the CJEU in Case C-444/02 *Fixtures Marketing Ltd v OPAP* [2004] ECR I-10549 protection subsists so long as the database is fixed, irrespective of the means used thereof. *See* also Recital 13 Database Directive, a database needs to be "stored".

[204] *OPAP*, [20]-[30].

[205] Hugehnoltz (2016), 211, § 9.3.1.1.

[206] *OPAP*, [24]-[25].

[207] *OPAP*, [29].

The requirement of "independence" has been addressed by legal scholarship at length. Derclaye has clarified that the elements of the database must be "*valuable on their own, because of the information they carry*", which is complete, makes sense by itself and does not depend on something else, another piece of information[208]. The elements hold the same self-contained informational content when accessed separately or when viewed together[209].

On that basis, as prescribed by Recital 17 Database Directive, a recording, an audio-visual work, a literary work or a musical work, as such, do not fall within the scope of the Directive, even if they can be conceived as a collection of images, words, notes and sounds.

The same Directive also makes clear that the notion of database does not extend to the computer program used in the making or operation of the database (Article 1(2)). It follows that computer programs as such are not granted protection under the Database Directive.

As better explained in the next section, databases get protection in Europe via the database right and traditional copyright.

9.3. Cumulative Protection of Databases

Under the Database Directive, a database enjoys cumulative protection by copyright (Chapter II of the Directive) and the *sui generis* database right (Chapter III of the Directive). Copyright attaches only to "*the original selection or arrangement of the contents of a database*"[210], rather than to the data as such, whereas the *sui generis* right covers the content of the database, i.e. the aggregate data or works.

Let us examine the two legal regimes in more detail. It must be first noted that "*the copyright and the sui generis right amount to two independent rights whose object and conditions of application are different"*[211]. Consequently, a database not eligible for protection under the *sui generis* right is not automatically precluded protection under traditional copyright[212].

Article 3 Database Directive provides for a common standard of originality ("the author's own intellectual creation") for copyright subsistence in databases[213]. It also clarifies that "*no other criteria shall be applied to determine their eligibility for protection"*.

As clarified by the CJEU in *Football Dataco*, the originality standard is satisfied when, "*through the arrangement of the data which it contains, its author expresses his creative*

[208] Dercalye (2008), 62.
[209] *Id.*
[210] Article 3 Database Directive.
[211] *Football Dataco*, [14].
[212] *Id.*
[213] This standard is the same as that in Article 10(2) TRIPS and Article 5 WCT.

ability in an original manner, by making free and creative choices and thus stamp his ‘personal touch’”[214].

The main difference between copyright and the *sui generis* rights resides in the requisite creativity: merely investing skill and labour cannot, as such, confer copyright protection to databases. Hence, a sufficient amount of originality should be expressed in the selection and arrangement of the data. The financial and intellectual effort employed in the production of the database will not, in itself, suffice to trigger copyright protection. By contrast, databases devoid of any trace of creativity can still obtain protection under the *sui generis* right.

It should also be noted that the subsistence of copyright in “the selection or arrangement” of materials in no way affects the copyright and related rights in the works and subject matter incorporated into the database. It follows that such works or subject matter cannot be incorporated into, or extracted from, the database without the permission of the copyright holder (Recitals 26 and 27 Database Directive).

This may be better illustrated by a database containing a selection and arrangement of poems (i.e. literary works). It is the original “choice” (i.e. the subjective selection of the poems among a potentially infinite number of works) and/or the “arrangement” (i.e. the creative order in which the works are listed), and not the particular literary works as such, that are the subject of copyright under the Database Directive.

The arrangement of the database’s elements (i.e. of the poems) most likely will not be sufficiently original if it is premised on a purely alphabetical or chronological order. On the other hand, assuming that the originality criterion is met[215], reproducing the whole or a substantial part of the contents will not, as such, infringe copyright in the database, if the selection and/or arrangement of the works is not appropriated; most likely, such an activity will amount to infringement of the *sui generis* right.

As far as the *sui generis* right is concerned, Article 7 of the Directive aims to protect the expenditure of a significant amount of time, labour and resources in collecting, presenting and verifying information. As discussed, creativity is not required to give rise to protection.

Hence, as noted in the next paragraph, the substance of the *sui generis* right differs substantially from that of copyright: it accords protection to the substantive investment of the database producer.

9.4. The *Sui Generis* Right: Historical Roots and Nature

[214] *Football Dataco,* [38].

[215] Since the arrangement and/or selection of the poems is the result of purely subjective and creative choices.

The *sui generis* database right was introduced within the EU more than twenty years ago, with the entry into force of the Database Directive. The main objectives behind the legislative reform can be identified in promoting the smooth functioning of the internal market through the approximation of national laws, as well as in redressing the imbalance in the level of protection as between EU countries and the "*world's largest database-producing countries*", such as the United States (Recital 2 and 11 Database Directive).

Hence, apart from protecting the "*original selection or arrangement of the contents of a database*", through traditional copyright, the Database Directive sought to safeguard the substantial investment made in either the obtaining, verifying or presenting such contents (i.e. the "sweat of the brow" of the database producer)[216].

Hence, the *sui generis* right gives the maker of a database, who takes the initiative and the risk of investing, the special right to prevent unauthorized extraction and/or re-utilization of all or a substantial part of the content of that database[217]. The Directive makes clear that protection against misappropriation concerns the acts carried out by third parties that are liable to "*cause significant detriment – evaluated qualitatively or quantitatively – to the investment*"[218].

A *qualitative* investment might descend from the expertise required in acts such as gathering, updating and presenting the contents. A *quantitative* investment relates to the financial resources used for such purposes[219].

Interestingly, the CJEU, in *OPAP*, has clarified that the relevant investment refers to "*the resources used to seek out existing materials and collect them in the database*", but does not cover the "*resources used for the creation as such of independent material*"[220].

In other terms, the allocation of resources in the creation of the data and materials that later conflates into the database does not amount to relevant "investment" within the meaning of the Database Directive. The *sui generis* right aims to promote "*the establishment of storage and processing systems for existing information, and not the creation of materials capable of being collected subsequently in a database*"[221].

Most legal scholars agree that the *sui generis* right cannot be classified as a form of unfair competition, but rather as a specific type of IPR. In the first place, the *sui generis* right

[216] Hugehnoltz (2016), 212, § 9.3.1.2.
[217] Database Directive, Recitals 41-42.
[218] Case C-203/02 *British Horseracing Board Ltd v William Hill Organization Ltd* [2004] ECR I-10415, [69].
[219] *See OPAP* [28] clarifying that "the quantitative" investment in the creation of the database refers to *quantifiable* resources, whereas the "qualitative" assessment to efforts which cannot be quantified, such as intellectual effort or energy".
[220] *Id.*, [34].
[221] *Id.*, [24].

protects against acts carried out by competitors as well as by users, operating outside a competitive scenario, if such acts are liable to harm the database producer's investment.

Second, on a par with other IPRs, the protection conferred by the right is aimed at a definite object (i.e. collections of data, works and other materials). The database right does not condemn behaviour *ex post*; it is an exclusive right that can be assigned and licensed[222].

Third, the rights provided for by the *sui generis* protection are similar to those enjoyed under traditional copyright[223]. Moreover, similarly to other IPRs, the *sui generis* right has a fixed term of protection[224] and is subject to the principle of exhaustion and to exceptions[225]. Some exceptions to copyright infringement, however, are not also applicable to the database right, such as quotation and news reporting[226].

As noted by Hugenholtz, the database right can either falls within the rubric of "neighbouring rights" or qualify as an IPR of its own kind. Like the neighbouring rights of phonogram producers and of broadcasters organisations, the *sui generis* right is conferred as a reward for investment and does not require originality on the part of the creator.

The issue of classification is not merely the result of academic pedantry, but has serious and practical implications for non-EU database producers. Noteworthy, Article 11 Database Directive denies the application of the "national treatment" principle, replacing it with the requirement of reciprocity.

Hence, non-European database producers can only become eligible for the *sui generis* protection in the EU by virtue of reciprocity, i.e. if their countries offer to EU producers a protection that is comparable to the *sui generis* right.

The denial of national treatment accounts for a substantial discrepancy between the database right, existing IPRs and unfair competition law[227]. The argument goes that way: if the *sui generis* right were to be equated to either existing IPRs or to a rule of unfair competition, it

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[222] For a comprehensive overview of scholarship that qualifies the database right as an intellectual property right, *see* Derclaye (2008), note 44.

[223] For example, "extraction" – which is defined as "*the permanent or temporary transfer of all or a substantial part of the contents of a database to another medium by any means or in any form*" – shows resemblance with the right of reproduction. "Re-utilisation" – which is defined as "*any form of making available to the public all or a substantial part of the contents of a database by the distribution of copies, by renting, by on-line or other forms of transmission*" – includes acts of physical distribution and acts of making the database available online. *See* Article 8 Database Directive.

[224] The term of protection for databases under the *sui generis* right is fifteen years from the date of completion of the making of the database or the first publication (Article 10(1)). However, according to Article 10(3), any substantial change to the content of the database, including successive additions, deletions or alterations, which would result in a substantial new investment, shall trigger a new term of protection for the resulting database. *See* Hugenholtz (2016).

[225] Pursuant to Article 7(2)(b) Database Directive.

[226] Hugenholtz (2016), 214.

[227] See Article 11 Database Directive.

would be subject to existing international obligations, including the principle of "national treatment", enshrined both in the Berne Convention and in the Paris Convention.

However, in the Explanatory Memorandum accompanying the Directive, the Commission made clear that the *sui generis* right is a newly crafted legal construct, not linked to predating international Conventions, but to its own specific legal provisions[228].

In conclusion, databases fall outside the scope of protection accorded by Berne (i.e. "literary and artistic works") and by the Paris Convention (i.e. rights of industrial property and unfair competition remedies).

9.5. Whether a CAD File Falls Within the Definition of a "Database"

In determining whether a CAD file qualifies as a database within the meaning of the Database Directive, one should note that it is possible for such file to contain disparate and separate constitutive elements.

As already noted above, while STL files can only encode the geometry of a 3D model, other file formats, such as 3MF, have support for storing additional information about the object properties, metadata, digital signatures and thumbnail images.

Moreover, in light of the foregoing, in order for a CAD file to fall within the definition of a database, it does not need to be a collection of a large number of data, works or other materials[229]. The fact that a CAD file can potentially be broken down into a very small number of elements does not, in itself, prevent classification as a database[230].

In order for a CAD file to qualify as a "database", it is also irrelevant whether the materials that make it up come or not from the same source or sources constituting the collection[231]. This, in turn, means that one may select pre-existing data and materials (i.e. pre-rendered shapes and predefined object properties) without creating them, and nonetheless give rise to a database.

Hence, at a first glance, CAD files bear some similarities with databases. A CAD file can be conceived as a collection of works and data that is fixed in electronic form. Such a collection is "systematically or methodically arranged", since the retrieval of data is made possible by loading the CAD file onto apposite software.

[228] Hugenholtz (2016).
[229] *OPAP*, [24].
[230] As noted below, the question would rather be whether there is a sufficient qualitative or quantitative investment in the amount of materials making up the CAD file, to trigger protection by the *sui generis* right.
[231] *OPAP*, [25].

In other terms, a CAD file can be conceived as a string of unorganized data fixed on a hard disk that, if combined with CAD software, enables retrieving the data[232]. It should also be noted that the CAD program driving the database is not protected by the Database Directive, but it can receive autonomous protection under the Software Directive.

Classification of a CAD file as a database, however, requires the works and data contained therein to be "independent". Hence, one should ask whether the various components of the CAD file can be independently accessed and separated from one another, without their informative, literary or artistic value being affected[233].

Taking the example of 3MF files, the latter can embed the 3D model's geometry, along with: information about colour, material, texture; metadata about the creation time, author, search keywords and other information; digital signatures; and thumbnail images of the model[234].

Therefore, the CAD file includes all the fundamental information necessary to generate the physical object through addictive manufacturing or subtractive manufacturing techniques[235]. Such information can be conceived as a "*well-defined set of parts and relationships, each fulfilling a particular purpose in the document*"[236].

The collection of these interdependent parts and relationships within the file is called "payload"[237]. The 3D model can be described as the root part of the "3D payload"[238]. Other parts included in the payload are explicitly linked to the 3D model by different sorts of relationships.

This is to say that, for the most part, information internal to the 3MF must necessarily point to, rely on, attach to or be referenced to the 3D payload root. For example, complex information about texture gains significance only if applied to the 3D model, i.e. when interpreted in conjunction with the targeted part.

Hence, the components of the file are closely interrelated. Existing relationships between different constitutive elements of the file explain why most of the CAD-based data does not have an independent meaning, but rather looses its informative value when extrapolated from the context.

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[232] The CAD program constitutes the means of processing the information included in the CAD file, i.e. "*the method or system of some sort for the retrieval of its constituent materials*" *OPAP*, [32].

[233] As prescribed in *OPAP*, [29].

[234] For a detailed inquiry into how 3MF files are organized internally *see*: https://all3dp.com/3d-printing-file-formats/.

[235] All such material is contained in a single digital archive.

[236] 3D Manufacturing Format, Core Specification & Reference Guide, at §1.2, available at: https://3mf.io/wp-content/uploads/2015/04/3MFcoreSpec_1.0.1.pdf.

[237] *Id.*, at § 2.1.1. The 3D model – i.e. the representation of one or more objects to be fabricated by 3D manufacturing processes – is the only essential or compulsory part of the 3MF file.

[238] Hence, in every 3MF file there is one primary 3D payload root, which is the 3D model.

Arguably, some elements of the CAD file are not valuable on their own, because the information they embed depends on another piece of information; they do not "hold the same self-contained informational content when accessed separately" as when they are viewed together[239].

Whereas not *each* of the constituent elements of a CAD file is separable from one another without the value of its content being affected, it is however argued that *some* of the materials contained in the CAD file may actually be covered by the concept of "independent data" within the meaning of Article 1(2) of the Directive[240].

Against this background, assuming that a CAD file, such as a 3MF file, constitutes a database within the meaning of the Database Directive, the ensuing question is whether it could enjoy cumulative protection via the *sui generis* right and traditional copyright.

It follows from the above analysis that a CAD file could form the subject matter of the *sui generis* right only if it can be shown that there has been a substantial investment. Following the CJEU's case law, such investment presupposes that resources are used for "*the obtaining, verification or presentation of the contents*" of the CAD file[241].

Accordingly, resources shall be used in the creation of the database as such (i.e. the CAD file), rather than in the creation of the database's content (i.e. the 3D model).

Indeed, it must be established whether the search for and collection of data, their systematic or methodological arrangement in a CAD file and/or the verification of their accuracy require a substantial investment[242].

Such an investment should be distinct from and independent of the initial and underlying investment in the creation of the CAD file's constituent data. Accordingly, it is irrelevant that the data were already available to the maker of the CAD file at the time the file was created and, therefore, he has not made a substantial investment to create those materials[243].

Furthermore, one should ascertain whether the deployment of human, financial and technical resources was substantial in quantitative or qualitative terms[244]. That is to say that the

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[239] Derclaye (2008), 62.

[240] While the data concerning, for example, colour and texture do not have an independent value, some other constitutive elements, such as the thumbnail image, views or descriptions, may constitute autonomous works fixed in electronic form that can be independently accessed and whose value remains unaltered when separated from the other contents of the document. Scholarship suggests that elements such as measurement and proportions need to be referred to the object, whereas elements such as structural strength and mass may have an independent value. Antikainen; Jongsma (2017), 272.

[241] Case C-203/02 *British Horseracing Board v William Hill Organization Ltd* (BHB decision),[2004] ECR I-10415, [71].

[242] Compare with *OPAP*, [26].

[243] *Id.,* [30].

[244] *Id.,* [28].

investment in the creation of the CAD file should either be computable in quantitative terms or require unquantifiable intellectual effort or labour.

This needs to be evaluated on a case-by-case basis. It is, however, unlikely that the storage of data in the form of a CAD file would represent the right type of investment, triggering the *sui generis* protection[245]. This is so because, in most instances, the information, data and works are archived in the CAD file too easily, with the help of apposite software, with little or no investment at all[246].

As far as traditional copyright protection is concerned, CAD files could gain protection only if, "*by reason of the selection or arrangement of their contents, they constitute the author's own intellectual creation*"[247].

Hence, the structure of the CAD file, not the materials included in the database, must be sufficiently original, i.e. originate from the author's creative ability, without being dictated by technical considerations.

This sort of inquiry does not take into consideration the investment (skill and labour) made in the creation of the database. Moreover, the scope of copyright protection for databases is unrelated to the copyright status of the CAD file's content. It is not the data as such which is the subject matter of copyright protection.

Hence, in the first place it must be established whether the selection of data and materials making up the file originates with the author, rather than with CAD software. Secondly, one should look at the constraints that inhibit the author's creativity in the selection and arrangement of the CAD file's components.

Taking the example of 3MF files, their internal structure is predetermined by software. The file is represented internally with specific parts and relationships that fulfil a particular purpose in the document. Hence, a 3MF file is a collection of interdependent parts, following a specific pattern and serving a given function. Arguably, technical considerations leave no room for creative freedom.

9.6. Final Remarks on the Categories of Works Implicated in Three-Dimensional Printing

The considerations made so far lead us to the following conclusions.

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245 Recital 19 Database Directive.

246 Derclaye (2008), 56. Although it might be rare to have a CAD file fulfilling the requirement of substantial investment, this possibility cannot be ruled out *a priori*.

247 *Football Dataco* [38], referring to *Painer* [92].

When a person creates a design drawing with the assistance of CAD software or writes the GCODE from scratch, he or she is potentially giving birth to a work of authorship, which corresponds to the final print out.
One should, therefore, consider what is the final output: if it is a protected work of authorship, then the design drawing representing it and the literary instructions for manufacturing it are all manifestations of the same work (copies).
In fact, the same work can be recorded in different forms of expression: the literary work, the graphic work and the final 3D-printed article are all instruments of fixation of the same work. An analogy can be drawn with choreographic works that can be expressed either in words or in symbols.
Hence, the best approach is to look at the final output and, if it is copyright protected, then the graphic and literary expressions embedded in the file are just means to fix such work in tangible form (or “copies”). This does not mean, however, that they cannot be protected also as (graphic or literary) works in their own right, provided that they are the author’s own intellectual creations.
Accordingly, the design drawing in a CAD file may be regarded as a medium of fixation of the “work of art” that will be printed, but also enjoy protection in its own right. Likewise, the code that enables printing the product serves to fix the artistic work in a tangible medium of expression, but may also constitute a work of authorship per se.
Upon closer inspection, however, it emerges that the literary work (if human-authored, written from scratch and not generated by software) is mainly dictated by functional considerations, being a set of commands to the printer. Thus, it is questionable whether the code will ever attract separate copyright under the InfoSoc Directive.
The lines of the code that instruct the printer on how to build the item may also qualify as a “computer program” under the Software Directive, although functionality poses again a major hurdle to overcome.
The graphic work embedded in a printable file is more “technical” than the drawing in a CAD model and lacks additional elements such as colour, lighting, shading. It can be equated to a technical drawing that, in order to gain protection, must not be functional and be sufficiently original, i.e. contain additional elements besides technical instructions that are not banal or commonplace (protectable elements may include the angular position, the perspective, the hatching, etc., which most of the times are lacking in printable files).

According to an academic strand, it is also essential to distinguish among the various CAD formats, especially between CAD models and printable files, to understand which categories of works are implicated in 3DP.

The "CAD model" is a representation of an object with additional creative elements, such as lighting, shading, etc. The digital item represented therein may be used for purposes other than printing (such as videogames or rendering).

When analysing CAD models, it is questionable whether they are copies of the work of applied art, sculpture, etc., corresponding to the final print out, because the file needs to be converted into another format to become "printable".

In other words, the CAD model, as opposed to the GCODE file, does not contain the coded instructions to print the item: it is just a 2D depiction of such an item, with an underlying computer code that permits only to see the image on a computer screen. It follows that it is not possible to "perceive" the work (sculpture, applied art, etc.) with the help of a machine (i.e. the printer). Rather, the only work that can be perceived with the assistance of a computer is the two-dimensional graphic representation of an object. This pictorial representation may be eligible for protection in its own right.

Therefore, some commentators suggest that the CAD model is a mere depiction of an object, to be distinguished from the object itself. Arguably, it is not an instrument of fixation of the sculptural work, architectural work or work of applied art, but just of a pictorial work.

On the contrary, a printable file may be regarded as a copy of the 3D-printed object, insofar as it contains the coded instructions that are sent directly to the printer.

As far as databases are concerned, it has been suggested that most constituent elements of CAD files do not have an independent meaning, pursuant to Article 1(2) Database Directive, because they do not hold the same value when accessed separately or when viewed together. It is questionable whether a CAD file may attract the *sui generis* protection, as storing data and information in the file does not require a significant investment. Finally, most of the times, the internal structure of a CAD file is predetermined by software, thus lacking the authorial input necessary to attract traditional copyright.

10. Authorship and Ownership in Copyright Law

There are just few provisions in the *acquis* addressing authorship and ownership[248]. Thus, for the most part, the issue of who is the author and/or initial owner of a work is a matter of non-harmonized national law[249].

As a general rule, in both common law and civil law countries, the author and first owner of a work is the *natural* (i.e. not legal) person who creates the work. Nonetheless, some countries provide for exceptions and allocate initial ownership to entities[250]. This issue may be relevant if one thinks that CAD models and 3D-printed items can be produced by 3DP platforms.

Moreover, exceptions to this rule apply with respect to anonymous works[251], works made in the course of employment[252] or works of multiple authorships; all such exceptions may be relevant in the 3DP context.

In the UK CDPA 1988 the author of a work is defined as "the person who creates the work" (Section 9(1)). Ginsburg notes that, "*as the law does not also define creation, the author definition does not get us very far*"[253].

Furthermore, a special provision in the UK CDPA deals with computer-generated works, stating that the author of the work "*shall be taken to be the person by whom the arrangements necessary for the creation of the work are undertaken*" (Section 9(3)). This provision leads to possible ambiguity, as Ginsburg stresses, insofar as it does not define what sort of "arrangements" are required[254].

Moreover, a computer-generated work, by definition, has no author[255]. Thus, as pointed out by Bently, the notion of "author" is an artificial construct, a legal fiction that is used to allocate rights[256]. Depending on the circumstances it designates either a human being or a legal person.

In the 3DP context, the question to be answered is whether the code component of a CAD file is a computer-generated work, given that in most instances CAD software automatically

[248] See Article 4 of the Database Directive 96/9/EC, Article 2 of the Software Directive 2009/24/EC, and Article 2(1) of the Term Directive 2006/116/EC.

[249] Ginsburg (2003), 1069, notes that the Berne Convention largely leaves the issue of authorship to Member State determination.

[250] For example, in France, the initial owner of a collective work can be a legal person. *See* Goldstein; Hugenholtz (2013), 248.

[251] Note that many user-generated CAD files remain anonymous.

[252] The issue of first ownership in works created by an employee in the course of employment is harmonized only for computer programs. See Article 2(3) of the Software Directive.

[253] Ginsburg (2003), 1070.

[254] *Id*.

[255] Provided that computer-generated works do actually exist. Ginsburg, J. (2018) makes several examples of what can be defined as "computer-generated works" – i.e. "*outputs of digital neural networks*" that are not the fruits of human authorship, since the human input in producing them is too attenuate to meet the Berne standards of authorship, for instance, the outputs of Google Translate.

[256] Bently; Sherman (2014), 120.

generates it while the designer draws the CAD model. While creating a CAD-based design may involve sufficient creativity on the part of the designer, even when he or she is assisted by software, the underlying code is not human-authored.

Following the same line of reasoning, the design-drawing and code portions of printable and GCODE files can be regarded as a computer-generated works. In fact, while the designer creates the initial CAD model (or scans it with the mere assistance of a scanner), the conversion into different file format – and the resulting code/design drawing, which may differ from those embedded in the primary CAD model – is automatically performed by software.

If one considers such creations as "computer-generated", in the UK copyright will be vested in the person who had wrote the computer program used to make the file conversion. Most likely, however, all subsequent versions to the original CAD model will be deemed as copies of the primary work, rather than autonomous works.

Furthermore, a harmonized definition of "works of joint authorship" and "collective works" is lacking at the EU level. As noted by Angelopoulos, Member States define joint authorship "*according to some variation of the simple formula of "collaboration + inseparability"*"[257].

While countries such as Italy, Spain, the UK, and the Netherlands tend to denote the concept of inseparability in factual terms (i.e. considering whether the contribution of two or more persons is inseparable because it is not possible to attribute part of the work to one author only), the Czech Republic favours the concept of "economic" inseparability, meaning that the various components of a work (even if separable) are not suited for independent exploitation, and France privileges "intellectual" inseparability, focussing on the common creative effort and mutual inspiration underneath a work[258].

An open source CAD file, therefore, may qualify as a single work in one country, but be separated into multiple works in another.

Adding complexity, collective works do not have a uniform definition throughout Europe. As a general matter, collective works are created at the initiative and under the direction or management of an entrepreneur, being it a natural person or legal entity, and include works such as magazines, newspapers, dictionaries, encyclopaedias, and anthologies. The term of protection of collective works, set forth in Article 1(3) of the Term Directive, is 70 years after the work is lawfully *made available to the public*.

[257] Angelopoulos (2012).
[258] *Id.*

It should be noted, however, that in the UK collective works also encompass works of joint authorship[259] and are protected for a period of 70 years after the author's death, according to the general rule.

11. The Originality Threshold, the Idea and Expression Dichotomy, and the Requirement of Fixation

The originality threshold, the idea and expression dichotomy, and the requirement of fixation come into play in addressing copyright protection of the works incorporated in CAD files and the corresponding output. In the following sections, each of these legal requirements towards copyright protection will be analysed in turn.

12. Originality

As stressed above, copyright attaches automatically to a "work" provided that is sufficiently original and, in some jurisdictions, fixed in a tangible medium of expression. The requirement of originality is central to copyright law.

In an attempt to rapidly sketch out the numerous functions that the "originality" standard serves, it should be noted that, in general terms, originality enables distinguishing copyright from neighbouring rights and from other forms of protection of intangibles (i.e. patent law or trademark law).

Furthermore, the corollary requirement of originality operates as a threshold standard of qualification for copyright protection, ruling out trivial or obvious works. In addition to operating as a threshold, originality is a chief factor in the infringement analysis: in an action for copyright infringement the judiciary will have to ascertain if what was taken from the claimant's work is sufficiently original[260].

In civil law countries that have an "open list" of works, originality has also played the important role of delimiting the contours of the copyright domain by identifying new categories of works, in which the personality of the author is expressed – a role performed in the UK by the "closed list" of protected subject matter set forth in Section 1 of the UK CDPA 1988[261].

[259] UK CDPA 1988, Section 178.
[260] On the purpose of the originality requirement see Bently; Sherman (2014), 95, 3.2.
[261] Quaedvlieg (2009), 484.

The originality requirement, however, lacks a statutory definition[262]. At the international level, the Berne Convention omits a general reference to "originality". This last concept can be inferred from international legal sources only indirectly (i.e. from the reference to the "intellectual creation" criterion)[263].

Likewise, as noted above, up until relatively recently, the originality threshold was not harmonized at the EU level. "Originality" for copyright purposes was a conception very well rooted in the legal tradition of each Member State. Hence, statements about originality have always depended on the specific copyright legislation and case law in any given country.

Furthermore, the kind of contribution that makes a work original depends on the nature of the work at stake. Therefore, as noted by Bently and Sherman, it has always been "*very difficult if not impossible to state with any precision what copyright law means when it demands that works be original*"[264].

Having made such preliminary remarks, it should be noted that in the tradition of both continental Europe and common law countries, such as the UK and the U.S., the requirement of originality in copyright law does not conflate with the concept of novelty, uniqueness of inventiveness. Originality relates to the relationship between the author and his/her work, rather than between the work and the state of the prior art[265].

Although they share this solid common ground, traditionally common law and civil law systems have approached the originality requirement in different ways. Some commentators have stressed that the Anglo-American approach – as opposed to the *droit d'auteur* approach – has been historically "*more favourable to a wide concept of work*" and a loose notion of originality, compensated by the existence of formalities[266].

For instance, in the tradition of UK copyright law a work is original if it originates with the author and is not copied from another work[267]. The intellectual effort that the author must have exercised in producing the work is summarized by the very well known expression "skill, labour and judgement" [268].

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[262] Ricketson; Ginsburg (2006), 8.05.

[263] See Article 2(5), Article 2(3) and Article 14-bis Berne. These very few indications apart, the Berne Convention does not provide any explanation of what the originality requirement demands for.

[264] Bently; Sherman (2014), 93.

[265] *Id*.

[266] Vallés (2009), 111.

[267] *University of London Press v University Tutorial Press* [1916] 2 Ch 209. The word "original" does not mean that the work must be expressed in an original or novel form, but that the work must originate with the author, i.e. "*it should not be copied from another work*".

[268] *Ladbroke v William Hill* [1964] 1 All ER 465, 469 *per* Lord Reid. Note that sometimes courts use the phrase "*skill, labour and judgement*" or "*labour, skill and effort*". On this point, *see* Bently; Sherman (2014), 95.

Such a concept of originality, on the one hand, reduces to lowest terms any form of subjective appraisal towards copyright entitlement. On the other hand, it reflects the incentive-based justifications generally offered for copyright protection, by considering investment of labour and capital, which results in a literary or artistic expression, worthy of protection[269]. Thus, a work that is an independent creation, showing a *quantum* of creativity albeit small, represents a potential economic value that deserves copyright entitlement[270].

On the contrary, in countries belonging to the civil law tradition, a work is not merely the result of ability, labour or effort; it bears traces of the author's personality[271]. In other terms, the continental understanding of the originality requirement focuses on the author's personal and intellectual imprint, rather than on the skill and labour employed: the author is himself/herself in the work [272].

Thus, we can trace the originality criterion back to the rationale of copyright: conferring protection to the author's personality. Courts have sometimes referred to originality as "*la marque d'un apport intellectuel*" (the mark of an intellectual contribution)[273] or as the mirror of "*la personalità dell'autore*" (the author's personality)[274].

As suggested above, understood in this way, the criterion of originality also serves as an external delineation of copyright, when dealing with new types of creation[275].

In addition, in the civil law tradition the originality requirement validates the grant of moral rights to authors – besides economic rights – as it entails a strong relationship between the creator and the work.

12.1. Originality in the *Acquis Communautaire*

The CJEU, through a series of rulings, following up on the landmark decision in *Infopaq* in 2009, has construed a fully harmonized standard of originality, which applies to all works; at the European level "originality" now coincides with the concept of "author's own intellectual creation"[276].

Remarkably, the criterion of "intellectual creation" is not expressed in the InfoSoc Directive, but has its origin in the Berne Convention and is used in Directives other than the InfoSoc

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[269] *Id*.
[270] Rahmatian (2009), 289.
[271] Rahmatian (2011), 47.
[272] There is no definition of originality in French and Italian copyright statutes.
[273] Compare with the decision of the French Court of Cassation in *Babolat Maillot Witt v Pachot*, C Cass, Assemblée plénière, 7 March 1986, No 82.
[274] On this see Rosati (2013), 74 and Rahmatian (2011).
[275] Quaedvlieg (2009), 484.
[276] Stamatoudi (2017), 64.

Directive. The CJEU in *Infopaq* took the view that this requirement should be extended to all types of works, in order to establish a "harmonized legal framework for copyright"[277].

The CJEU has also specified what constitues "intellectual creation" on different occasions. The "author's own intellectual creation" requirement is satisfied when "*the author expresses his/her creative abilities in an original manner, by making free and creative choices"*[278] and stamps the work created with his/her "*personal touch*"[279].

"This would not be the case if the work at stake were the result of technical considerations, rules, or constraints that leave no room for creativity"[280]. Accordingly, sporting events[281] and match fixtures[282] are ruled out from protection, lacking free and creative choices.

The significant effort, labour and skill required for creating a work are not, as such, relevant in order to assess the eligibility of that work for protection[283]. As Bently and Sherman put it, it is the qualitative, rather than quantitative, type of authorial contribution that justifies such protection[284].

At a first glance the "author's own intellectual creation" criterion may appear to be particularly high. A closer inspection reveals that the CJEU did not exclude copyright protection for an 11-word extract[285], a portrait photograph[286], and a graphical user interface[287].

12.2. Originality Under U.S. Copyright Law

Under U.S. copyright law, a work is original if it is independently created and possesses at least a modicum of creativity[288]. Let us examine each of these requirements in turn.

First, a work must be "independently" created by the author, rather than copied from other works. Then, the second part of the U.S. originality test focuses on the "create" requirement, i.e. the creative process, and ascertains whether the work is a product of the human mind, involving intellectual production, thought and conception[289].

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277 *Infopaq*, [36].
278 *BSA*, [50]; *Football Dataco*, [38].
279 *Painer*, [92].
280 *Football Dataco*, [39]; BSA, [48]; Murphy, [98].
281 *Murphy*.
282 *Football Dataco.*
283 *Football Dataco*, [46].
284 Bently; Sherman (2014), 102.
285 *Infopaq*.
286 *Painer*.
287 *BSA*.
288 *Feist Publ'ns, Inc. v Rural Tel. Serv*. Co., 449 U.S. 340, 345 (1991).
289 Lee (2012), 940.

The same "create" requirement focuses on the end product or "work", which shall fall within copyrightable subject matter[290]. In this respect, the "create" requirement is tied to Article 1, Section 8, Clause 8 of the U.S. Constitution"[291].

Furthermore, a work must possess some creative spark, hence a very low level of creativity[292]. Only "*works in which the creative spark is utterly lacking or so trivial as to be virtually non-existent"* do not meet the originality threshold[293].

Thus, the author's expression that is "entirely typical", "garden-variety", "devoid of even the slightest traces of creativity", "an age-old practice, firmly rooted in tradition and … commonplace" does not satisfy the originality requirement[294].

12.3. Originality of CAD Files

This section examines the originality of CAD files for copyright purposes. To this end, it is important to note at the outset that the originality inquiry varies depending on the way in which the CAD file has been created: (1) the CAD file is created freehand by the designer; and (2) the CAD model is a scanned representation of a pre-existing physical object[295].

Moreover, it is possible to distinguish the following scenarios. In the first scenario, the CAD is created from scratch by using CAD software to represent something new, rather than a pre-existing object. The "new" object represented in the CAD file may be an artistic creation or a useful article.

In the second scenario, the CAD file is aimed at reproducing an existing item. There are two ways in which the CAD file for an existing item can be realized: by scanning the object or by drawing it freehand from scratch. The pre-existing object may be itself eligible for copyright protection or not.

Following the CJEU's case law, a CAD model is an original intellectual creation of the author on condition that it reflects his or her personality and expresses his or her free and creative choices in its production.

The artist can use software tools to create shapes, define texture and materials, and manipulate the object background, shades and lighting. As scholarship notes, to some extent digital tools that enable creating a CAD model can be assimilated to more "traditional" tools, such as

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[290] *Id.*
[291] Ginsburg (2003), 1078.
[292] *Feist*; [345].
[293] *Id.*, [359].
[294] Compendium of U.S. Copyright Practice: Chapter 308.2. Revised 09/29/2017, available at: https://www.copyright.gov/comp3/chap300/ch300-copyrightable-authorship.pdf.
[295] Mendis (2014).

pencils, paper, canvas or paint[296]. These are all instruments at the artist's disposal thanks to which an artistic work is realized.

In other terms, the fact that the artist uses "digital" means of production does not, as such, diminishes the space available for creative expression. In fact, as Weinberg notes, much as a word processor "*allows a writer to add, delete and edit text freely, a CAD program … allows a designer to manipulate a design as she sees fit*"[297].

When a CAD program is used, the output is a computer-assisted (rather than computer-generated) work, and the artist is vested with copyright. The artist has considerable impact on the program's output and may express creative choices in the design, although he or she has relied on the assistance of computer software[298].

Yet, one should not underestimate the potential constraints to creativity in using CAD programs. First, there might be some digital constraints, such as limitations imposed by software application. The choice of which software to use may significantly impact on the final output. In fact, as opined by Van Gompel, creative freedom could be limited to the extent that existing software applications may run into technological deficiencies[299].

Second, depending on the space for creative freedom that the computer program leaves, the artist will have to handle a larger or smaller number of restrictions. Unlike when an artwork is created by painting on canvas, CAD software may impose limitations to creativity since it requires choosing between pre-rendered shapes or building blocks.

As noted by Dasari: "*most block libraries alone are not sufficient original because the libraries offer basic shapes analogous to unprotected words and phrases*"[300]. It follows that the designer must make sufficiently original changes and alterations to such shapes, which are not solely dictated by functional motivations, in a similar way to how a "*story writer uses common colloquial phrases and words in a story*"[301].

In addition to the just-mentioned limitations concerning the (digital) depiction of an object, there might be some constraints imposed by the manufacturing process and the final product itself.

Technical limitations of the printer to be used – such as the printer's dimension or the printing materials – may operate as constrictions. Finally, it may well be that a CAD model contains

[296] Antikainen; Jongsma (2017), 259.
[297] Weinberg (2010), 4; Dolinsky (2014), 640.
[298] *Id.*
[299] Van Gompel (2014), 113.
[300] Dasari (2013), 294.
[301] *Id.*

some expressive or decorative elements that are eligible for copyright protection, although the ultimate 3D-printed product has a utilitarian function.

The product's utilitarian function may well impose additional constraints to creative freedom. In such a case, the features of the CAD model that are imposed by technical or practical considerations, in order to enable the final product to perform its function, should be filtered out for copyright purposes. To some extent, the purpose of the final product restricts the designer's artistic judgement: his or her decisions may be guided by a practical, non-expressive necessity to create a useful article.

It is also important to notice that, in creating a CAD file, the artist most likely will not make decisions about lighting, backgrounds, shading and texture if the aim is to create a printable file. As discussed, while all such features are essential to generate an accurate and faithful representation of the object, they are wholly unnecessary if the CAD model is intended to be printed. Most information gets lost during the conversion from the CAD model to the STL file.

In light of the foregoing, it is here suggested that, although some digital or technical constraints might interfere with the artist's creative freedom throughout the design process, creating a CAD model from scratch could conceivably require originality.

Many CAD files would also contain the modicum of creativity required under US copyright law[302].

An important issue to address is whether a CAD file that represents a physical object that is not copyright protected may nonetheless be capable of protection. In fact, in certain cases, one should distinguish the CAD file from the object represented therein.

First, a CAD file may represent a useful article or functional object that is not within the copyright's reach (i.e. a screw or a hammer). Second, it is also possible that a CAD model is based on a 3D public domain object that can be freely reproduced, such as an artistic work to which the term of copyright protection has expired[303].

In such cases, the question should be answered whether the person who transforms a non-protected object into a digital design imparts some authorial contribution that is worthy of protection. It is possible that the design-drawing component of the CAD file does not depart from reality in a sufficiently creative way.

One can imagine a CAD program that assists the user in creating a faithful representation of the original object or provides the stock shapes that the user can pick to reproduce the original

[302] *Id.*, 828.
[303] Dagne (2016), 7.

object[304]. As noted by Osborn, in that case the modicum of creativity that is needed to attract copyright protection is missing.

The same commentator notes that the CAD software enables the designer to select from numerous pre-stored shapes (i.e. the pre-stored shape of a screw)[305]. Similarly, the designer does not draw a line, a circle or a triangle in the same way as she would with a pencil: these are all pre-determined options that the designer can select.

Having noted that, it is extremely simple to transform functional or public domain features into artistic features when using digital modelling techniques, as changes to the digital design can be made until the file is sent to the printer[306].

Design drawings reproducing non-protected objects may add creative features such as colour, lighting, shading and perspective. All such elements can be the result of the designer's creative choices. Yet, it has been suggested that these features will unlikely appear on a printable file, as they are unnecessary for printing purposes.

The designer can also attach some decorative features to the object, thereby transforming it into a design that falls within the realm of copyright protection[307]. One can imagine a CAD file representing a coffee mug to which the designer adds an ornamental or aesthetic feature to the surface, thereby imparting his or her personal touch.

Drawing the dividing line between CAD files that add some creative spark to the representation of an object and those that do not contain a modicum of creativity is not easy. Useful objects must stay outside of the copyright regime. The fact that making the digital versions of these objects has now become much easier as compared to the past does not justify an undue extension of the copyright's reach. Copyright licences should not be used to refrain the diffusion of CAD files for purely functional objects.

On the other hand, as a highly realistic painting or a portrait photograph attract protection regardless of the copyright status of the subject they represent, one may argue that CAD drawings shall likewise be eligible for protection if the draftsperson draws the object with creativity in the copyright sense. As Lee puts if, "*one can always copy what exists in real life and still receive copyright*"[308].

As Nimmer suggests, when taking a photograph of a pre-existing product "*the photographer manifestly cannot claim to have originated the matter depicted therein*", but he or she is

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[304] Osborn (2014), 829.
[305] Osborn (2017), 49.
[306] Dagne (2016), 7.
[307] *Id.*, 8.
[308] Lee (2012) discussing importance of the *Bleinstein* approach, note 148.

"*entitled to copyright solely based on lighting, angle, perspective and the other creative elements that traditionally are included in that art-form*"[309]. Determining whether a CAD file for a useful object contain any such inherent creativity will need to be assessed on a case-by-case basis.

One can also qualify CAD files as technical drawings, to which copyright protection may attach irrespective of whether the product represented therein is also eligible for protection[310]. As discussed, technical drawings may display sufficient creativity in the way they present facts (i.e. measurements, distances, tolerances and strength), which are not by themselves copyright protected.

Finally, the CAD model could be a modification of a pre-existing 3D digital model. Again, the question of whether modification without permission infringes will depend on the facts of the case.

Clearly, the closest the modification is to the original work, the most likely it will be infringing. Hence, the question should be answered whether what has been altered is just the image's medium or the substance of the work. This issue is addressed in more detail below when dealing with the adaptation right.

The second scenario under scrutiny is that of a CAD model that is a scanned representation of a pre-existing physical object. The first question that comes to one's mind is whether the process of scanning involves sufficient creative freedom.

As Ginsburg notes "*the participation of a machine or device, such as camera or computer, in the creation of a work does not deprive its creator of authorship status, but the greater the machine's role in the work's production, the more the author must show how her role determined the work's form and content*"[311].

It is worth noticing that there are many different 3D scanning technologies. In general, different scanning techniques require different amounts of human intervention. Yet, as Weinberg puts it, "*in many cases copyright does not – and should not – protect 3D scans*[312]*. This is especially true for scans that are primarily designed to turn a physical object into an accurate digital representation. If the scanner is primarily motivated by "simply" making a*

[309] *Meshwerks, Inc. v Toyota Motor Sales U.S.A., Inc.*, 528 F.3d 1258 (10th Cir. 2008) citing Nimmer on Copyright §3.03 [C][3].

[310] One may argue that similarly to how blueprints or architectural plans are the instructions followed to produce a building, CAD drawings hold the instructions to guide the printer to produce a copyright protected object.

[311] Ginsburg (2003), 1074.

[312] Weinberg (2017), 220, § 10.01.

realistic digital representation of a physical thing, it is unlikely that the scan file will be protected by its own copyright"[313].

In other words, if the goal of the scan is to "*create a faithful digital copy of an existing physical object by capturing its shape and dimension into a set of three-dimensional coordinates*"[314], it lacks sufficient originality to attract protection.

It is true that scanning activities require intensive skill, effort and knowledge; however, hard work as such does not justify copyright protection[315]. Technical knowledge or know-how does not involve the authorial input required for copyright purposes.

Ginsburg recalls a U.S. federal district court's decision holding the view that scanning a pre-existing work without otherwise modifying its content "confer[s] no authorship" "*on the person doing the scanning; the work is the same, despite the machine-generated medium change*"[316].

When discussing whether scanning involves creativity, it is possible to divide the scanning process into three different phases: preparing the scan, making the scan and processing the data generated by the scan[317].

One may argue that preparing the scan does not require originality in the same way as taking a photograph. The CJEU in *Painer* has clarified that "*the photographer can make free and creative choices in several ways and at various points in its production*"; in the preparation phase, the photographer can chose "*the background, the subject's pose and the lighting*"[318]. Generally speaking, all such creative choices are simply not required for scanning an object.

Likewise, when taking a photograph, the photographer can stamp the work with his or her personal touch by choosing the framing, the angle of view and the atmosphere created[319]. Making a scan, instead, is mostly a mechanical process that consists in placing the object to be scanned in the machine or on a surface where the scan can be made[320]. Otherwise, scanners are simply waved above an object of interest to build a 3D model by measuring the object's surface structure[321].

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313 *Id.*
314 Antikainen; Jongsma (2017), 260.
315 Weinberg (2017), 221, § 10.02[A].
316 Ginsburg (2003), 1074.
317 The division into these three different phases is taken from Weinberg (2017), 227, § 10.02[C].
318 *Painer*, [91].
319 Painer, [91].
320 Antikainen and Jongsma (2017), 261.
321 http://www.dummies.com/computers/pcs/printers/how-to-scan-objects-for-3d-printing/.

These activities do not differ from scanning activities already employed in the past, which do not entail free and subjective choices and clearly amount to copying for copyright purposes (i.e. using a photocopier to scan a copyright protected document and making a photocopy).

Once the 3D scan is obtained, the data will need to be altered, adjusted and decoded by a person in order to make the CAD model "printable". Such data processing activity, however, could entail highly technical choices rather than artistic freedom, if it is aimed at reproducing the scanned object as faithfully as possible.

In fact, in such a case, the aim of the operator is to fill those gaps in the scanned representation that makes it different from the original physical object. This does not as such imply creative decision-making, but practical considerations aimed at achieving a higher quality of the scan. Moreover, one should always filter out those choices that are pre-determined by the computer software used in the post-processing phase.

No matter how much time, skill and labour are involved, the vast majority of scans are not protected by copyright. Copyright protection requires creativity on the part of the author: when scanning an object the choices available are just too limited.

It follows that scanning a copyright protected work without the owner's authorization infringes upon the exclusive right of reproduction. By contrast, if the scanned object is a useful article, which is not protected by copyright, everybody is free to reproduce, use or distribute the scan without seeking permission.

However, under specific circumstances, a scanned CAD model might constitute a derivative work, especially when the scanned data are modified substantially to create a new work of authorship (i.e. in case of "expressive scans") [322].

For the purposes of the present analysis, it is important to recall the Tenth Circuit's decision in *Meshwerks.* The facts of the case can be summarised as follows. Meshwerks was hired by Toyota to create wire frames models of Toyota cars. To this end, Meshwerks followed a three-step process: first, it took measurements of Toyota's vehicles; second, from the data so collected, it created digital wire-frame models, with the aid of software; third, it finalized the models trough manual modelling.

[322] Some scanners require an active contribution by the operator. Dasari has analysed the extent to which different scanning techniques may influence originality of the scan, by requiring a different degree of user assistance. More precisely, at the opposite ends of the spectrum lie automated scanners and scanners that require extensive human intervention (such as stereophotogrammetry), with a number of technologies that fall at different points of the spectrum. Some scanning technologies require users to take a series of photographs of an object from various angles that are then processed by software to recreate the 3D image. The user must then manually identify the "merge makers" points of the object. *See* Dasari (2013), 299 et ss.

The Court found that Meshwerks was not vested with copyright in its digital wire-frame models, which were not independent creations, but infringing copies of Toyota's vehicles. Key to the Court's findings was the fact that "*such models depicted nothing more than unadorned Toyota vehicles, car as car"*[323].

Even if creating the models required a great amount of skill, the end-results were unadorned images of cars, the appearance of which owes its origin to Toyota[324]. Meshwerks' goal was simply to depict real-world objects on a computer screen, without adding original and creative elements.

Yet, the Court made also clear that "*digital modelling can be, surely is being, and no doubt increasingly will be used to create copyrightable expressions*"[325]. However, the Court also admonished that "*just as photographs can be, but are not per se, copyrightable, the same holds true for digital models*"[326]. To be eligible for copyright protection, choices about shading, lighting, angle, background scene or other creative decisions must be made.

Shifting from one medium to another is not a defence to copyright infringement. The person who scans an object is a copyist to the extent that he or she merely performs an easy mechanical function.

Noteworthy, Lee has criticised the approach followed by the Tenth Circuit in *Meshwerks* on the following grounds. First, Toyota cars were not copyrighted and thus could be freely depicted. Second, Meshwerks contributed human thought in creating the models, i.e. exercised an act of authorship. Finally, the digital models at stake were *imaginary* representations of objects that satisfy the originality threshold. The Court erroneously held that the types of choices that make photographs original, such as those related to lighting and shading, shall also apply to digital modelling[327].

The present writer agrees with Lee on this last point. A different test must be applied for assessing originality of printable files, since elements that traditionally confer originality to a photo hardly will be included in the CAD model, being wholly unnecessary for printing purposes.

Simon further notes that the distinction drawn in *Meshwerks* between CAD models that make an accurate depiction of the underlying object and those that add creative features is well

[323] *Meshwers*, [1266].
[324] *Id.*
[325] *Id.*, [1270].
[326] *Id*.
[327] Lee (2012), 947.

illustrated by the Penrose triangle, "*a 2D figure that is interpreted by the brain as a 3D object, even if it is not possible for such object to exist"*[328].

Dr. Schwanitz created a 3D manifestation of the Penrose triangle and posted a video showing his results[329]. Hence, after the video was released, another 3DP enthusiast worked out how to create a tangible version of the Penrose triangle and uploaded the CAD file for it onto Thingiverse.

In the opinion of Simon, Dr. Schwanitz's work "*would appear to be subject to copyright protection, in light of the fact that previous to his work the object was considered to be an impossible theoretical optical illusion"*[330]. Hence, the triangle was not just a realistic reproduction of a pre-existing work.

On the other hand, it is plausible to argue that Schwanitz's takedown notice against the Penrose triangle "*had no legal basis because he … did not have a right in the image nor in the process of converting it from an image to 3D because processes are not protected by copyright*"[331]. It is likewise questionable whether the 3D version of the triangle created by Schwanitz added sufficient creativity to the original 2D version of the triangle.

Hence, the first issue to address is whether the original 2D image contained creative elements, rather than being just a trivial representation of a triangle. In the former case, the follow-on physical/digital manifestations of the Penrose triangle, which are not merely inspired by the idea of an impossible triangle, but appropriate the creative choices expressed in the primary work, may potentially infringe on the owner's exclusive right of reproduction and/or the right to make derivatives[332].

The simple conversion of a protected image in 3D form does not entail enough creativity to establish a separate copyright in the 3D model.

13. Idea Versus Expression

It is generally known that copyright does not extend to the intangible information that exists in the mind of its creator. What is protected is not thought, but the original way in which thought is expressed. Hence, a work must be exteriorized in some way, in order to be capable of being sensed, experienced and appreciated by third parties.

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328 Simon (2013), 74. On this see also: Rideout (2011), 165.
329 Simon (2013).
330 *Id*., 74.
331 Dama; Chinmaye (2016), 80.
332 See also Daly (2016) expressing puzzlement over this case, 40.

Merely having an idea is not enough; expression is the only way for a work to become real and "*accessible to the public and to start potentially an exploitation life"*[333]. Hence, the expression requirement means that the author's creative endeavour needs be expressed in some external form, in order to be perceivable in one way or another.

A key principle upon which copyright law rests is the distinction between "content" and "form" or between the "subject matter" of a work and the protectable "expression" of the work. Copyright protects only the original expressions of authors, i.e. the form in which the subject matter is expressed. Subject matter as such - i.e. ideas, concepts, theories, thoughts, facts – forms part of the public domain and is available for anyone to use without restrictions, insofar as the form is not copied.

In the common law practice this cornerstone of copyright is known as the "idea and expression dichotomy". This principle is mandated by Article 9(2) of the TRIPS Agreements, which provides that "copyright protection shall extend to expressions and not ideas, procedures, methods of operation or mathematical concepts as such"[334].

This fundamental distinction between "content" and "form" or "idea" and "expression" (hereafter "the idea/expression dichotomy") is at the essence of copyright law, since it delineates the ambit of the copyright monopoly. It has been defined as "the most pervasive thread in copyright law", which is aimed at drawing the boundaries between the private and public elements of a work[335].

As put forward by the U.S. court in *Holmes*, "words are common property of the human race, and are as little susceptible of private appropriation as air or sun light"[336]. Likewise, ideas alone, if not communicated "*are of value to no one but the author*"[337].

As a general matter, the dichotomy implies that works can be based on the same essential ideas and, nonetheless, enjoy copyright protection, if they result in different expressive forms. In other words, it is not an infringement for someone to take the unprotected ideas underlying a copyright protected work and incorporate them into her own work.

It follows that the idea/expression dichotomy is aimed at promoting the free flow of creative ideas and facilitating transformative uses of creative works. In the words of Professor Nimmer: "*to grant property status to a mere idea would permit withdrawing the idea from the stock of materials which would otherwise be open to other authors, thereby narrowing the*

[333] Latreille (2009), 133.
[334] Compare the WCT, Article 2; U.S. Copyright Act 1976, Section 102(b); Software Directive, Article 1(2).
[335] Jones (1990), 552, note 5.
[336] *Holmes v Hurst*, 174 U.S. 82 (1899).
[337] Jones (1990), 556.

field of thought open for development and exploitation"[338]. Indeed, ideas should be freely accessible to the public so that "*they may be used for the intellectual advancement of mankind*"[339].

The distinction between idea and expression further seeks to mark the line between the domain of copyright and of patent. Patents, with their requirements of novelty, non-obviousness and inventive-step appear to be the more appropriate vehicle for protecting functional works.

As Simon noted, "*if one was permitted to obtain copyright protection for an invention merely because the inventor wrote down on a paper a description of the idea or process, the inventor would be circumventing the rigorous prerequisites of patent law and keeping this new knowledge out of the public domain for an extended period of time*[340]".

It is worth noticing, however, that numerous commentators have expressed criticism towards the idea/expression dichotomy. A first general critique argues that the terms "idea" and "expression" are often used in different senses, with a certain degree of ambiguity[341].

Sometimes the term "expression" is used to describe what is the protected element of a work, some others to describe the embodiment of an idea, whether protectable or not. By analogy, the term "idea" may either denote an abstract concept that has not been expressed or the unprotected element of a protected expression[342]. Hence, it has been contended that the distinction to be made is not between ideas and expressions, but only between those expressions that attracts copyright protection and those that do not.

A second group of criticism argues that the dichotomy does not represent a valid tool for courts to rely upon in resolving copyright disputes. As noted by Justice Hand in *Nichols*[343], the distinction between ideas and their expression will seem arbitrary no matter where it is drawn. It may be regarded as a policy decision that implies a broader or narrower scope of copyright protection.

Likewise, for some scholars the supposed "dichotomy" is artificial and illusory, since the relationship between ideas and expressions is not binary, but a continuum, leading from the very general idea to the articulated elaboration of that idea (i.e. the "expression"), with a large

[338] Nimmer; Nimmer (1989), §13.03[A].
[339] *Id*.
[340] Simon, 70.
[341] Jones (1990), 565-566.
[342] *Id*.
[343] *Nichols v Universal Pictures Corp* 45 F.2d 119 (2nd Cir. 1930), cert. denied, 282 U.S. 902 (1931).

number of graduations between these two extremes[344]. Accordingly, "*the law operates by degrees in determining whether a work's content is protectable or has been infringed*"[345].

13.1. The Doctrine of Merger

The idea/expression dichotomy presents another major hurdle: the doctrine of merger. If the idea merges with the expression, protecting the expression would monopolize also the underlying idea[346]. Hence, in those circumstances, copyright does not apply to the expression that retains the same unprotected status of the idea. As a consequence, copying the expression is not barred[347].

A likely scenario in the 3DP landscape, where the doctrine of merger applies, is exemplified by *Herbert Rosenthal Jewelry Corp. v Kalpakian*[348], a case involving a claimed infringement of a jewelled pin in the shape of a bee. The court held that since there were very limited ways in which a jewelled bee pin (i.e. the idea) could be expressed, to confer copyright protection to the design would exclude all others from manufacturing any jewelled bee[349].

The "scènes à faire" doctrine operates in a similar fashion to the merger doctrine. It excludes from protection those elements that are common to works belonging to a certain artistic genre. By way of explanation, "*it is virtually impossible to write about a particular historical era or fictional theme without employing certain "stock" literary devices*", for instance "*scenes depicting German greetings such as "Heil Hitler*"[350].

The rationale behind *scènes à faire* is analogous to that underlying the merger doctrine: conferring copyright protection over elements in a genre or style would restrict entry by other authors.

13.2. The Idea/Expression Dichotomy Applied to CAD files

The idea and expression dichotomy bears particular relevance in the 3D printing context. As already stressed, a CAD file constitutes the means that is used to incorporate a (possibly) copyright protected work.

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[344] Jones (1990), 561.
[345] Goldstein (1970), 1018.
[346] Samuels (1989), FN280 et ss.
[347] *Id.*
[348] 446 F.2d 738 (9th Cir. 1971).
[349] This conclusion is, however, questionable as there are many different ways in which a jewelled bee pin could be arranged.
[350] *Altai*.

A major challenge that 3DP poses is how to provide protection to the designs without attaching protection to the underlying ideas[351]. Hence, it is important to screen out those elements of a CAD file that belong to “ideas”.

First, when looking at the design-drawing component of the CAD file for a useful object, it seems clear that copyright will attach to its expressive and creative features, without extending to the object itself, if such object is not within the copyright’s reach[352]. Even if the file is protected by copyright (for example, as a technical drawing), copyright will extend only to the creative elements that exist independently of the drawing’s utility[353].

As noted by Weinberg, no matter how the CAD file is treated, the copyright on the file would not prevent a third party from creating the useful object represented therein[354]. Copying the file to create the object may or not be copyright infringement: if the only way to create the object is to copy the file, then unauthorized copying may be excused[355].

Moreover, elements such as spatial coordinates, measurements or information about colour, structure, strength and texture are outside the copyright realm, being mere facts or ideas.

Interestingly, in *Baystate*[356], a U.S. district court found that data structures in a CAD program were not independently copyrightable. The case concerned a data translator that was designed to read and then translate data files between different CAD systems. In this case the court applied the *scènes à faire* doctrine to conclude that the internal structure and organization of the data files were dictated mainly by external factors (i.e. the need to achieve compatibility whit other systems that were aimed at reading the data files)[357].

If data were not structured in a certain way, it would not be possible for a computer program to translate them. In other terms, without compatibility, the translator would misread the data files’ structure.

Similarly, the names (i.e. the words or abbreviation) used to describe the files and the data structures were not protectable under the merger doctrine, since they were mainly dictated by functional considerations and efficiency concerns. For example, a file that creates colour has a name in which the world colour appears. In that case, the name of a file “colour” merges with the idea or function of the file, “to create a colour”, and is not protected by copyright law[358].

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[351] Dagne; Dubeau (2016), §115.

[352] In countries such as France that embrace a “unity of art” system a useful article may enjoy copyright protection on the same grounds as a work of fine art.

[353] Weinberg (2013), 16.

[354] *Id.*,19.

[355] *Id.*

[356] *Baystate Technologies, Inc. v Bentley Sys., Inc.*, 946 F. Supp. 1079 (D. Mass. 1996).

[357] *Id.*, [1088].

[358] *Id.*, [1089].

Second, one should consider that, in addition to the digital design, a CAD file contains a set of instructions for the printer to follow. The question should, therefore, be answered whether copyright in the expressive components of a CAD file is negated by its ultimate function. Among others, Simon seems to suggest that the CAD file's function precludes copyright protection or, at least, "*calls for a presumption against copyright protection*" of such files[359]. Arguably this is not the right approach to follow.

The fact that the CAD file differs from a more traditional design drawing because it also serves to send instructions to a 3D printer should not as such deprive it of copyright protection, because the design-drawing component can be seen separately from its functional code. Arguably most digital designs do not merge with the utilitarian elements of the code, because they contain expressive features that are not necessary for the code to perform its task.

This leads us back to the distinction between different categories of CAD files: "CAD drawings" or "CAD models"; "3D printable files" (such as STL files); and "GCODE files. It is most likely that CAD models will be inclusive of features that are not arranged for purely functional and utilitarian reasons (i.e. not only elements such as lighting, the background, and shading, but also labels, views, part lists, and legends that are not required for manufacturing but are meant for human viewing)[360].

In such a case, the design drawing can be conceived as a separate entity from the code that serves to print the item. That is, the design is not necessarily incidental to the function of printing the object, which belongs to ideas, because it adds creative features that the printer does not use to create the item.

Following this line of thought, however, it is possible to contend that pre-made shapes that correspond to a block of code do actually merge with the CAD file's function. As noted by Dolinsky, this leads to the conclusion that CAD models most likely will survive the merger inquiry if they are created freehand, by means of surface modelling software, rather than solid modelling software[361].

By contrast, most likely every aspect of a printable file and GCODE file will be present entirely for utilitarian reasons[362]. As discussed, after the conversion into STL or GCODE file

[359] Simon (2013), 71; Mendis (2015), 25.
[360] Osborn (2016), 43.
[361] Dolinsky (2014), 656.
[362] Osborn (2016), 46, suggesting that the Tenth Circuit in *Meshwerks* implicitly held that wire-frame models are not sufficiently original for copyright purposes, because they merely represent the vehicles as they exist in reality.

format, the creative and artistic features of the design drawing, which do not form a part of the instructions for the printer, will just disappear.

Hence, in such cases, copyright protection will turn on the merger analysis: the question should be answered whether some features of the digital design could be expressed differently and, notwithstanding that, the code could still perform its function. If not, it means that there is just one way to express an idea and, therefore, the expression is said to have merged with the idea itself.

To conclude, one may argue that most sliced CAD files, which are saved in GCODE file format, contain a design drawing that will not survive the merger inquiry, as they do not contain sufficient expressive elements.

In fact, the reason why the design drawing is depicted in a certain way is dictated by the underlying purpose to enable printing the item. By the same token, the coded instructions to manufacture the item are generated automatically and correspond entirely to the design of the object. Differently, CAD drawings that are created freehand, at least those created with the aid of surface modelling software, most likely will be sufficiently creative to escape merger[363].

As discussed, the application of the idea/expression dichotomy has proven particularly compelling in relation to computer programs: it entails filtering out those lines of code that are incidental to the program's function.

If expression in the code is not indispensable to perform the function of printing the item, and must not necessarily be present in all CAD files, conferring copyright protection to such expression would not monopolize ideas.

14. CAD Files Meet The Fixation Requirement

In certain countries, such as the U.S.[364] and the UK[365], fixation is a fundamental requirement for copyright subsistence: the work must be fixed in a tangible medium, i.e. be "*sufficiently permanent or stable to permit it to be perceived, reproduced, or otherwise communicated for a period more than a transitory duration*"[366].

A digital file, as a CAD file, can be seen as an instrument of fixation of the work: the work is fixed in the computer's RAM and may be perceived with the aid of a machine or device. The

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[363] Dolinsky (2014), 67.
[364] 17 U.S.C. § 102(a) (1976).
[365] In the UK there is an express "fixation" requirement in relation to literary, dramatic and musical works under Section 3(2) UK CDPA, but not in relation to artistic works.
[366] See 17 U.S.C. § 101 (2006).

work can be reproduced either as a graphical representation or as a line of code. In addition, once printed, the physical object represents the tangible embodiment of the work[367].

As specified by US courts, the issue of what is meant by "transitory duration" is necessarily "fact specific"[368] and requires "qualitative" (a sufficient period of time in which the work is fixed) as well as "quantitative" (the status of the transaction)[369] characteristics.

Reitinger raises the argument that using a 3D printer to make an object requires the printer to store the file in the printer's RAM[370]. Quantitatively, the printer seems to embody the work for more than a transitory duration, considered that it may take hours to print an object. Qualitatively, a 3D printer is not meant to store the CAD file for more than one-time use. Therefore, a copyright protected work is not infringed while the printing process is still on-going.

Part II
Infringing Activities in the Three-Dimensional Printing Landscape

15. Derivative Works: Legal Background

15.1. The International Landscape

The Berne Convention contains numerous provisions that need scrutiny.

In the first place, Article 2(3) Berne expressly deals with "derivative works", i.e. "follow-on" or "secondary" works that are based on another, pre-existing "source" or "primary" work.

The same provision enumerates four different types of derivative works ("translations, adaptations, musical arrangements .. and other alterations of.."), clarifying that they "*shall be protected as original works, without prejudice to the copyright in the original* (i.e. primary) *work*".

The WIPO Guide to the Berne Convention details that, while "*this provision refrains from laying down what constitutes 'adaptation'*", it is nonetheless agreed that the latter includes "*any new form of the substance of the work, marginal cases being left to the courts*"[371].

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[367] Dasari (2013), 289.

[368] *See* the Second Circuit's decision in *Cartoon Network, LP v CSC Holdings, Inc.* 536, F.3d 121 (2nd Cir. 2008).

[369] For instance if the alleged infringer acted on behalf of another, without interacting directly with the work in transit.

[370] Reitinger (2015), 139 et ss.

[371] Guide to the Berne Convention for the Protection of Literary and Artistic Works (Paris Act, 1971).

The first three types of derivatives listed in Article 2(3) Berne are the so-called "named derivatives", namely derivatives that are recognized at an international and national level[372].

Under Berne, "translation" means expressing "*other's thoughts in a different language"*, "*adaptation"* means *"the recasting of a work from one format into another, as from a short story into a dramatic play or from a cartoon series into a musical comedy";* whereas *"musical arrangement"* probably means *"modification within the same format such as an orchestral arrangement of a popular song"*[373].

The fourth type of derivatives that is covered by Article 2(3) – i.e. "*other alterations of literary and artistic works*" – is particularly pertinent to the present analysis. The all-encompassing expression "other alterations" purports to cover different types of "unnamed" or "penumbral" derivative works, which the U.S. Copyright Act defines as works that are "based upon" pre-existing works[374].

Hence, a reading of international legal sources reveals that a derivative work may qualify as protected subject matter in its own right, provided that the requirements for protection are met: it must be the author's own intellectual creation, within the domain of literature, science or art[375].

Courts in various jurisdictions tend to apply the same originality standard to derivative works and other works[376]. Hence, a derivative work is protected as an original work since its creation calls for intellectual effort. The secondary author brings his own mind in translating, adapting, transforming or re-arranging the work in a different language or format[377].

Therefore, only adaptations that involve a sufficiently creative contribution, since they transform or make original additions to the underlying work, can benefit from copyright protection in their own right[378].

In such a case, the scope of protection accorded to the secondary work is identical to that accorded to the original work under Article 2(1) Berne. It is noteworthy to stress, though, that

[372] Gervais (2013), 808.
[373] WIPO Guide to the Berne Convenion § 2.13-2.17.
[374] Gervais (2013), 808.
[375] Van Eechoud (2014), 153.
[376] Goldstein; Hugenholtz (2013), 207.
[377] *Id.* as noted by Goldstein and Hugenholtz, courts in both France and the United States have found the required originality in art reproductions that reflected, even to a modest degree, the impress of the adapter's personality.
[378] On the contrary, the mere non-inclusion of a part of the underlying work into the secondary work, the insignificant and unsubstantial modifications made to the primary work, as well as the incorporation of other unoriginal material, most likely will not amount to "derivative works" obtaining autonomous protection. *See* Margoni (2013), 19, clarifying that simple omissions, small changes and the inclusion of material not accompanied by new authorial input are not eligible for protection.

the author of a derivative work obtains protection only for its newly added intellectual achievement.

In other terms, as better clarified throughout this thesis, a derivative work takes the original expression of the source work, with the purpose of adding new creative elements to it or transforming it. It is the expression of creative choices in the added or transformed elements that is worthy of protection, rather than the creative choices that made the source work original in the first place.

This principle is unequivocally set forth in the laws of certain jurisdictions. For instance, the U.S. Copyright Act explicitly provides that: "*the copyright in a derivative work extends only to the material contributed by the author of such work, as distinguished from the pre-existing material employed in the work, and does not imply any exclusive right in the pre-existing material"*.

Going back to Article 2(3) Berne, the protection accorded to a derivative work "*is without prejudice to the copyright in the original work*"[379]. It follows that derivatives need authorization from the owner of the underlying work. Adapting a work without such prior permission will infringe, unless the work is in the public domain or a defence is available[380].

In this respect, it must be noted that Article 2(3) Berne is closely linked to another provision: Article 12, which sets forth the author's exclusive right of authorizing adaptations, arrangements and other alterations of their works[381].

Accordingly, on the one hand, derivative works show the potential of constituting copyright infringement inasmuch as they require "*adaptations, arrangements and other alterations*" of pre-existing works. On the other, once the author authorizes adaptations, arrangements and other alterations, they may enjoy protection as original works.

Yet, the Berne Convention does not postulate what is the legal status of the follow-on work that has been created without permission[382]. Whether, for the purposes of Berne, use of the primary work exposes the secondary creator to copyright infringement and, on top of it, deprives the follow-on work of copyright protection remains altogether unclear[383].

Different approaches have been adopted at national level about whether derivative works based on infringement can or cannot be legally protected. For example, the U.S. Copyright Act explicitly provides that "*protection for a work employing pre-existing material in which*

[379] Article 2(3) Berne.
[380] The WIPO Guide to the Berne Convention, § 2.16.
[381] Other relevant norms in the Berne Convention include: Article 2(5), Article 8 and Article 14bis.
[382] Goldstein; Hugenholtz (2013), 209.
[383] *Id*.

copyright subsists does not extend to any part of the work in which such material has been used unlawfully"[384].

Courts in the UK upheld the opposite view noting that derivative works using underlying copyright material unlawfully may, nonetheless, enjoy copyright protection insofar as the derivative work contributes new expression to it[385].

The same holds true in most civil law jurisdiction. While the follow-on work may violate the derivative right in the primary work, it is up to the copyright owner to claim infringement or not. Whether liability is pursued or not does not affect the copyright status of the secondary work.

Having laid the statutory framework, if one sticks to the Berne terminology, in theory, a 3D-printed object or a digital design based upon one or more pre-existing works may well seem to fit within the notions of "*adaptations" or "alterations"*.

At the terminological level, printing an object from a protected digital design can be conceived as an "adaptation", whereas the creation of a digital design, drawing on a pre-existing CAD file, most likely will fall within the fourth category of derivatives previously identified, being an "unnamed" or "penumbral" *alteration* of a work.

In fact, while an adaptation entails the recasting of the primary work in a different format, an alteration implies a modification within the same format, which does not come within one of the three derivatives in named forms[386].

In the abstract, these types of transformation of the original work would need to be authorized by the right-holder of the primary work, pursuant to Article 12 Berne. Nonetheless, a preliminary inquiry would rather be whether the follow-on creations should be considered as "reproductions" within the meaning of Article 9 Berne, rather than adaptations/alerations. As seen below, the relationship between these two economic rights is intricate.

Suffice here to note that the derivative right in the Berne Convention has a different normative footing than the reproduction right, albeit their undeniable intersection. While at national level some countries subsume the derivative right under the reproduction right, at the international level the former is normatively and conceptually distinct from the latter. Where to draw the line between unlawful copying and derivation remains highly problematic.

[384] 17 U.S. Code § 103(a).

[385] Goldstein; Hugenholtz (2013), 208.

[386] It goes without saying that any claim of copyright infringement will always be dependant on the circumstances of a given case. Likewise, whether the follow-on creation involves sufficient originality on the part of its creator would need to be assessed on a case-by-case basis.

As fully addressed below, the main reason why such a classificatory distinction is so puzzling lies in the borderline nature of the derivative right, which implies that a reproduction is accompanied by creative modifications[387].

15.2. The EU Landscape

While many steps have been taken in the process of harmonizing EU copyright rules, the adaptation right has not been object of any "horizontal" harmonizing measure. This right falls outside the scope of the InfoSoc Directive; it remains a non-harmonized legal terrain at the EU level, with the remarkable exceptions for Software and Databases, where the copyright holder's exclusive right to do or authorise translations, adaptations, arrangements or other alterations is expressly regulated[388].

Therefore, insofar as the right of adaptation is not part of the EU *acquis communautaire,* it should be excercised according to national law and relevant international legal sources (Berne, WCT, WPPT). Noteworthy, there remain many differences among national copyright laws on the right of adaptation.

The law of certain countries categorizes such right as a sub-category of the reproduction right (i.e. France, Belgium and The Netherlands), whereas, in countries such as Germany and Italy the right is governed by a separate provision. In the UK, the right to control adaptations is treated as a separate right; however, the right to prohibit copying has been interpreted broadly to cover most adaptations[389].

It follows from the foregoing that drawing the diving line between the right of adaptation and the right of reproduction may prove highly challenging. One may take the view that the adaptation right should be systematically classified as a form of "reproduction" at the EU level, which is subject to the common standards of Article 2 InfoSoc. This also implicates that the right is subject to the exceptions listed in Article 5 InfoSoc.

Such an extensive interpretation of the reproduction right would overcome existing discrepancies in the way the derivative right is regulated by individual Member States. Having noted that, if the reproduction right were interpreted broadly to cover many non-literal uses of pre-existing works, the adaptation right would become superfluous and meaningless.

[387] Gervais (2013), 837.
[388] Article 4(b) Software Directive and Article 5(b) Database Directive.
[389] Margoni (2013); van Eechoud (2014).

The broad interpretation given by the CJEU to the reproduction right, in the aftermath of the *Infopaq* decision, has been relied on to support a conceivable overlap between the two rights at the EU level.

Indeed, as we saw earlier, the CJEU in *Infopaq* made clear that copying parts of a text (including 11-word long snippets) constitutes a "reproduction" provided that such parts are the author's own intellectual creation of the author. The *Infopaq* decision concerned a case of literal copying, i.e. the taking of parts of fragments of literary works. Literal copying is a straightforward act of reproduction requiring the copyright holder's consent.

Yet, the traditional distinction between reproduction and adaptation lies in that the former covers the act of copying, i.e. the production of mechanical copies of the work, which may also involve a format shifting or a change of the medium (i.e. if affects the "*corpus mechanicum*"), whereas the latter covers changes to the intellectual substance of the work (i.e. if affects the underlying "*corpus mysticum"*). This explains why the *form* of a derivative work is almost always different from that of the original work (such as two v three-dimensional form)[390].

Hence, derivation has traditionally been intended as a transformation of a work into another form of expression, which is not a simple reproduction. The second author does not copy the *form* (as in the case of literal copying), but uses the original work at an abstract level, by taking the *free and creative choices* made by the primary author[391].

Having noted that, the CJEU in *Infopaq* suggested that the infringement test to assess whether a reproduction of a copyright protected work has occurred is to ascertain whether "the author's own intellectual creation" has been appropriated in the defendant's work[392].

The same infringement test applies to the individual "units" composing a work, and a *de minimis* assessment cannot be made. Hence, the CJEU emphasised the qualitative ("intellectual creation") rather than quantitative ("the amount taken") aspect of the infringement test, in the sense that liability can be pursued even if what was copied amounts to small extracts, elements or units of the work that, nonetheless, reflects the author's own intellectual creation.

As clarified by subsequent case law from the CJEU, the "author's own intellectual creation" criterion requires *free and creative choices* and, the author's personal stamp onto the work. Accordingly, if one looks at the *creative choices* that have been taken from the original work,

[390] Gervais (2013), 846-847.

[391] Gervais (2013), 808.

[392] Therefore, the CJEU gives much more weight to the *qualitative* ("intellectual creation") rather than *quantitative* ("substantial part") aspect of the infringement test.

most non-literal uses of a pre-existing work can certainly be subsumed under the reproduction right.

This is why some scholars suggest that, for the adaptation right, the focus should rest on what was added in the derivative, rather than what was taken from the original work; otherwise, the reproduction right would be broad enough to cover almost every adaptation, following the *Infopaq* test[393].

In the words of Professor Torremans: *"transformative works that contain by definition (small) parts of the expression of the pre-existing works are therefore by definition at risk of copyright infringement. But if we value the added value of the transformative nature of the work, limitations and exceptions need to be in place to overcome this hurdle and to allow valuable transformative works"*[394].

The AG's approach in *Painer* seems to support the view that reproduction might also occur through non-literal copying. One of the questions in the case under scrutiny was whether the making of a photo-fit image of a woman from a portrait photograph infringes the copyright in the photo used as a template. In the AG's opinion, in a case where the photo-fit embodies "*the personal intellectual creation which justifies the copyright protection of the photographic template*" a reproduction for the purposes of Article 2 InfoSoc occurs[395].

It should, however, be noted that the ruling in *Painer* came out before another decision from the CJEU: *Art & Allposters*[396]. This last decision will be analysed at length in the next paragraph. Here suffices to note that both the AG and the CJEU concluded that the adaptation right does not fall within the realm of the reproduction right.

This, in turn, leaves open the door for the introduction of a tailored exception to the adaptation right, at the level of individual Member States, with the purpose of enabling non-literal uses of pre-existing works that are truly *transformative*[397]. Through this avenue, lawmakers might attempt to keep pace with today's practice of collaborative productions, especially in the context of UGC[398].

One of the central problems in copyright law is where to strike the balance between the interests of copyright owners – deserving a high level of protection that promotes *ex ante* incentives and *ex post* reward to generate new works – and other important values in society,

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393 Margoni (2013).
394 Pila; Torremans (2016), 624.
395 [129].
396 Case C-419/13 *Art & Allposters International BV v Stitching Pictoright* (22 January 2015).
397 Among others, Hugenholtz and Senftleben (2012) suggest that Member States aspiring to introduce a measure of flexibility in their copyright norms should avail themselves of the freedom left by the unregulated status of the adaptation right.
398 *Id*., 14.

such as the promotion of new forms of human creativity. Gains on the copyright swing should not exceed loses on the side of users, creators and the public at large.

As Gervais points out, normatively one must seek to establish "*an optimal point of protection*", which is a point where enough protection is granted to authors, without preventing others from creating their own works by non-literal copying[399]. This goal is particularly desirable in the 3DP context, where digital tools enable Internet users to reuse, modify, remix and make mash-ups of pre-existing works.

The following section elaborates on a recent decision from the CJEU that does not thoroughly address the right of adaptation and its relationship with the reproduction right, as the crux of the dispute concerned the right of distribution, but clearly postulates that the right of adaptation is not within the harmonized landscape of the EU.

15.3. *Art & Allposters*

The facts of the case can be summarized as follows. Allposters marketed through its websites posters and other reproductions of famous artworks within Pictoright's control. Pictoright is a Netherlands copyright collecting society that looks after the interests of copyright owners affiliated to it[400].

Allposters used a chemical process to perform a "canvas transfer", i.e. a transfer of the ink from a paper poster of a famous artwork onto a canvas, which was then stretched over a wooden frame. Through such a process, the image of the work disappeared from the paper backing, meaning that the ink was saved and the poster ceased to exist.

Pictoright, the holder of copyright in the pictorial works, had only consented to the reproduction and sale in the European Economic Area of the works in poster form; it did not allow the "canvas transfer". Therefore, in essence, the question at issue in the main proceedings, giving rise to a preliminary reference, was whether Pictoring could or not prohibit the marketing of the image depicted in the posters as a canvas transfer.

The case ended up before the Dutch Supreme Court that decided to stay proceedings and to refer the following questions to the CJEU for a preliminary ruling: *whether the rule of exhaustion of the distribution right set out in Article 4(2) InfoSoc applies in a situation where a reproduction of a protected work, after having been marketed in the EU with the copyright holder's consent, has undergone an alteration of its medium, such as the transfer of that*

[399] Gervais (2013), 788 gives a critical reading of the open-ended derivative right enshrined in the U.S. Copyright Act, according to which the copyright owner has the ability to prevent others from making almost *any* work that is "*based upon*" one or more pre-existing work.
[400] *Art & Allposters*, [14].

reproduction from a paper poster onto canvas, and is placed on the market again in its new form[401].

The CJEU observed that the parties were in disagreement: first, as to whether exhaustion of the distribution right covers "the tangible object" or "copy" into which a work is incorporated or the immaterial "author's own intellectual creation"; and, secondly, as to whether the alteration of the medium has or not an impact on the exhaustion of the exclusive distribution right[402].

Allposters essentially argued that exhaustion of the distribution right occurs at the time of distribution of the *work,* which is embodied in a tangible object; any subsequent alteration of the *copy* or the object does not have any consequence with regard to exhaustion[403].

Having clarified this point, Allposters submitted that, in the present case, it was the medium rather than the work which has been alerted and, as a result, the applicable provision is Article 4 InfoSoc, which has completely harmonized the distribution right (para. 1) and the exhaustion rule (para. 2). Accordingly, there is no latitude for reference to national legal provisions.

For its part, Pictoright was of the view that, owing to the significant alteration undergone by the posters in the process of "canvas transfer", the resulting canvases should be regarded as "adaptations" of protected works, which are not covered by the distribution right. The adaptation right has not been harmonized at the EU level, but is governed by Article 12 Berne[404].

In relation to the first question referred, the CJEU avoided conclusion on the concept of "adaptation" within the meaning of Article 12 Berne; it is sufficient to state that both the paper poster and the canvas transfer contain the image of a protected artistic work, thus falling within the scope of Article 4(1) of the InfoSoc Directive as "copies" of a protected work[405].

Then, the Court held that exhaustion of the distribution right applies only to the "tangible object" in which a protected work or its copy is incorporated, if placed on market with the copyright holder's consent[406].

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[401] *Art & Allposters*, [21].
[402] *Id.*, [33].
[403] [AG 21].
[404] In other words, Pictoright took the view that canvas transfer affected the *work* and not solely the object or material medium in which the work is embodied, thus being an adaptation that falls outside the scope of the InfoSoc Directive [AG 54]. By contrast, Allposters submitted that the canvas transfer merely entailed an alteration of the object or material medium, meaning that this was a case of distribution and not adaptation, with the result that the InfoSoc Directive was applicable [AG 55].
[405] *Art & Allposters* at [24]-[28].
[406] *Id.*, [40].

In relation to the second point of disagreement, the CJEU had to consider whether the fact that the object has undergone subsequent alterations to its physical medium has an impact on the exhaustion rule[407]. In that regard, the CJEU concluded that the canvas transfer, since it provided a result closer to the original, constituted a new "reproduction" (rather than an adaptation) within the meaning of Article 2(a) InfoSoc, even though the poster itself ceased to exist and, therefore, there was no multiplication of copies.

In the Court's view "*the fact that the ink is saved during the transfer cannot affect the finding that the image's medium has been altered. What is important is whether the altered object itself, taken as a whole, is, physically, the object that was placed onto the market with the consent of the right-holder. That does not appear to be the case in the dispute in the main proceedings*"[408].

Therefore, the fact that the object incorporating the work has been altered to a significant extent has an impact on the exhaustion of rights; it constitutes a new "reproduction" of that work, which is not exhausted upon the first sale of the object incorporating the work.

Interestingly, the CJEU made clear that the canvas transfer increased the durability of the reproduction, improved the quality of the image and provided a result closer to the original of the work[409]. Hence, the economic value of canvases significantly exceeded that of posters. Authors should be in the position to require appropriate reward for the commercial exploitation of their works[410].

By way of conclusion, unfortunately the CJEU did not take this opportunity to give some guidance on the scope of the adaptation right, since it considered the question asked by the referring court limited to the right of distribution.

With this background in mind, the CJEU issued a clear statement: the adaptation right is not part of the European *acquis* and certain kinds of alterations are covered by the broad reproduction right under Article 2 InfoSoc. Yet, where to draw the line between "reproductions" and "adaptations" is not altogether clear.

Noteworthy, the AG Opinion gave an important insight into that issue: strictly speaking, an "adaptation" affects a "work" rather than the object in which the work is incorporated[411]. The secondary work should be the result of an artistic creation, "*i.e. a process of adjustment of the*

[407] *Id.*, [41].
[408] *Id.*, [45].
[409] *Id.*, [42].
[410] *Id.*, [48].
[411] [AG 57].

subject matter of an artistic creation to the methods of expression peculiar to different types of art'[412].

Therefore, the essential elements of an "adaptation" can be identified in: (1) "*the diversity of languages and artistic techniques that are employed*"; (2) the fact that adaptation "*seeks to intervene in the work itself rather than to adjust the work to the expressive characteristics of another artistic language, making the work, in its own language, a different work in so far as it is only vaguely recognisable in its original expression*"[413].

It is apparent in the present case that the canvas transfer did not affect the original image and that the "work" remained unaltered[414]. The defendant did not attempt to modify the artistic creation, but rather reproduced the original image on canvases as faithfully as possible. Thus, there was no addition of elements that come within the concept of "adaptation".

On that basis, in order to distinguish a "reproduction" from an "adaptation", one should always consider if the medium, rather than the work, has been modified. Having noted that, the degree of alteration that is needed to claim that the right of adaptation is applicable remains unsettled; it will have to be assessed on a case-by-case basis.

Moreover, the Court sought to clarify two important points that were still unclear: (1) exhaustion of the distribution right concerns the tangible object (i.e. to the *corpus mechanicum*), and not to the work as such (the *corpus mistycum*); (2) exhaustion does not apply if the tangible object has been altered substantially, and thus constitutes a new reproduction of the work. In such cases, copyright owners shall have the right to require appropriate remuneration for the exploitation of the modified work.

15.4. Final Remarks on the Adaptation Right

In light of the foregoing, it is possible to draw the following conclusions about the derivative right. As seen above, at the international level the derivative right has its own legal and conceptual foundations and is viewed separately from the reproduction right, whereas some national legal regimes anchor it to the reproduction right.

Lacking a uniform legal landscape, defining what are the metes and bounds of the derivative right, and the extent to which its scope differs from that of the reproduction right, is an arduous task. In attempt to work out this puzzling issue, it is necessary to recapitulate some foundational principles underlying the derivative right.

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[412][AG 58].
[413] [AG 58].
[414] [AG 59].

The first of these principles is that, in order for the derivative right to be triggered, the follow-on work must *reuse* the elements that contributed to the primary work's original character. In fact, the derivative right, on a par with the reproduction right, presupposes the taking of what made the source work original in the first place. Otherwise, no infringement could be found. This also means that the derivative right is not activated if unprotected elements, such as ideas, are borrowed[415].

It has been suggested that the reproduction right, if interpreted broadly, might cover many non-literal uses of copyright protected works. Moreover, the CJEU's decision in *Art & Allposters* suggests that, at the EU level, a multiplication of the number of copies is not necessary to trigger the reproduction right.

However, an almost complete overlap between the two rights would neglect the derivative right's own significance and normative basis. The main difference between the two rights under comparison lies in the purpose behind the use of the primary work: while the reproduction right involves situations in which the creative features of the primary work are *appropriated* (by literal and nonliteral copying), the derivative right covers nonliteral uses that are aimed at *transforming* the primary work into the final derivative product. Here lies the main difference between the two rights: appropriation v derivation.

If the act carried out by the secondary user goes beyond mere literal copying, the question should be asked whether he or she has taken the original parts of the primary work in order to adapt and/or transform them or to merely copy them. In deciding whether the derivative right applies, courts should ascertain whether there is a transformative purpose behind the use of the primary work.

Hence, a separate inquiry is whether the secondary production is a "derivative work" for the purposes of copyright law, bearing in mind that, in jurisdictions such as the U.S., an adaptation cannot be infringing and original at the same time. Hence, unless the copyright holder consented to the adaptation of the work, the secondary creation will not be worthy of protection in its own right.

As noted in the next paragraph, the uncertainty surrounding the scope of the derivative might have serious implications in the 3DP environment, where several types of online activities, most notably the creation of user-generated CAD files, may or not be lawful, since they are premised on reuses, remixes and mash-ups of pre-existing works.

[415] The reach of copyright must not go beyond creativity expressed in a work; if the creative features of the primary work are not appropriated into the secondary work, and the distance between the two is appreciable, there is no infringement.

16. Right of Reproduction v Right of Adaptation in Three-Dimensional Printing

In an attempt to apply the considerations made so far to the 3DP context, it must be noted that certain acts, such as uploading[416] and downloading CAD files for protected works, clearly infringe the reproduction right[417]. Likewise, an infringement of the reproduction right occurs if a CAD model is created by copying a copyright protected digital design or physical object, without the copyright owner's permission.

In addition, it is well settled that reproduction extends to changes of dimension, such when a two-dimensional work is transformed into a three-dimensional work, and the other way round. As such, copying includes making a 3D-printed object from a CAD file without any change to the underlying artistic work, if the 3D version is not an unprotected useful article.

Differently, any change, modification or alteration to a digital design or physical object that takes the creative choices embedded in the primary work in order to adapt and/or transform them might well qualify as an act of adaptation.

In particular, courts will consider if, during the process of translating dimensions or mediums, the author made changes that are driven by an artistic impression, rather than by functional or mechanical considerations imposed by the different artistic language[418].

In such a case, the following considerations must be made. First, in the U.S., only if the pre-existing work is used with permission, then the resulting work may qualify as a protectable "derivative" work deserving protection for any non-trivial and original change[419].

Hence, lacking the copyright owner's authorization, the resulting model/3D-printed object will be infringing and not capable of protection in its own right. The same does not hold true in jurisdictions other than the U.S., where an adaptation could qualify as protected work even in the absence of the owner's permission.

In any case, the later work will be infringing upon the owner's exclusive right of adaptation only when enough characteristics of the source work are recognisable and more than a mere act of copying has occurred[420].

It has been suggested that merely scanning an object that is itself protected by copyright – that is making an exact replica or a substantially similar copy of the work – most likely will constitute a mere "reproduction".

[416] Uploading CAD files for protected works infringes the making available right too.

[417] The individual who innocently downloads or uploads a CAD-based model without knowing that such activities are infringing does not escape liability.

[418] Dasari (2013), 297.

[419] Dasari (2013), 295.

[420] Van Eechoud (2014), 148.

As discussed, "copying" in the copyright sense means reproducing the work by any means and in any material form. There is little doubt that reproduction includes the conversion of a work from physical into digital form perceivable into a series of ones and zeros[421]. It must also be noted that, if the scanned object is protected by copyright, not only the first scanned representation, but also any subsequent copy of it most likely will be infringing.

The extent to which modifications to a scan no longer fall within infringing reproductions, but are included within the different exclusive right of adaptation, is not entirely clear. As Bently and Sherman note, there are limits to the concept of reproduction, even if it can be "in any form" [422]. However, this is still a non-harmonized terrain.

Hence, depending on the circumstances, in cases where scanning and subsequent steps involve activities that go beyond literal copying and affect the substance of the work, Article 12 Berne might rather be called upon. The 3D-scanned model, as well as the corresponding 3D-printed output, can be considered as "adaptations" and/or "alterations" of the pre-existing physical object.

Provided that a modicum of creativity required for copyright subsistence is demonstrably present – which stems from creative choices made by the author – then the resulting adaptation can claim the status of work in its own right.

Hence, in order to qualify scanning activities as infringing or not, the question should be answered whether the decisions involved in the various phases of scanning (especially in the post-processing phase) are driven by an artistic vision or by practical and/or technical considerations[423].

In particular, an operator most likely will make creative decisions whenever the scanning activity is not aimed at making a perfect digital replica of the scanned object, but at transforming the CAD model into a different work of authorship. The scanned data that form a CAD model are edited, changed and altered and result in a digital design that no longer faithfully reproduces its physical counterpart.

This is what Weinberg classifies as "expressive scans", to be distinguished from "representational scans"[424]. A "representational scan" is designed to reproduce the object scanned as accurately as possible[425]. An "expressive scan" is a distinguishable variation, material alteration or embellishment of the object reproduced.

[421] Bently; Sherman (2014), 145.
[422] *Id.*
[423] Weinberg (2015), 227.
[424] Weinberg (2017), 219 et ss.
[425] *Id.* at 228.

This issue is of particular importance insofar as scanning and 3DP technologies are often used for the restoration and reconstruction of out-of-copyright works[426]. While public domain works can be freely scanned, usually such digitization process does not give rise to new copyright, especially if it is aimed at making an accurate replica of a pre-existing work[427]

In Weinberg's opinion, avoiding granting copyright protection to representational scans is not only legally sound but also "good public policy", even in cases where the process of digitizing ancient copyright works (such as a famous art-work) involves substantial skill and labour.

In the presence of an "expressive scan", instead, the source work is not faithfully replicated, but adapted and changed significantly. Therefore, that scan is no longer a reference, but a creative work that is justifiably protected by copyright[428].

In the opinion of Ong, there is no sound basis on which re-creative works should be ruled out from copyright just because they are identical, scanned reproductions of antecedent works[429]. He rejects all the arguments that are usually put forward against copyright protection of re-creative works[430], namely: (1) the re-creative authors would monopolize public domain subject matter, thus diminishing the accessibility and availability of works of cultural, social and historical importance; (2) the copyright term would be artificially and unduly extended; (3) in any case, copying is incapable of giving rise to original copyright works.

Ong maintains that "*it is difficult to see why copyright law should only seek to incentivize the creation of works that are materially different from pre-existing works. It could be equally in the public interest for authors to make identical replicas of antecedent works which were, for example, of major cultural significance or extremely inaccessible or both*"[431].

Mendis refers to some judicial decisions providing some helpful guidance to answer the question of what is the copyright position of re-creative works that have been scanned from pre-existing works[432].

Moving forward, the following main issues will also need to be unravelled in the 3DP landscape. It has been suggested that, during the file conversion from a CAD model to a

[426] In fact, it is now possible to scan an ancient work, modify the digital scan by adding the "missing pieces", and then print it. Possibly, a derivative work is thus originated.
[427] On this *see* Margoni (2013), 12.2.1.
[428] Weinberg (2017), 231.
[429] Ong (2010), 175.
[430] I.e. "*works that have been derived from, and which purport to be perfectly accurate copies of, antecedent works that were create at an earlier point in history*".
[431] Ong (2010), 174.
[432] Mendis (2014), 277 referring to *Sawkins v Hyperion Records* [2005] EWCA Civ. 565 and *Eisenman v Qimron* 54(3) PD 817.

printable file or GCODE file, some artistic features just vanishes. Hence, the question should be answered whether format shifting does actually involve a reproduction: is the original work simply recorded in a different medium or form of expression (i.e. from an "artistic" to a "literary" mode of expression), without the underlying intellectual creation being altered?

An issue that might likewise arise is whether or not a three-dimensional article could reproduce a literary work, such as a GCODE. As discussed, in most cases the GCODE does not entail sufficient creative choices to trigger copyright protection as a (literary) work in its own right, since its expression will mainly be dictated by functional considerations.

Nonetheless, in the unlikely event that the GCODE at stake is regarded to be sufficiently original to attract protection, does the act of printing an article from such code amount to infringement[433]?

A question should therefore be answered whether making a 3D object would or not reproduce the literary code embedded in the CAD file.

Case law from different jurisdictions seems to suggest that copyright in a work that consists of instructions on how to make things is not infringed by making the thing[434]. In fact, while it is an infringement of the reproduction right in an artistic two-dimensional work to replicate it in a three-dimensional form, the same does not hold true if the primary work is a literary work.

Thus, if treating CAD-based instructions as a purely literary work, it is not an infringement of copyright to 3D print an item from a CAD file, in the same way as making a cake by following the instructions contained in a recipe does not amount to infringement of the literary copyright in the recipe[435]. The essence of a reproduction is to be a copy of the original work: while making a cake does reproduce the recipe, it does not reproduce anything protectable in the recipe.

Likewise, the article that is produced following the CAD-based instructions would not enable to find and perceive the literary expression of the code.

The outcome would be different if the coded instructions contain a perfectly detailed description of how to manufacture an object that is a protected work of authorship (differently

[433] Laddie J in *Autospin* at [700]; Aplin; Davis (2017), 179 et ss.

[434] In the UK, see *Autospin* quoting *Interlego AG v Tyco Industries Inc* [1998] RPC 343, per Lord Oliver and *Brigit Foley Ltd v Ellott* [1982] RPC 433. The same holds true also in the U.S.

[435] This is so because protection extends only to the expressive elements of the recipe that go beyond mere facts or ideas (i.e. commentary, suggestions, tales that are sufficiently expressive and other elements that go beyond a mere list of facts). Hence, the list of ingredients and the process necessary to prepare a particular dish can be freely "copied" by making the dish, without infringing copyright in the literary expression. *See* also the U.S. decision in *Barbour v Head*, 178 F. Supp. 2d 748, 764 (S.D. Tex. 2002). Dolinsky (2014), note 259; Weinberg (2015), 10-11; Bently; Sherman (2014), 146.

from a cake). As the code would also serve as a medium of fixation of a work, then making the object that is described therein would amount to a reproduction of such work[436]. Accordingly, 3D printing an object from a copyright protected digital design would be an infringement of both the artistic and the literary works embodied in the CAD file.

In an attempt to apply the above made reflections, imagine that a person writes a GCODE directly from scratch, rather than obtaining it through CAM software; then, a third party sends the code to the printer, in order to manufacture the item represented therein, without seeking prior authorization. Such a conduct clearly amounts to an infringement, as sending the code to the printer reproduces the literal expression of the code.

If the person who has access to the code does not send it to the printer, but merely follows the instructions contained therein to produce an unprotected 3D object, making the final product does not amount to infringement of the literary work expressed in the form of computer code.

It is likewise possible that a person makes a 3D-printed artefact (which is *not* a protected work of authorship) that looks visually similar to the object described in the GCODE instructions, without having access to the underlying code. As in the previous example, there is no infringement of the literary work by making the thing, since the expressive elements of the GCODE are not reproduced. Arguably, the 3D-printed item as such would not contain the intellectual creation of the code as a literary work.

A more delicate issue arises when a person reserve-engineers an object produced by means of 3DP in order to obtain the underlying code and then sends such code to the printer. The question should be answered whether sending the code and producing the resultant 3D-printed article constitute infringing “reproductions” of the literary work represented by the GCODE instructions.

The same question with respect to a recipe/cake would be: is reverse engineering a recipe from the finished cake an infringement of the first recipe? The answer would be no, insofar as the cake as such is not a copy of the literary work (i.e. the recipe).

In the opinion of the present writer, the best approach to untangle this conundrum is to affirm that, even when a GCODE is human-authored rather than computer-generated, what should be protected is the intellectual creation embodied therein, i.e. the digital design it represents. If the object that the GCODE enables to print is capable of copyright protection so are the instructions to make it.

[436] *Autospin*, [700].

One should not ask what literary expression in computer code is worthy of protection in its own right; the literary work accurately defines the article's shape. If the 3D-printed object is a copyright protected work, both the GCODE and the digital design are "copies" for copyright purposes. Hence, the act of 3D printing the object falls within the owner's exclusive rights.

If the code is perceived as a purely literary work, rather than as a medium of fixation of a work, infringement of the reproduction right might occur only if the code is copied, rather than if a 3D object is made without reproducing the code.

17. Exhaustion of the Distribution Right

The CJEU's ruling in *Art & Allposters* has clarified that the traditional distinction between the intellectual creation and its material embodiment bears particular significance in determining whether there has been exhaustion of the distribution right.

The rule of exhaustion is tied to the "tangible object" incorporating the intellectual creation. Accordingly, one may argue that the transfer of a CAD file for a copyright protected work requires the owner's consent, since exhaustion relates only to the tangible copy of the work.

The CJEU in *Art & Allposters* has also clarified the scope of the principle of exhaustion in cases where the *corpus mechanicum* has undergone significant transformation. This is an additional reason why the CJEU's ruling may carry significant implications in the 3DP environment.

Imagine the following scenario: a copyright protected work, such as a painting in paper form, is scanned. The scanned image so obtained is applied to a different object, such as a coffee mug, thanks to digital design tools and then sent to a 3D printer.

In such a case, the second user has incorporated the intellectual creation into a different medium of expression. The new "reproduction" (or potentially adaptation) so created would require the copyright owner's consent; the distribution right would be exhausted only upon the first sale of the coffee mug, with the copyright owner's permission.

This is a rather straightforward example, since the original medium (the paper) has not undergone substantial alteration, but is still perfectly intact.

A different scenario, instead, may be that of a work of authorship that is made with a material that, after some time, begins to crumble, disintegrate or fall apart (such as sandstone). The person who purchases such object decides to scan it and then 3D print it with a different (potentially more durable) material. The original 3D version of the work no longer exists, but the following physical manifestation of the work is a new reproduction that requires the copyright owner's authorization to be distributed.

In fact, the new 3D-printed item is not the same object that was marketed with the owner's consent: the original embodiment of the work has been altered substantially, so as to give rise to a new reproduction of the same work.

It is important to remind the reader that the CJEU is *UsedSoft* gave birth to "digital exhaustion" in respect to software. The Court took the view that the authorized download of software, along with the grant of a perpetual licence, amounted to a first "sale", within the meaning of Article 4(2) Software Directive (*lex specialis*), which exhausted the right of distribution of that copy within the Community.

The commercial transaction of distributing online a copy of the computer program, alongside with a user licence agreement for an unlimited period, in return for a payment, formed an indivisible whole: it was the "functional equivalent" of the transfer of ownership of a material copy, such as a Cd-Rom or DVD[437].

Hence, the copyright holder could not prevent any subsequent transfer of the software to a second-hand acquirer, who is a "lawful acquirer" under the Software Directive. The latter is therefore entitled to make a copy of the program that is necessary for use in accordance with its intended purpose (Article 5(1) Software Directive)[438].

In its more recent decision in *Ranks & Vasilevics*[439], the CJEU confirmed the principle of digital exhaustion with respect to software. Besides this confirmation, the Court clarified that exhaustion applies to the original copy of the software, not the back-up copy. Accordingly, when the software has been sold, either in a tangible support or via electronic transmission, the acquirer cannot resell the back-up copy he might have made, but only the original copy.

Moreover, in the aftermath of *UsedSoft*, the German District Court of Biefeld underlined the special nature of the Software Directive, to conclude that the InfoSoc Directive regulates the resale of digital content other than software, such as e-books and audiobooks[440].

Distribution of digital copies of copyright works amounts to the act of "making available to the public" under Article 3 InfoSoc: accordingly, exhaustion does not apply[441].

Even if the principle of exhaustion were applicable to online distribution, the InfoSoc Directive does not contain an exception as the one under Article 5 Software Directive, according to which the "lawful acquirer" (including the secondary purchaser after *UsedSoft*)

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[437] For a comparison with the U.S. legal system *see*: *Vernor v Autodesk, Inc.,* 621 F.3d 1102, 96 U.S.P.Q.2d 1201 (9th Cir. 2010).

[438] Case C-128/11, *Usedsoft GmbH v Oracle International Corp*., 2012 E.C.R. I-0000, [80].

[439] Case C-166/15, *Aleksandrs Ranks e Jurijs Vasiļevičs contro Finanšu un ekonomisko noziegumu izmeklēšanas prokoratūra e Microsoft Corp.*, ECLI: EU:C:2016:762 at [29]-[32].

[440] *See* the decision of the U.S. District Court of New York, *Capitol Records, LLC v ReDigi, Inc.* 934 F.Supp. 2D 640 (S.D.N.Y. 2013), where the court held that the "first sale doctrine" does not apply to digital copies.

[441] *See* Caso; Giovannella (2015).

can reproduce the work for use lacking the copyright holder's authorization. Hence, the transfer of the downloaded file to a secondary purchaser would infringe the owner's exclusive right of reproduction under the InfoSoc Directive.

In January 2014, the CJEU has also addressed the relationship between software and videogames: videogames cannot be considered only as computer programs, as they comprise also "*graphic and sound elements that have a unique creative value*", which can be granted protection under the InfoSoc Directive[442]. Therefore, digital exhaustion does not apply directly to videogames.

The CJEU in *Vereniging Openbare Bibliotheken* (*VOB*)[443]

One of the questions referred to the Court, in essence, was whether the concept of "lending" within the meaning of Directive 2006/115 covers also the lending of digital copies of the book, which may be downloaded from the library's server and are accessible by the user for a limited period of time[444].

The CJEU made clear that the right of rental refers exclusively to copies fixed in a physical medium, and not also digital copies, in light of Art. 7 WIPO Copyright Treaty. However, since the concept of "rental" is defined separately from that of "lending" under Directive 2006/115, the latter concept may well include certain lending carried out digitally[445].

The CJEU, in *VOB*, refrained from giving a clear answer to the question of "digital exhaustion", stating that it was irrelevant to rule on the matter[446]. In fact, the exclusive lending right – as opposed to the distribution right – is not exhausted by any sale or other act of distribution. Likewise, the AG Szpunar, in his opinion in *VOB*, maintained that *Art & Allposters* left the question of digital exhaustion for works other than software unanswered[447].

Interestingly, as in *UsedSoft*, the CJEU's reasoning in *VOB* hinges on the fact that certain e-lending activities are "functionally equivalent" to a traditional loan. It remains to be seen whether, in order to respond to economic, societal and technological progress brought about by 3DP, the transmission of CAD files for products will ever be regarded as the functional equivalent of more traditional commercial transactions.

[442] *Nintendo*, [23].
[443] Case C-174/15 *Vereniging Openbare Bibliotheken v Stichting Leenrecht*, ECLI:EU:C:2016:459, [32].
[444] *Id.*, [27].
[445] *Id.*, [35]-[39].
[446] *Id.*, [59]: "*public lending is different in nature from a sale or any other lawful distribution, since the lending right remains of the prerogatives of the author notwithstanding the sale of the physical medium containing the work*".
[447] *VOB*, [AG 54].

It follows from the above that the applicability of the *UsedSoft* ruling – and, consequently, of the principle of digital exhaustion – to CAD files depends on whether such files qualify *only* as "software" within the meaning of the Software Directive.

As *UsedSoft* is not directly applicable to videogames, in the aftermath of the *Nintendo* decision, most likely it is not applicable to CAD files either, which contain creative elements falling within the InfoSoc Directive on top of a computer code.

Accordingly, making a CAD file available for download does not exhaust the distribution right with respect to the *physical* copy of the product embedded in that file. Even if digital exhaustion were recognised in the EU, the act of 3D printing the item by a secondary purchaser would produce a different copy (i.e. a new "reproduction" following the CJEU's decision in *Allposters*).

18. CAD Files as User-Generated Content

Central to the present analysis is the notion of User-Generated Content (UGC). UGC covers a broad array of different activities and, therefore, cannot be easily defined. By and large, UGC comprises all content generated by individual users for commercial and non-commercial purposes alike, as a part of a collaborative process of creation and communication. This definition seems broad enough to avoid the exclusion of certain practices.

Accordingly, UGC covers: text-based blogs, open source software, films and videos (such as video parodies), music and audio content (such as music remixes), virtual content (such as virtual artefacts and virtual currency that are used in online games), citizen journalism and political or social commentary, wikis, twits, content created on mobile phones or other devices, collages, so on and so forth.

The practice of UGC is flourishing in disparate sectors. It has attracted the attention of most attentive scholarship across a number of different disciplines and is still at the core of the policy debate. It is widely accepted that information and communications technologies (ICTs), alongside with the growth of web 2.0, have enabled the rise and spreading of UGC.

In the sharing economy, users contribute to the creation and dissemination of content at little or no financial cost, share their opinions, experiences or views, and collaborate in various forms. The playground where users operate includes different types of online platforms, namely open source software repositories (such as SourceForge and Github), content sharing sites (such as YouTube, Instagram, FlickR and Pinterest), collaborative online encyclopaedias (Wikipedia), peer-to-peer file sharing platforms (such as Pirate Bay), and virtual opinion sharing platforms (such as TripAdvisor and Yelp).

Typically UGC is not aimed at pursuing financial reward, but it may also cover activities undertaken for commercial purposes. In fact, content created by users may be shared with fellow users or peers and/or with firms, for a fee or not.

As noted by commentators, all instances of the sharing economy (open source, online collaboration, peer-to-peer file sharing and crowdsourcing) have in common the following main characteristic: a new form of consumption of goods and services that primary hinges on *access* to content, rather than *ownership*[448].

The present analysis does not endeavour to give a full picture of such emerging practices. Nonetheless, it must here be acknowledged that the scale of activities where "*the contribution and use of resources are intertwined through peer-to-peer networks*" is growing to a significant extent in the 3DP context[449].

We will probably soon reach the point where not a few committed makers, but millions of enthusiastic users will be active in distributing and sharing their own and third party CAD-based content, in reviewing and rating it, in producing 3D-printed products as well as in simply seeing what other users made[450].

3DP platforms already offer software tools, storage space, browsing functionalities to their users, who can post, share and rate digital design models, for free or in exchange of a fee. Users are allowed to create, modify, upload and download digital design files, the accompanying instructions, the descriptions of the objects embodied in the CAD files, as well as photos that depict the actual printed-out products[451].

Hence, 3DP platforms create the playground where users engage in the creation and dissemination of UGC[452]. The following discussion aims to highlight the copyright implications of UGC.

18.1. The Treatment of UGC Under Copyright Law

As noted in the previous section, UGC is an all-encompassing term that covers a broad array of different practices. It follows that, from a legal standpoint, UGC enjoys an undefined status.

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[448] Bertoni; Montagnani (2017), 397. The most common modes of exchange are renting and lending. Examples include *AirBnb*, *Netflix*, *Spotify*, *Car2go*, and *Uber*, where users can access goods and services for a certain amount of time and often in exchange of a fee. *See* also: Ginsburg (2000).

[449] Hamari; Sjoklint (2016).

[450] Helberger et al. (2009),

[451] He (2017), 241-242.

[452] *Id*.

UGC crosses various areas of law, including copyright law[453]. The tension between UGC and copyright law is not *new* as such; the literature has analysed this issue at length. For this reason, this section does not provide extensive doctrinal analysis, but mostly refers the reader to the general literature addressing the challenges that UGC poses to copyright law.

In his remarkable contribution, Gervais has traced the historical roots of UGC, highlighting the inability of copyright law to deal with the progressive shift from the *private* sphere, which has traditionally collided with the *amateur* sphere, to the *public sphere,* which has always been closely intertwined with the *professional* sphere.

The "empowering" nature of the Internet, along with the "participative" nature of Web 2.0. technologies, have caused this fundamental shift in content creation. Users have gained access to increasingly sophisticated and reliable tools to create, reproduce, distribute, assemble and remix digital content, and to interact with other users[454].

Hence, the ability of individual users to become "content providers", even though they are not professionals, is an exciting feature of Web 2.0[455]. We have observed a significant change in the creation and consumption of content, with users stepping out their private zone in order to actively produce and share content, rather than *passively* consume content by reading, listening and watching it.

While this shift was unpredictable at the time most national copyright acts were enacted, it has certainly challenged fundamental concepts of copyright law, such as the distinction between *private* and *public.*

As Gervais points out, the private, individual user was not the original focus of copyright law. For almost 300 years, copyright has served as a legal tool to govern relationships between professionals, including authors, publishers, and other commercial exploiters of protected content: copyright was "traded by and enforced against professionals"[456].

This last point can be better illustrated by making reference to the "private use" exception, clearly not designed for mass-scale use and reuse of content by individual users. Users were identifiable (i.e. in known quantities), could not produce perfect copies of copyright material on a large scale, only exceptionally engaged in the creation, transformation and dissemination of content, and, therefore, were rarely licensed and/or enforced against by professionals.

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453 Among others: IP law; data protection law; consumer law; audio-visual law; contract law; e-commerce law; and criminal law.

454 Van der Noll et al. (2012), 2.2.2.

455 Gervais (2012), 849.

456 Gervais (2012), 847.

Yet, the exponential growth in the number of individuals *using* and *reusing* content, along with a significant improvement in the quality of UGC, made the difference. For the copyright analysis, one can immediately perceive the potential economic harm to right-holders, and the potential economic interest of the secondary creators, who may be vested with copyright in their UGC.

As noted, UGC content amounts mainly to text, images, videos, sounds, source code, graphic and product designs that, from the copyright viewpoint, can be original and infringing at the same time.

For the sake of clarity, it is necessary to divide UGC in the following three main categories, originally conceived by Gervais: (1) user-authored content; (2) user-copied content; and (3) user-derived content[457].

The first category is not particularly problematic from a copyright perspective. Wherever UGC is created from scratch and is not based upon a pre-existing work, it is clear that such content may be worthy of protection in its own right, as an original and primary contribution. This conclusion is not affected by an accidental inclusion of copyright protected material in the work.

As far as the second category is concerned, "user-copied content" that reproduces (literally or *verbatim*) parts or fragments of a pre-existing work clearly constitutes prime facie infringement, without leaving much room for doctrinal quarrels.

Examples of (infringing) user-copied content are countless. One may think of a copy of a pre-existing digital design or a scan of a copyright protected work uploaded and shared onto an online platform without the copyright holder's consent. Unless a copyright exception or limitation applies, there would be an infringement.

At the EU level, this issue becomes particularly relevant in light of the *Infopaq* decision from the CJEU. In its judgement the CJEU found that an (11 words) extract of informational content, such as a headline or a snippet, is capable of copyright protection in its own right.

Therefore, it is a common belief that the CJEU's reasoning in *Infopaq* suggests that a copyright protected work can be divided in smaller units or parts amounting to autonomous "works". Assuming that each individual unit composing a work is subject to copyright, this means that possible infringement by UGC becomes much easier. In the words of Pila and Torremans, "*the threshold for infringement goes down when the size of the work that can attract copyright goes down*"[458].

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[457] Gervais (2012), 841.

[458] Pila; Torremans (2016), 624.

To the extent that copyright applies to parts of a work as such, permission may be required for including such parts in UGC. The main downside of such an approach is that it loses sight of the work in its entirety, splitting it into a number of distinct layers. The work is no longer regarded as a self-contained and distinct unity with an own original character; rather, it is an entity constructed in layers each deserving protection as an autonomous intellectual creation[459].

Finally, it is worth noticing that the third category of UGC has come under deeper scrutiny in recent years. User-derived content is more problematic from a copyright perspective, since it takes one or more source works, transform it in some respect, and then distribute it online.

This may be the case if an individual adds some decorative elements to a pre-existing CAD model, changes the appearance of the product design or carries out post-processing activities, such as inserting some light and shadow effects (especially for digital design files that are used for 3D rendering). User-derived content is also inclusive of the so-called "mashups", i.e. content that results from the act of recombining and remixing earlier works[460].

In all such instances, determining *a priori* whether the secondary user's contribution is in violation of copyright is far from simple. It goes back to the distinction between infringing and non-infringing adaptations.

Against this backdrop, it is important to highlight that the struggle between UGC and copyright is still on-going. Within the copyright system, UGC raises the following main fundamental (although not *novel*) issues: (1) the classification of UGC as copyright subject matter; (2) the identification of the author(s) and right-holder(s); (3) the identification of potential acts of copyright infringement; (4) the application of statutory E&L to copyright infringement, such as private copying and the exception for parody or quotation; (5) the pros and cons of introducing a general UGC exception.

Persisting legal uncertainties about these essential matters might discourage new forms of collaborative productions and prove a great hindrance to the proper development of UGC in Europe. In the sections below, each of these problematic issues will be briefly touched upon.

18.2. Classification of UGC as the Subject Matter of Copyright

First, it is worth pointing out that UGC poses the question of what content can be protected under copyright law. As mentioned earlier, the vast majority of UGC most likely will fall

[459] *Inter alia*, van Eechoud (2012).
[460] *Id.*

within established categories of copyright works, such as literary works, photographic works, pictorial and graphic works, musical works, sound recordings and audio-visual works.

As far as 3DP is concerned, we have seen that the question of whether CAD files contain copyright subject matter is not entirely clear and is very fact-specific. If the focus rests on the final 3D-printed item that the CAD file could generate, quite rarely it will fall within protectable subject matter (i.e. it is a useful article or of a public domain work). One should also keep in mind that there are special copyright regimes in force for material such as photographs, databases and software.

In their inspiring contribution, Bertoni and Montagnani analyse the case of "foodporn", i.e. the watered-down version of professional food photography[461]. The issue at stake here relates to the lawfulness of uploading photographs of meals on social media sites. Hence, at the core of the inquiry is whether a culinary dish may be regarded as falling within the copyright domain, requiring the chef's permission to be photographed.

Interestingly enough, CAD files may be used to print food, and may be accompanied by a visual image of the culinary dish to be printed. Is it lawful to 3D-print and/or upload onto online platform images of 3D-printed meals without the authorization of the person who invented the culinary "creation"? Can we qualify a culinary dish as a work of applied art for the purposes of copyright law?

Moreover, as discussed above, another pertinent issue that UGC raises is what constitutes an independent "work" or "unit", as opposed to merely part of a larger work. This issue is likewise relevant for the purposes of establishing copyright infringement.

There is little hesitation that, following *Infopaq*, even an isolated sentence, such as a "tweet", can in principle be accorded the work status in Europe. Even so, demonstrating the sufficient degree of independent intellectual effort, through the choice, sequence and combination of words in a very short text can be difficult.

This question may likewise arise in the 3DP context, given that CAD files are composed of various "units", which may or may not be regarded as independent works. Applying the *Infopaq* test to CAD files is not without difficulty. Should we say that elements such as pre-made shapes, measurements or build information are not independent "units" deserving the status of "works", as distinguished from the design drawing in its entirety, the thumbnail image of the object or the verbal description accompanying the CAD file?

[461] Bertoni; Montagnani (2017).

Another issue not strictly related to subject matter eligibility, but rather to the infringement analysis, is that a single unit of a work will only gain "thin" copyright protection, against literary or verbatim copying. This is so because, in most instances, a unit is just the expression of facts or ideas that are not eligible for protection per se but only in the precise way they are expressed.

To conclude, not all UGC in 3DP is a cultural production that can be fitted into the "work" concept. This in large part depends on the legal classification that will be reserved to CAD files and the rationale behind such a decision. Arguably, the preferable solution is to accord protection only to those CAD files from which a copyright protected product can be created.

Moreover, open source CAD files are open-ended creations or continuing "works-in-progress"[462]. Making these works involves multiple creative contributors, who continuously intervene updating, editing and versioning the source material. This, in turn, raises troubling questions about the "work" status of the updates and revisions. The problem is whether each modified version is likely to be considered as a separate work[463].

Hence, it is not obvious to speak about these open-ended Internet-based peer productions in terms of discrete "works of authorship"; we might more accurately describe them as "processes", "information services", "libraries" or "practices"[464].

Therefore, there seems to be an increasing number of large-scale creative collaborations that place strain on the concept of a "stable, finished work"[465]. As detailed in the following paragraph, the ensuing problem is how to ascertain the identity of different authors who contributed to the UGC in question.

18.3. Author(s) of UGC

A key element for a work to warrant copyright is that it should reflect the author's personality. In a series of recent decisions following *Infopaq*, the CJEU has tied the originality criterion to the notion of "personal touch" or "personal imprint" of the author.

Hence, the Court's reasoning seems to imply that, in assessing the work's originality, it is first necessary to identify the author, and then ask whether he or she made personal choices during the creation process. Accordingly, an integral part of the originality test hinges on the identification of the author.

[462] Van Eechoud (2014), 163.
[463] *Id.*
[464] *Id.*, 150.
[465] *Id.*

Ginsburg defines an author as: "*a human creator who, notwithstanding the constraints of her task, succeeds in exercising minimal personal autonomy in her fashioning of the work*"[466]. Hence, in Ginsburg's opinion, copyright derives its authority from human creativity: copyright "*makes sense only if one recognises the centrality of the author"*, rather than the necessity to invest in dissemination of copy-vulnerable productions[467].

As literature points out, it is questionable whether the author's "personal touch" is an appropriate crierion for determining originality of large-scale collaborative works, especially those produced in the digital environment, where it is not possible to attribute the work to one specific person and the bond between the author and the work is thus loose[468].

CAD files often result from the contribution of different users and/or platforms belonging to online creative communities. In such cases, it can be very challenging to ascertain whether the CAD file reflects the personal touch of each contributor.

It might be convenient to verify, first, whether the work was created under the guidance and leadership of one or more authors[469]. Van Gompel considers it safe to assume that whenever one or more "leading" contributor(s) can be identified, the work can be attributed to their subjective choices and said to reflect their personality[470].

However, identifying a guiding and dominant figure (i.e. the principal artist) who has the last word on the finished product – and therefore deserves to be vested with copyright for having left his or her personal imprint on the finished work – may be extremely complicated in 3DP online communities, where a myriad of different co-creators collaborate and share their views. As Van Gompel details: "*such large-scale creative collaborations are not well accommodated in the wording of the 'author's own intellectual creation'-test for copyright*". For these types of works, the additional problem is to determine the "work" or "unit" whose originality is to be established, and whether all subsequent modifications to such work shall be deemed as a series of "derivative works".

Moreover, although each individual contributor may be vested with copyright, this does not automatically imply that he or she will also be entitled to protection in the joint work[471]. A different outcome could be reached depending on the legal rules on co-authorship existent in different jurisdictions.

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[466] Ginsburg (2003), 1092.
[467] Ginsburg (2003), 1068.
[468] Van Gompel (2014), 127.
[469] *Id.*, 131.
[470] *Id.*, 132.
[471] *Id.*, [35].

The essence of joint authorship is “collaboration” between people in the execution of the work. Collaboration suggests a process of cooperation in which each author’s contribution is not distinct or separate from the other[472].

In the UK, for a collaboration to be found there must be a *common design* at the time of its creation, which is more than mere suggestion or criticism and implies shared responsibility regarding the necessary decisions as to the work[473].

Some contributions may be more evidently capable of giving rise to joint authorship than others. For example, the person who draws the CAD-based digital design more likely will be deemed as a joint author, as compared to the person who merely selects the colour combination from a range of pre-determined options. It is also a truism that the person who merely supplies ideas and technical information, rather than original contribution in the copyright sense, will not be deemed a joint author.

In the UK, it seems that “mutual intent” to create a joint work, meaning that the parties have pre-concerted such work, is not a requirement[474]. In theory, a drummer who improvises a piece of music may be a joint author.

Contrariwise, in the U.S. “mutual intent” is a critical factor in establishing joint authorship, which may be proved by giving evidence of, inter alia, the exercise of extensive control and decision-making authority[475].

Finally, the person who simply executes the work, by following others’ instructions, is not an author. The author shall (mentally) conceive the work and supervise its execution. Hence, the 3DP platform’s operator who carries out the client’s order and print the item is not the “author” of the final output: he or she is only an executant of the client’s request, whose activity amounts to mere fixation of the intellectual creation into a tangible medium.

Whether a putative author’s contribution is sufficient to establish joint authorship will always be dependant on the circumstances.

19. Liability of Intermediaries: A Brief Reference to The Proposed Copyright Reform

This work purposively does not deal with liability of online providers for copyright infringement, since this topic is currently under discussion for possible reform at EU level.

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472 Waelde (2016), 90 et ss.

473 Blum; Blair (2017).

474 Aplin; Davis (2017), 142, 3.2.2.3.

475 See *Aalmuhammed v Lee* 202 F.3d 12271229-30 (9th Cir. 2000). The second relevant factor in addition to “mutual intent” is that each joint author must have contributed protectable expression, as distinguished from mere ideas or facts.

The original EU Commission’s proposal for a *Directive on Copyright in the Digital Single Market Strategy* (“draft Copyright Directive”) was aimed, *inter alia*, at tackling the “value gap”, by imposing filtering and monitoring obligations on a certain category of (active) providers that store and provide to the public access to large amounts of copyright protected works, potentially including 3DP intermediaries (Article 13 and Recital 38 of the draft Copyright Directive)[476].

On 12 September 2018, the European Parliament adopted an amended proposal for the Copyright Directive, which has now entered the Trilogue procedure with Council and Commission.

The future of the E-Commerce Directive 2001/31/EC is also uncertain, as some voices have been raised arguing for the necessity to amend the liability exemptions under Articles 12-15 of the Directive[477].

Against this indefinite background, reflections on liability of 3DP platforms with respect to copyright protected works are better off postponed to a later date.

Having made such preliminary observations, the next section elaborates on the more general issue of intermediaries’ role in preventing IP infringement. It then offers a general overview of the different principles governing primary and secondary liability for the infringement of IPRs.

Such general remarks shall form the groundwork for the subsequent inquiry, developed in each chapter of the present thesis, relating to potential acts of indirect infringement by 3DP online platforms.

20. Enforcement Strategies: Direct v Indirect Infringement

It is important to remind the reader that discussions and debates over the need to expand intermediaries’ liability, by holding them accountable for their users’ activity, as well as the option to revise the current “safe harbour” rules within the E-Commerce Directive, have gained particular attention in recent years.

The following discussion endeavours to explain why, when looking at 3DP, particular attention should reside on intermediaries. To this end, it is first important to note that, in order

[476] The present writer has analysed more in depth the present proposal in: Elam (2017), available at: file:///Users/violaelam/Downloads/3111-13552-2-PB.pdf.

[477] On this *see*: EU Parliament, DG Internal Policies (2018), *Liability of Online Service Providers for Copyrighted Content – Regulatory Action Needed?*, IP/A/IMCO/2017-08.

for IPRs to function properly, "*an efficient enforcement system is necessary*"[478]. Unless such a system is in place, in a setting where infringers can free ride without being punished, innovation and investment are stifled[479].

As noted by some commentators, "*it is one thing to provide for exclusive rights, it is yet another thing to make sure that the rights granted are respected and, if they are not, can be enforced against infringers in practice*"[480]. This is "the essence for a well-functioning IP system"[481].

As provided for in the Enforcement Directive 2004/48/EC, which is currently under review, "*the protection of intellectual property is important not only for promoting innovation and creativity, but also for developing employment and improving competitiveness*"[482].

Hence, the Directive requires "effective" enforcement of the substantive law on IPRs as a necessary condition for the success of the internal market (Recital 3). In order to ensure effectiveness, the Directive requires Member States to establish fair, equitable, not unnecessarily complicated or costly, effective, and proportionate measures, procedures and remedies (Article 3).

However, as acknowledged by the CJEU in *Promusicae*[483] and *L'Oreal*[484], the need for effective enforcement of IPRs must be balanced against other rights. Efficiency considerations should not be the only driving factor.

In fact, the protection conferred to IPRs must be balanced against other rights, such as privacy, freedom of expression and freedom to conduct a business. The need for a balancing act between different rights has been further confirmed in *Scarlet v Sabam*[485].

Moreover, it is also a truism that infringement is "part of the game", meaning that, when it occurs in normal business, it is to some extent inevitable[486]. In most cases, the possibility for an infringement to take place is undesirable as the opposite scenario, i.e. "*when the right*

[478] Europe Economics, The Economic Review of Industrial Designs in Europe – Final Report (January 2015) MARKT/2013/064//D2/ST/OP, 7.
[479] *Id.*
[480] Kur; Dreier (2013), 434.
[481] Recital 1 Enforcement Directive.
[482] Note that the Directive was aimed at approximating the enforcement frameworks of different Member States, whilst not seeking full harmonization (Recitals 10-11).
[483] C-275/06 *Promusicae v Telefónica de España SAU* ECLI:EU:C:2008:54.
[484] C-324/09, *L'Oréal SA et al. v eBay International AG et al.* ECLI:EU:C:2011:474.
[485] C-70/10 *Scarlet Extended SA v Société belge des auteurs, compositeurs et éditeurs SCRL (SABAM)* ECLI:EU:C:2011:771.
[486] Kur; Dreier (2013), 434-5.

holder overestimates the scope of his right and files infringement claims which, in the end, are rejected as unfounded"[487].

However, if 3DP were to become a widespread technology for duplicating products, it would most likely raise new enforcement issues. With the decentralized nature of 3D printing technologies, enforcement of IPRs may become a more convoluted issue.

In fact, if infringement occurs on a large scale, it might be extremely difficult to hold individual users accountable. In this respect, it is possible to draw a lesson from the battle conduced against digital piracy in the copyright realm. Enforcing rights against individual users most likely will prove an ineffective, costly and counterproductive enforcement strategy.

It should also be noted that aggressive enforcement against individual users not only could undermine consumers' loyalty to the right owner, but also the public support for IPRs. In fact, a general feeling of mistrust towards the role that IPRs play in our society might be generated. This risk was faced by the music industry, where "*cases of individual enforcement were perceived as the industry targeting certain populations, leading to the public holding negative attitudes towards policy change*"[488].

On the contrary, pursuing secondary infringement actions is usually regarded as a preferable and more efficient enforcement option. This, in turn, requires going back to the fundamental distinction between primary and secondary liability.

In general terms, primary (or direct) liability can be established when a party is directly responsible for the harm caused to the right holder. Hence, as noted by the INTA 3DP Task Force, "*in the context of 3DP such liability typically refers to persons who upload infringing designs to 3D printing design websites for sale, download and print infringing materials from such sites for public use, or print and traffic in infringing goods*"[489].

Secondary (or indirect) liability is an umbrella term that covers different forms of infringement that do not turn on the defendant itself directly infringing, but to third parties inducing, contributing to, or facilitating such direct infringement.

The objective of a rule against indirect liability is to ensure effective protection of IPRs, by making enforcement of such rights easier, as intermediaries become the target of infringement

[487] *Id.*
[488] Europe Economics, Economic Review MARKT/2013/064//D2/ST/OP, 139.
[489] INTA 3D Printing Task Force (2017), 3.

actions. It is usually posited that, in many instances, "*such intermediaries are best placed to bring infringing activities to an end"*[490].

Provisions against indirect infringement are also effective in preventing direct infringement before it can take place. In fact, there is a strict relationship between direct and indirect infringement in the sense that the latter aims at preventing activities that would result in direct infringement[491].

As legal scholarship notes, secondary liability "*enables the right owner to secure, in a single proceeding, relief against a party whose conduct is simultaneously enabling multiple acts of infringement by a number of primary infringers*"[492].

As Leistner observes "*the framework of European Law with regard to indirect liability of infringement is still patchy*"[493]. Hence – the author notes – the question of whether there are common rules on secondary liability for the different kinds of IPRs does not entail a straight answer.

What can be described as a general rule of secondary liability in European Law is the possibility to apply for injunctions against intermediaries that offer their services to primary infringers[494]. However, the conditions and procedures of such injunctions, as well as the existence of alternative remedies, are left to the discretion of EU Member States. This, in turn, means that European law does not address the issue of whether *damages*, on top of injunctive reliefs, can be claimed against *indirect* infringers.

Moreover, the situation at EU level is further aggravated by the intricate relationship between rules on intermediaries' liability contained in the Enforcement and InfoSoc Directives – prescribing injunctions against such intermediaries – and the "safe harbour" exemptions for ISPs, set forth in Articles 12 to 15 E-Commerce Directive.

It has been suggested that the advent of 3DP technologies will further enhance the benefits of pursuing secondary infringement actions. In fact, gains in terms of enforcement efficiency can be appreciated when the number of direct infringers is substantial and their activity is prolonged. In the context of 3DP, remedies against indirect infringement might prevent third parties from distributing CAD files, as well as from offering additional services, such as print-on-demand and delivery services[495].

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[490] *Id.*
[491] Mimler (2013), citing Benkar, note 44.
[492] Dinwoodie (2014).
[493] Leistner (2014).
[494] See Articles 9 and 11 of the Enforcement Directive, Article 8(3) InfoSoc.
[495] Third parties that may be liable for indirect infringement include hosting providers, such as *Thingiverse*, as well as intermediaries that print and ship the objects directly to purchasers, INTA Task Force, 3.

Moreover, a rule on secondary infringement might also serve to shift part of the enforcement costs to intermediaries. This might be the case if intermediaries are requested, by way of a court order, to undertake measures to detect and/or prevent potential infringement of IPRs.
For example, Internet intermediaries have been increasingly involved in assisting right owners in their fight against unauthorised file-sharing of digital music files. In fact, ISPs have often been ordered to implement *ex ante* measures, such as blocking users' access to certain websites[496].
Some online platforms have spontaneously employed, as a part of their business model, filtering measures that are aimed at preventing infringement. This might also be a competitive strategy to win over smaller service providers that cannot afford the implementation of costly technology.
In that regard, another "lesson learned" from the copyright battle is that stakeholders have different views on whether technological measures to prevent illegal up- and downloading should or not be implemented.
Right holders usually emphasize that ISPs "*have the capability to exercise significant control over the traffic generated by their subscribers"*[497]. Hence, in their opinion, it is "*technically possible to identify, detect and block protected works"* illegally shared among users[498].
ISPs do not usually regard technological measures as an effective instrument to address piracy. They usually believe that it is not possible to detect the legal status of a work circulating over the Internet, or, where possible, the cost of implementing technological measures, such as ContentID recognition technologies, is substantial, and, as a result, competition between ISPs is stifled[499].
Arguably, this contention will be exacerbated in the 3DP environment, considering that the possibility to detect potential infringement of IPRs, by ContentID-like technology, is undermined by the uncertainty surrounding the legal status of CAD files.
To conclude, what is the best policy option to provide an effective legal mechanism against piracy is one of the basic dilemma of enforcement policy. Arguably, the phenomenon of digital-design-file-sharing cannot be easily assimilated to P2P copyright cases of the past; at present, the spreading of file-sharing in the 3DP landscape is not significant and does not pose

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496 Nordberg; Schovsbo (2017), 324.
497 EC (2009-2010), Synthesis Report on the Stakeholders' Dialogue on Illegal Up- and Downloading, 3.6., available at http://ec.europa.eu/internal_market/iprenforcement/docs/synthesis_report_2009_2010_en.pdf.
498 *Id.*
499 *Id.*

challenges comparable to those faced by the music industry wen fighting against platforms such as Napster and the Pirate Bay.

As the possibility that 3DP will trigger widespread infringement of all IPRs is still remote, any policy recommendation, including that of targeting providers of 3DP-related services, must be revaluated when the technology is more mature.

21. Exceptions and Limitations in Copyright Law

The following discussion briefly touches upon the exceptions and limitations (E&L) to copyright infringement, provided for by the InfoSoc Directive, which are relevant to 3DP.

It must be noted at the outset that Article 5 InfoSoc mandates only the implementation of the limitation on certain “temporary acts of reproduction” (Article 5(1)), whereas the other limitations to the reproduction right (5(2)) and to the reproduction and the communication to the public rights (Article 5(3)) are not mandatory [500]. Hence, without any claim to completeness, the following E&L may be relevant in the 3DP context.

- Article 5(2)(a): reprographic copying

The respective ambits of the exception for reprographic copying (Article 5(2)(a)) and for private copying (Article 5(2)(b)) overlap to a certain extent. However, while the reprographic exception is applicable to “*reproductions on paper or any similar medium*”, the private copying exception applies to “*reproductions on any medium*”[501].

From the wording of Article 5(2)(a) it seems that the reproduction must take place using a particular *analogue* medium, thus excluding digital copies as CAD files. The meaning of “similar medium”, however, is not further defined: it may include, for example, textiles that are produced by means of 3DP[502].

Moreover, the exception for reprographic copying covers “*photographic technique or some other process having a similar effects*”. This may include 3DP scanners, although in this case it is not clear whether the exception covers the storage of a scanned document in computer memory or whether such storage in electronic form should fall within the context of the private copying exception[503].

[500] Westkamp (2007), 11.
[501] Case C-463/12 *Copydan Bandkopi v Nokia Denmark* EU:C:2015:144 (5 March 2015), 85.
[502] Westkamp (2007), 110.
[503] *Id.*, 314.

Furthermore, unlike private copying, the reprography exception may cover "*reproductions carried out by users other than natural persons, as well as those carried out by natural persons for a use other than a private use or for commercial purposes*"[504].

- Article 5(2)(b): private copying

In essence, by virtue of the private copying exception, a natural person, who reproduces lawfully acquired works for private and non-commercial use, shall not be held liable. Private copying may also involve "format shifting", i.e. a shift from a two-dimensional design to a three-dimensional object and vice versa.
The private copying exception has formed the subject matter of a number of recent decisions from the CJEU. In sum, the following main principles can be extrapolated from the Court's findings.
"*Fair compensation",* within the meaning of Article 5(2)(b) InfoSoc, *"is an autonomous concept of European Union law, which must therefore be interpreted uniformly in all the Member States"*[505]. Fair compensation must be calculated on the basis of the (actual) harm suffered by the author by the exercise of the private copying exception[506]. The person responsible for paying compensation is the final user who makes private copies for personal use (not companies or professionals for business use)[507].
Furthermore, "*given the practical difficulties in identifying users … it is open to the Member States to establish a levy chargeable not to the users concerned",* but to the persons who make available to such users the reproduction equipment, devices and media[508].
In theory, a levy could also apply to 3DP equipment, devices and media, such as 3D printers, 3D scanners and 3DP material[509]. In fact, the simple fact that the 3DP hardware is liable to be used for private copying may justify the application of a levy[510]. It is unnecessary to show that private copies have in fact been made[511].

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504 *Copydan*, [33]-[34].
505 *Padawan*, [37].
506 *Padawan* at [40]-[42]; Case C-572/13 *Hewlett-Packard Belgium SPRL v Reprobel SCRL*, (12 November 2015), [36].
507 *Reprobel*, [40]-[43]
508 *Reprobel*, [70].
509 Note that the CJEU in Joined cases C-457/11 to C-460/11, *VG Wort and Others* (27 June 2013), expressly deals with levies on printers, computers and plotters.
510 *Padawan*, [51]-[54]; *Copydan*, [29].
511 *Copydan*, [24].

The higher or lower capacity of the printer or scanner to reproduce works will then contribute to determine the amount of compensation[512]. In certain circumstances where the prejudice to the copyright holder would be minimal, no fair compensation is due (i.e. *de minimis* harm)[513]. Moreover, the amount of a levy, which is necessarily set as a lump sum, should not be solely based on "*the speed at which (the) device is technically capable of producing copies"*[514].

The CJEU has also clarified that the private copying exception does not apply, if the source from which the reproduction is made is unlawful (i.e. the exception covers only CAD files lawfully downloaded from the copyright owner's website or from licensed sources) [515].

Moreover, even if it is possible to implement TPMs on relevant 3DP devices, in principle this should not affect the requirement to pay fair compensation[516]. Likewise, the fact that the copyright holder has authorised the use of his or her work for private copying purposes has no bearing on whether fair compensation is owed.

Finally, the private copying exception may cover reproductions made by a private individual with the aid of a device that belongs to a third party[517]. In fact, the Directive does not specify the characteristics or specific features of the device to be used, nor does it state who should be the owner of such device[518].

Arguably, the private copying exception is applicable in case a third party intervenes in the act of reproduction – such as when users request a third party to print the item for them – as long as it is the user who "*takes the initiative in respect of the reproduction and defines its object and modalities"*[519]. The fact that the third party asks for remuneration in exchange for the reproduction may not invalidate this conclusion[520].

Similarly, the reproduction that is done with the aid of computer software made available by a provider, such a 3DP platform, is not excluded from eligibility for the private copying exception[521].

- Article 5(2)(c): acts of reproduction made by libraries, educational establishments or museums

[512] *Copydan*, [29].
[513] InfoSoc Directive, Recital 35.
[514] *Reprobel*, [77].
[515] C-435/12 *ACI Adam BV v Stichting de Thuiskopie et al.* ECLI:EU:C:2014:254.
[516] *Copydan.*
[517] *Id.*, [87].
[518] *Id.*, [88].
[519] AG's Opinion in Case C-265/2016 *VCAST Ltd v RTI SpA* EU:C:2017:913 (29 November 2017), [AG25].
[520] *Id*. [AG26]. For different national approaches, see Westkamp (2007), 19. The involvement of third parties is sometimes restricted to non-commercial services, even if copying is done on behalf of a beneficiary.
[521] *See* the AG's Opinion in *VCAST*, note 10.

Amongst the various 3DP-related initiatives undertaken by museums and educational establishments, it should be mentioned the British Museum's project aimed at providing, on the "Sketchfab" online platform, 3D models and printable files that anyone could then print at the museum[522].

- Article 5(3)(a): use for the sole purpose of illustration for teaching or scientific research

3DP is increasingly used in schools, universities, libraries and other educational settings for educational purposes[523]. The areas in which physical prototyping by means of 3DP is used to support education include: science, math, physics, engineering, architecture, medicine, and palaeontology[524].

3DP is also incorporated into existing university courses, either in the lab or in classrooms. 3D models are used to support visual learning. In fact, in many fields, having a 3D-printed artefact, rather than a virtual representation of an object, provide students and teachers with aid. Many libraries also provide the physical space and expertise for experimentation by means of 3DP.

- Article 5(3)(b): use for the benefit of people with a disability

An illustrative example of this exception relates to the digitisation and manufacture of works of art that people who are visually impaired could touch and hold. In particular, the company 3DPhotoWorks developed a technique to convert 2D photographs, paintings and drawings into the corresponding touchable 3D-printed versions[525]. In that way, blind people can experience art by touching it with their fingerprints.

- Article 5(3)(h): use of works, such as works of architecture or sculpture, made to be located permanently in public places

[522] https://3dprint.com/182710/british-museum-3d-printing/.

[523] https://www.researchgate.net/publication/320617391_3D_printing_in_teaching_and_education_A_review_of_where_and_how_it_is_used.

[524] *Id.*

[525] https://www.3dphotoworks.com/

This exception to copyright infringement, commonly referred to as "freedom of panorama" has been implemented in certain EU Member States, such as Germany and the UK, but not in others, such as Italy and France.
This exception allows a person to take pictures or make videos of artworks that are displayed in public spaces, in accordance with certain conditions provided for under national law. The scope of the exception may vary depending on the jurisdiction: it may be limited to personal uses of the work or include commercial uses alike, refer to certain work categories only, and be subject to a restrictive or expansive interpretation of what is a "public space" and what does "permanently located" means.
Without any claim to completeness, it must be noted that the option to harmonize this exception at EU level has been the subject of intense policy debate in recent years. For present purposes, it suffices to note that this exception may potentially cover scanned representations of works of art, which are made available online for 3DP purposes, and the resulting 3D models.

- Article 5(3)(m): use of a drawing or plan of a building for the purposes of reconstructing the building

While the initial construction of a building that is based on a CAD-based drawing or plan requires the copyright owner's consent, the same might not hold true if the drawing or plan is used to reconstruct the building.

Chapter III

The Murky Boundary Between Art and Utility

Introduction

The application of artistic design to objects for practical use is now a key factor for commercial success, especially for mass-produced products. Companies are increasingly seeking to differentiate their products based on aesthetically pleasing designs. This is true also for everyday objects – ranging from smartphones and cutlery to lamps and bicycles – that owe part of their value to a particular shape, colour, or decoration.

Moreover, input from consumers is increasingly taken into account during the creation of products. Supply chains and factories are now designed to satisfy the demand of many individual customers selecting custom-made products[526]. Thus, customization is a new driver of market value.

In this respect 3DP plays a crucial role. Most of the products that are currently being produced by means of 3DP for the consumer market can be categorised as objects of "applied art", i.e. objects of utility that are artistically designed.

In fact, as far as consumer products are concerned, 3DP is primarily being used for manufacturing jewellery, accessories, figurines, toys, lamps, home products (i.e. cups and vases), shoes, and clothes. These items are better suited for customization, have a small printing size and, therefore, a reasonable cost of production.

Some 3DP platforms, such as *Materialise*, offer for sale also larger pieces, such as furniture and lamps, but these are typically far above the average price for that category of product[527]. Consumers' demand for 3D-printed replacement parts is also scarce, at least for now[528].

For present purposes, identifying the legal regimes applicable to applied art becomes of utmost importance. This is so because applied art blends form and utility and, therefore, may be subject to different forms of protection within the realm of IP law.

To this end, this chapter first aims to provide a definition of "applied art", and then sketches out what IPRs could coexist, overlap or even be combined when it comes to aesthetic designs that are fixed or embodied in utilitarian articles.

Thereafter, it touches on the acceptance in the international legal framework of works of applied art and industrial designs. It then focuses on the relationship between copyright and design rights in the *acquis communautaire*.

[526] Reeves; Mendis (2015), 29.
[527] *Id*., 40.
[528] *Id*., 18.

Significantly, the extent to which the post-*Infopaq* case law of the CJEU has harmonized the originality requirement for copyright subsistence in works of applied art is by no means clear. Hence, particular attention will be devoted to the wide implications of the CJEU's decision in *Flos*[529].

Then, the discussion points out the conditions under which, presently, works of applied art may attract copyright protection in different jurisdictions. The jurisdictions chosen for the comparison are: Italy, France, Germany, and the UK.

A comparative approach serves the purpose of showing changes in most recent case law from these jurisdictions, establishing looser, rather than tighter, requirements that applied art shall satisfy to receive protection.

Finally, the question of whether it is advisable, from a policy perspective, to apply the "author's own intellectual creation"-test to works of applied art and industrial design, in the same way as with all other works, is addressed. Arguably, an approach to copyright's originality that centres on the "room for creative choices" may be too mild, as far as applied art is concerned.

To conclude, a comprehensive overview of protection available for works of applied art under U.S. law will be offered, with special emphasis on courts' application of the statutory "separability" requirement.

Thereafter, attention will be given to the viewpoints expressed by various stakeholders, in response to the Sixth Circuit's decision in *Varsity Brands, Inc. v Star Athletica, LLC.*[530]. It appears that companies involved in various aspects of 3DP have been active, arguing for limited copyright in works of applied art, whereas right holders, such as commercial designers, insisted for broader protection of such works.

The final part concentrates on the recent decision from the U.S. Supreme Court in the *Varsity Brands*[531] case and its potential implications in the 3DP landscape.

1. Defining Works of Applied Art

"Applied art" can be best defined as artistic expression applied to objects that perform specific utilitarian functions. As such, it is equally concerned with the design and/or aesthetics of functional objects produced on an industrial scale as well as with unique pieces of art that are intended for practical purpose.

[529] Case C-168/09 *Flos SpA v Semeraro Casa e Famiglia SpA* [2011] ECR I-00181.
[530] 779 F.3d 468 (6th Cir. 2015).
[531] *Star Athletica, L.L.C. v Varsity Brands, Inc.*, 137 S.Ct. 1002 (2017).

A distinction is usually made between "applied art" and "fine art". "Applied art" is taken here to refer to creations that are aimed at attaining both aesthetic and functional purposes. By "fine art", on the other hand, is meant creations that perform no particular function other than pleasing the senses and providing intellectual stimulation, such as drawings, paintings and sculptures.

Works of applied art may include, depending on the jurisdiction: industrial designs, graphic designs, fashion designs, decorative arts, engineering designs, and interior designs[532].

Works of architecture sometimes belong to a separate category (i.e. Germany), but some others are protected as "applied art" (i.e. France). The same holds true for photographs that are often protected as independent works.

Moreover, in certain jurisdictions, works of applied art are encompassed in the broader category of "artistic works" (i.e. Germany). In the UK, Section 4(1)(c) of the Copyright, Designs and Patents Act 1988 ("CDPA") protects "works of artistic craftsmanship" as a subcategory of "artistic works", which encompasses those works of applied art that meet the "artistic quality" and "craftsmanship" requirements.

Because of its dual nature (both artistic and functional) applied art may obtain simultaneous protection under different IPRs.

The different systems of protection applicable to applied art – depending on the nature of the object and on the jurisdiction – may include: copyright; design rights (registered and unregistered); trademarks; patents; utility models; and unfair competition.

The overlap between copyright law and patent law, however, will be rare. Technical and functional features are ruled out from protection under both copyright and design laws, whereas "aesthetic creations" are not regarded as patentable inventions[533].

In this regard it has to be noted that functional or technical features are economically critical, because they are strictly necessary for the product to perform its function or perform it in a certain way[534]. Hence, any prohibition to reproduce such features may considerably hinder competition, if not subject to stringent conditions[535].

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[532] For a comprehensive overview of the protection available for applied art in different jurisdictions see the responses to ALAI questionnaire: "*Applied Arts under IP law: The Uncertain Border between Beauty and Usefulness*", available at http://www.alai2016.org/.

[533] Article 52(2) of the European Patent Convention ("EPC").

[534] WIPO, Standing Committee on the Law of Trademarks, Industrial Designs and Geographical Indications, 9th session, 11-15 November 2002, *Industrial Designs and Their Relation with Works of Applied Arts and Three-Dimensional Marks*, 3.

[535] *Id.*

This principle is reflected in patent law: patents are granted for a relatively short period (20 years) as compared to other forms of IPRs, in return for disclosure of the invention, and provided that the applicant complies with an onerous registration process[536].

On the other hand, aesthetic features are not indispensable for a product to achieve its intended functional purpose. They reflect the subjective taste and preferences of the designer, and can have a strong impact on the commercial viability of the product.

Insofar as aesthetic features do not affect a product's technical performance, they do not pose the same competition challenges as technical/functional features. Hence, protection of the appearance of functional objects may be accorded under both copyright and design right legislation.

This discussion is mainly concerned with copyright protection of works of applied art and industrial designs.

An overview of the extent to which works of applied art may attract protection under other legal titles, such as design law and trademark law, will be given in, respectively, chapter IV and VI.

1.1. Works of Applied Art in the International Legal Framework

The question of whether art, even when applied to useful objects, should be the subject matter of copyright has been a matter of contention since the end of the XIX century.

On the one hand, it was controversial whether works of fine art should be denied copyright protection when applied to utilitarian objects, such as jewellery, ornaments, clothing, and wallpaper.

On the other, there was little consensus on whether objects that were mass-produced for purely utilitarian purposes, but nonetheless had some artistic features, should be entitled to legal recognition as art.

Therefore, two possible sources of applied art could be envisaged – those made by manufacturers and craftsmen and those made by traditional industrial processes – posing the same problem: the applicable legal regime.

The idea of protecting works of "applied art" by copyright was slow to gain acceptance at international level. It was only after the conference to revise the Berne Convention, which was held in Brussels in 1948, that protection of works of applied art became mandatory. Since

[536] The inventions must be new, involve an inventive step, and are susceptible of industrial application, pursuant to Article 52(1) of the EPC.

then, these works were expressly included within the broad list of protected subject matter, set forth in Article 2(1) of the Convention[537].
Moreover, pursuant to Article 2(7) of the Convention, the member countries can choose whether to protect works of applied art, industrial designs and models under copyright law, under *sui generis* design law or under both, as well as to determine "the conditions under which such works, designs and models shall be protected".
Besides, Article 2(7) provides a partial derogation to the principle of national treatment, making it possible for one to claim protection only under design legislation – and not under copyright legislation – in the other member countries, if the works are protected "*in the country of origin solely as designs and models*". Nonetheless, if a receiving state has no *sui generis* legislation on designs, such works "*shall be protected as artistic works*".
The term of copyright protection of works of applied art is fixed by Article 7(4) at a minimum of 25 years from the making of such works. However, the minimum term in question applies only insofar as these works are protected as artistic works (i.e. if they are protected as designs a shorter term of protection is admissible).
To recapitulate, works of applied art are to be protected under Article 2(1) of the Berne Convention, although each country of the Berne Union retains the authority to: 1) define the "applied art" to be protected by domestic copyright law; 2) distinguish between the category of applied art and the subcategory of "designs and models", that may be protected under *sui generis* legislation; 3) fix a shorter term of protection for designs and models as compared to works of applied art[538].
As a consequence, to meet the obligations under the Berne Convention, each member country could choose among different protection regimes for designs of utilitarian objects, namely: 1) a simultaneous and automatic "cumulative protection" between copyright and design rights (i.e. France); 2) "non cumulability" or "separability", that is a rigid separation of protection regimes, whereby copyright law does not extend to industrial designs as such (i.e. U.S.A.); 3) a "partial cumulation" regime, which stands halfway between the other two regimes, and imposes stringent conditions – such as a higher threshold of originality - to protect industrial designs under copyright law (i.e. Italy, Japan, Russia, Switzerland and, until recently, Germany).
The other relevant international treaties that expressly recognize industrial designs and applied art are the Paris Convention for the Protection of Industrial Property 1883 ("Paris

[537] *See* Rickeston; Ginsburg (2006). *See* also Reichman (1983).
[538] *Id.*, Reichman (1983), 1163.

Convention"), and the Agreement on Trade-Related Intellectual Property Rights 1994 (the "TRIPS Agreement").

The Paris Convention, apart from expressly stating that industrial designs shall be protected in all the countries of the Paris Union (Article 5 quinquies), does not provide a definition of "industrial designs", nor does it indicate the means of providing such protection and whether overlapping forms of protection should or not be allowed[539]. Therefore, member countries are free to protect industrial designs as they wish, i.e. by copyright, design or unfair competition law.

The TRIPS Agreement incorporates, in Article 2(1) and 9(1), provisions concerning works of industrial designs and works of applied art already contained in the Paris and Berne Conventions. It also determines the substantive requirements for protection of industrial designs (Article 25), and the scope of protection (Article 26). Moreover, it leaves countries with the option of protecting (at least) textile designs through industrial design law or through copyright law (Article 25(2)).

Review of the most relevant provisions of the Berne Convention, Paris Convention, and TRIPS Agreement shows that a simultaneous overlap between copyright and designs is possible for applied art. However, there is no international standard for determining originality of works of applied art, nor indeed for defining the category of applied art.

The vast majority of countries recognize that, to some extent, the same industrial product or the shape thereof can enjoy cumulative protection under both copyright and design rights[540]. However, inconsistencies in the legislative solutions elaborated in various jurisdictions across the world are glaring.

The following section outlines the way in which the principle of cumulative protection as between copyright and design rights has been formulated in EU design legislation. It then stresses that, at present, there is considerable uncertainty as to whether EU Member States are still free to rely on the principles developed in their own domestic laws for regulating the copyright-design interface.

An aspect worth noting is that the CJEU's case law casts doubt on whether the "author's own intellectual creation" standard of originality shall equally apply to works of applied art and industrial designs.

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[539] Nonetheless, the Paris Convention contains several provisions relating to industrial designs that countries of the Union must observe. *See* Article 4; Article 5B; Article 5D; and Article 11.

[540] *See* AIPPI, Study Committee, Summary Report, Question 231, *The Interplay Between Design and Copyright Protection for Industrial Products*, 2012 AIPPI World Congress, Seoul, available at: http://aippi.org/wp-content/uploads/committees/231/SR231English.pdf.

1.2. Works of Applied Art in the European Legal Framework

The European legal framework in the field of design rights – resulting from the Design Directive 98/71/EC (from now on "DD") and the Design Regulation (EC) No 6/2002 (from now on "DR") – establishes the principle of cumulation, according to which the existence of design protection should not prejudice the protection of works under the law of copyright[541].

However, copyright protection of designs is not harmonized at EU level: pursuant to Article 17 and 96 of, respectively, the Design Directive and the Design Regulation, Member States are free to determine the extent to which, and the condition under which, such protection is conferred, including the level of originality required.

The effect of this is that Member States cannot exclude works of industrial design and applied art from copyright protection (i.e. "non cumulability" or "separability"), but they are still able to choose whether to establish a "perfect cumulation" or "partial cumulation" regime.

Jurisdictions implementing a "partial cumulation" rule have introduced higher thresholds of originality for applied art and industrial designs. For example, in Italy copyright protection is granted to works of industrial designs provided that, in addition to the general requirement of creativity, they also meet the "artistic value" requirement[542]. In the vast majority of cases, cumulation of protection is thus barred.

Presently, it is unclear to what extent EU Member States are free to keep a higher originality standard for copyright subsistence in works of applied art and industrial design.

A possible construction of the CJEU's case law in *Infopaq* and subsequent rulings suggests that the standard of originality (i.e. the "author's own intellectual creation") is now the same for all copyright-protected works, including works of applied art.

In fact, the CJEU in *Painer* proclaimed that nothing in the European legal framework "*supports the view that the extent of copyright protection should depend on possible differences in the degree of creative freedom in the production of various categories of works*"[543].

If one sticks to the principle that all works should be treated equally, then the protection conferred by copyright on works of applied art cannot be lower than that recognised for other works, including works of fine art.

[541] *See* Article 96 of the Design Regulation and Article 17 DD.

[542] Article 2, n. 10, of the Italian Copyright Act, April 22, 1941, n. 633, confers copyright protection to "works of industrial design that possess creative character and artistic value".

[543] Case C-145/10 *Eva-Maria Painer v Standard VerlagsGmbH and Others* [2011] ECR I-12533, [97].

In practice, this would represent a direct challenge to the laws of European jurisdictions, such as Italy, that have long applied a "partial cumulation" rule, requiring a higher level of originality to be present in works of applied art than in other types of work (and thus a narrower scope for the restricted acts of reproduction and distribution).

As noted in the next section, the CJEU's decision in *Flos* has only added to the general confusion.

2. The CJEU's Controversial Decision in *Flos*

Before entering into the details of the CJEU's decision in *Flos*, this discussion will first review the legislative provisions peculiar to Italian law that have caused prolonged controversy.

In Italy, prior to the implementation of the DD, "works of art applied to the industry" could gain copyright protection subject to the principle of separability (i.e."scindibilità"), provided that their artistic value was "*separable from the industrial character of the product they were associated with*"[544], either conceptually or materially – in the sense that it could be conceived, appreciated or reproduced independently of it.

In essence, the principle of separability was aimed at preventing the operation of the broad and long-lasting protection conferred by copyright on objects intended essentially to satisfy practical needs.

To this end, in many occasions Italian courts have found that works of industrial designs incorporated in three-dimensional products (such as the "*chaise longue*" armchair made by Le Corbusier) could not be separated from the product itself, whereas two-dimensional works reproduced on industrial products (for example, textile or paper) could be conceived, appreciated and reproduced independently of the product itself [545].

Therefore, only two-dimensional expressive features applied to industrial products were, in principle, eligible for copyright protection.

With the entry into force, on 19 April 2001, of Legislative Decree No. 95 of 22 February 2001, implementing the DD, the Italian Copyright Act was amended[546]. The "separability"

[544] Italian Supreme Court, decision of 7 December 1994, No. 10514. For a detailed overview, *see* Italy response to ALAI questionnaire (question 1(a)), "*Applied Arts under IP law: The Uncertain Border between Beauty and Usefulness*", available at: http://www.alai2016.org/downloads/. *See* also Marzano (2014).
[545] Italian Supreme Court, decision of 5 July 1990, No. 7077.
[546] The amendment concerned Article 2, No. 4 of the Italian Copyright Act.

requirement was removed and the category of “industrial designs that possess inherent creative character and artistic value” was added to the list of protected subject matter[547].

It should also be mentioned that Legislative Decree No 164/2001 “*introduced, as a transitional provision, a 10-year grace period, starting on 19 April 2001, during which the protection conferred on designs* … (was not) *enforceable as against those persons* (i.e. “reliance parties”) *who engaged before that date in the manufacture, supply or marketing of products based on designs that were in, or had entered into, the public domain*”[548].

The rationale behind such transitional measure was to protect the expectations and investment made by reliance parties that, before the entry into force of this law, had already began to manufacture and market copies of industrial designs, which had never been registered as designs or had already fallen into the public domain.

This provision was replicated in Article 239 of the Italian Code of Industrial Property[549], and then abolished by Decree-Law No. 10 of 15 February 2007, converted into a law by Law No. 46 of 6 April 2009[550]. This last legislative reform rendered “*copyright protection unenforceable, for an indefinite period, in case of products manufactured on the basis of designs that were in the public domain before 19 April 2001*”, and extended this exclusion beyond reliance parties[551].

Therefore, the 10-year transitory regime disappeared and copyright protection for any design already in the public domain before 2001 was suddenly excluded *tout court*.

In 2009, the Court of Milan submitted a reference for a preliminary ruling to the CJEU in the case *Flos SpA v Semeraro Casa e Famiglia SpA*. The CJEU was called upon to decide whether the above mentioned legislative changes - providing, first, for a 10-year moratorium, and second, extending the transitional exclusion for an indefinite time and beyond reliance parties – were permissible under Article 17 DD.

The facts of the case are as follows. In 2006, Flos sued Semeraro before the Court of Milan complaining that the defendant had imported from China the “Fluida” lamp that imitated “*the stylistic and aesthetic features of the “Arco” lamp, an industrial design created by Achille and Pier Castiglioni in which Flos claimed to hold the property rights*”[552].

The Arco lamp consists of a marble base that supports a long curved metal arm finishing with a silver globe shaped lampshade. In the main proceedings, the Court of Milan found that the

[547] Article 2, No. 10 of the Italian Copyright Act.
[548] *See* the CJEU’s decision in *Flos,* [17].
[549] Legislative Decree No. 30 of 10 February 2005.
[550] *Flos,* [19].
[551] *Id.,* [64].
[552] *Id.,* [20].

Arco lamp was copyright eligible under the Italian Copyright Act, as amended by Legislative Decree No. 95/2001, implementing the DD. On the contrary, the same lamp would not have been protected under the separability rule.

After these proceedings were commenced, Decree Law No. 10 of 15 February 2007 entered into force, amending Article 239 of the Italian Intellectual Property Code.

As the 1962 Arco lamp entered the public domain before 19 April 2001, the post-2001 copyright could not be enforced against Semeraro.

In those circumstances, the Court of Milan referred three questions to the CJUE as to whether the moratorium in the protection of works of industrial designs introduced under Italian law was compatible with cumulation of protection under Article 17 DD.

The Court had first to consider the case of designs that have never been registered. In a passage that has attracted severe criticism, the Court held that "*Article 17 of the Design Directive provides that only a design protected by a design right registered in or in respect of a Member State in accordance with that directive may be eligible, by virtue of the directive, for protection under the law of copyright of that State"*[553].

Accordingly, Article 17 DD concerns only registered designs, whereas unregistered designs fall out of its scope.

The Court did not, however, exclude that *"copyright protection for works which may be unregistered designs could arise under other directives concerning copyright, in particular Directive 2001/29, if the conditions for that directive's application are met, a matter which falls to be determined by national court*"[554].

As far as registered designs are concerned, the Court took the view that the second paragraph of Article 17, allowing Member States to determine "the extent" to which copyright protection is conferred on a registered design, should not be interpreted as meaning that Member States "*have a choice as to whether or not to confer such protection"* (i.e. to decide on the "existence" of such protection) nor as to the term thereof[555].

The intention of the EU legislature was to grant protection under copyright law, for the full term, to all registered designs meeting the requirements for protection in a given Member State, regardless of whether they have already entered the public domain.

[553] *Id.,* [32].
[554] *Id.*, [34].
[555] *Id.*, [36].

The term of copyright protection (the author's life plus 70 years *p.m.a.*) has already been harmonized in the EU by the Term Directive 93/98[556], which does not distinguish works of applied art from other copyright-protected works.

The Court went on to consider that, in principle, certain transitional measures could be justified in order to protect acquired rights and legitimate expectations of third parties, which are fundamental principles of EU law[557].

However, the Court clearly stated that "*national legislation of a Member State which, either for a substantial period of 10-year or completely"*, excludes designs from copyright protection is not compatible with Article 17 DD[558].

A period of 10 years is too long "*to safeguard the economic interests of third parties"*, whereas making copyright protection unenforceable for an indefinite time, and without limiting the reliance parties, negates the principle of cumulation of protection set forth in Article 17[559].

The CJEU's ruling in *Flos* entails a high degree of uncertainty. A plausible interpretation of paragraph 34 of the *Flos* ruling is that a regime of "perfect cumulation" has become mandatory, within the EU, for works that are *unregistered* designs only.

Insofar as such works find protection under the *InfoSoc* Directive, they shall meet the now fully harmonized "author's own intellectual creation" standard. Accordingly, Member States cannot maintain in their own jurisdictions a higher originality threshold for copyright in unregistered designs.

By the same token, the CJEU in *Flos* appears to submit that, in accordance with the second paragraph of Article 17 DD, Member States are still free to determine the required level of originality for the operation of copyright in works that are (national or Community) *registered* designs.

This interpretation of *Flos* is troublesome, since it would introduce a two-tier regime for copyright in works of industrial designs in those Member States that have not implemented a "perfect cumulation" regime.

Taking as an example Italy, an industrial design that has not been registered as a design would enjoy copyright protection up until the date of its registration, provided that it is the author's own intellectual creation. Thereafter, the originality threshold would suddenly become much

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556 Directive 2006/116/EC of 12 December 2006 on the term of protection of copyright and certain related rights.
557 *Flos*, [50].
558 *Id.*, [65].
559 *Id.*, [63]-[64].

higher, demanding an "inherent artistic value" of the registered design. This, in turn, may disincentive registration of designs.

The other plausible construction of the *Flos* decision is that the CJEU intended to mandate a "perfect cumulation" regime for both registered and unregistered designs. Hence, this ruling would testify to a marked change in attitude towards the French "unity of art" approach.

Accordingly, the net effect of the CJEU's decisions in *Infopaq* and *Flos* is that all works of industrial design must be protected by copyright, for the full term, provided that they meet the EU originality standard.

This also seems to be the view of Advocate General Jääskinen in *Donner*[560]. As a result, national legislation would need to be amended where it subjects copyright protection of designs to certain conditions, such as a higher originality standard[561].

Interestingly, the Portuguese Supreme Court has recently referred two questions to the CJEU asking, in essence, if the uniform originality standard that has been established after *Infopaq* covers works of applied art and industrial designs or whether Member States retain their freedom to establish their own, potentially higher, originality threshold for this specific work category, in line with the DD[562].

Clearly, an approach that precludes the possibility for Member States to impose conditions on acquisition, minimizes the significance of Article 17(2) DD. Bently considers that this last provision, which explicitly reserves to Member States control over the conditions for granting and extent of protection afforded to designs by copyright, would be virtually deleted[563].

Moreover, Margoni highlights that it is unclear whether the CJEU in *Flos* intended to extend the "harmonizing effects" of the originality standard also to Unregistered Community Designs (i.e. based on the Community Design Regulation), because the Court referred to the DD only[564].

An interpretation of *Flos* that excludes from its scope of application "Community Unregistered Designs" is also worrisome. It would establish different originality thresholds for similar legal categories, i.e. "national unregistered designs" (that exist only in the UK) and "Unregistered Community Designs".

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[560] Opinion of Advocate General Jääskinen, delivered on 29 March 2012, in Case C-5/11 *Criminal proceedings against Titus Alexander Jochen Donner* [2012] EU:C:2012:195, [27]-[32].

[561] This seems to be supported by the Opinion of the Advocate-General Bot, delivered on 24 June 2010, in *Flos,* [50].

[562] *See* the request for a preliminary ruling from the Supremo Tribunal de Justiça (Portugal) lodged on 6 December 2017, in Case C-683/17 *Cofemel – Sociedade de Vestuário SA v G-Star Raw CV*. *See* also Rendas (2018), 440.

[563] Bently (2012), 654. The author points out that also Article 9 of the *InfoSoc* Directive would be misapplied.

[564] Margoni (2016), 20.

The other extremely controversial finding in *Flos* is that, although Member States retain the authority to determine the "extent" of copyright protection to be conferred on designs (Article 17(2) DD), they cannot limit the term of such protection, which has been harmonized by the Term Directive.

As suggested in scholarly works, the Term Directive applies to "literary and artistic works within the meaning of Article 2 of the Berne Convention"[565]. The latter provision permits member countries to limit the term of protection for works of applied art to 25 years.

Hence, one can infer that the CJEU's misread the scope of the Term Directive, preventing EU Member States from availing themselves of the Berne flexibility[566].

2.1. The Impact of *Flos* and Post-*Infopaq* Case Law in Different Jurisdictions

2.1.1. Italy

In different occasions, Italian courts have been called upon to resolve the ambiguity that arises out of paragraphs from 32 to 34 of the CJEU's decision in *Flos*.

Following the CJEU's preliminary ruling, the Court of Milan, in *Flos v Semeraro,* found that the claimant had provided sufficient evidence of the artistic value inherent in the *Arco* lamp, which, therefore, was eligible for copyright protection under Italian law.

The defendant's claim in the case at hand was that paragraph 32 of the *Flos* judgement should be interpreted as meaning that only works that are registered designs are eligible for protection under the law of copyright, whereas works that are unregistered designs are not.

The Italian court rejected this argument, taking the view that copyright protection for works of industrial design shall not be subject to any formality (i.e. registration), pursuant to Article 5(2) of the Berne Convention.

This principle finds its recognition in Article 6 of the Italian Copyright Act, which clarifies that copyright protection is acquired on the creation of a work, once the intellectual effort is externalized in a perceptible form[567].

The Court of Milan followed a similar line of reasoning in its more recent decision in *Cassina Spa v High Tech Srl* [568], stating that the preliminary ruling of the CJEU could not address aspects not regulated by Article 17 DD, such as the conditions upon which conferring copyright protection to unregistered designs.

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[565] *See* Article 1 of the Term Directive. For a detailed analysis of whether the Term Directive was intended to apply to applied art see Bently (2012), 662.

[566] Cook (2013), 85.

[567] See also Court of Milan, decision of 13 September 2012, No. 9917, *Vitra Patente AG* v *High Tech srl,* R.G. 1983/2007.

[568] Decision of 17 February 2014, No. 2311, R.G. 37937/2011.

The Court further noted that the CJEU's intent was not to dismiss such protection *tout court*. This is corroborated by paragraph 34 of *Flos*, clearly pointing out that, in principle, copyright protection might be available under the *InfoSoc* Directive for works that are unregistered designs.

Hence, the Italian court concluded that the unregistered design item (*Le Corbusier* furniture) produced by the claimant was eligible for copyright protection under Italian law, since it had "inherent creative and artistic value"[569].

Arguably, by applying the traditional "artistic value" test, the Court of Milan does not seem to share the allegation that the CJEU's decision in *Flos* had the effect of harmonizing the originality requirement for works of industrial designs.

As observed earlier, a possible consequence of *Flos* is that Italy must now protect all works of industrial design and applied art, upon the sole condition that they are "the author's own intellectual creation". It should, however, be noted that Italy has retained the "artistic value" requirement in the Italian Copyright Act.

Moreover, recent case law suggests that Italian judges remain wedded to such a statutory requirement, and do not examine whether the industrial design under consideration is the author's own intellectual creation.

It remains to be seen whether the Italian "raised bar"-approach, seeking to keep industrial designs out of copyright, will or will not be abandoned in the near future.

Obviously this matter must be addressed by the legislature within limited margins of discretion.

2.1.2. The United Kingdom

Despite fierce academic and judicial criticism[570], in 2013 the UK Government passed legislation to repeal Section 52 CDPA[571].

This last provision served to curtail the term of copyright protection – for works of art that have been made by an industrial process[572] – to 25 years from the end of the year in which they were first marketed, being the same duration as for registered designs.

[569] In a more recent decision of 22 January 2018, No. 2402, the Italian Court of Cassation confirmed that a work of industrial design is protectable under copyright law regardless of whether it is a registered or unregistered design. The Court has also made clear that the fact that an industrial design is produced on a mass scale does not as such rule out the artistic value requirement.

[570] *See* Kitchin LJ; Floyd J; Arnold J; HHJ Birss QC (2012).

[571] Section 74 of the Enterprise and Regulatory Reform Act 2013.

[572] An article is regarded as "made by an industrial process" where more than fifty copies have been made.

Hence, the effect of removing Section 52 CDPA is that the full term of copyright (70 years *p.m.a.*) is now granted to artistic works that are applied industrially. This legislative change was triggered by the CJEU's decision in *Flos*, proclaiming that works of applied art fall within the scope of the Term Directive.

On 28 July 2016, Section 52 CDPA was repealed, subject to a transitional period that ended on 28 January 2017. The effect of this is that, from this last date on, third parties cannot deal with replicas or unauthorized copies made in accordance with Section 52 CDPA. Unless an exception to copyright applies, the work must either be sold or destroyed or authorised by the rightholder[573].

As noted below in more detail, the Section 51 defence and the categorization scheme, according to which works of applied art could only receive protection if they fall under the category of "artistic works"[574], have been retained in the CDPA, notwithstanding the *Flos* decision.

Likewise, Section 4(1)(c) CDPA, providing protection for "works of artistic craftsmanship" has not been replaced. Therefore, applied art falling under this category of works (i.e. creations such as "jewellery, tiles, pots, stained-glass windows, wrought-iron gates, hand-knitted jumpers, and crocheted doilies"[575]) still needs to meet the highly demanding "artistic quality" requirement to attract copyright[576].

2.1.3. The Netherlands

The Dutch Supreme Court delivered judgements in three cases concerning unauthorized replicas of the "*Tripp Trapp*" children's chair designed by the Norwegian designer Opsvik for *Stokke AS*[577].

The Court referred to the CJEU's ruling in *Infopaq* to conclude that copyright may only attach to subject-matter that is original, being the "author's own intellectual creation".

It also observed that the criteria for copyright protection have been harmonized at EU level also with respect to works of applied art: such works should not be treated differently under

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[573] Guidance can be found in UK IPO, *Repeal of Section 52 of the Copyright, Designs and Patents Act 1988, Guidance for Affected Individuals, Organisations and Businesses*, revised March 2017, available at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/585718/160408_guidance_s52_final_web_accessible.pdf.

[574] UK CDPA, Section 4(1).

[575] Bently; Sherman (2009), 77.

[576] "Artistic quality" means an "element of real artistic or aesthetic quality". *See Cuisenaire v Reed* [1963] VR 710, 730.

[577] *Stokke v H3 Products* (2013) ECLI: NL:HR:2013:BY1529, HR 22.02.2013, RvdW 2013, 331; *Stokke v Fikszo* (2013) ECLI:NL:HR:2013:BY1532, HR 12.04.2013, RvdW 2013, 589; *Hauck v Stokke* (2013) ECLI:NL:HR:2013:BY1533, HR 12.04.2013, RvdW 2013, 590.

European law. Therefore, this category of works should likewise meet the EU originality standard to benefit from protection.

Interestingly, the Dutch Supreme Court further ruled that the combination of the various technical elements constituting the *Tripp Trapp* chair was sufficiently original, albeit these elements were by themselves unprotected.

The Court clarified that originality must be appreciated globally on the basis of the overall impression of the work and not by an examination of each component of the work. Hence, it was such assembly of elements that constituted the author's own intellectual creation, even if the elements, considered in isolation, belonged to the public domain.

To address this last issue - i.e. whether the combination of the technical elements of the *Tripp Trapp* chair was itself sufficiently original – the Dutch Supreme Court examined if the designer had sufficient "space for creative freedom" (i.e. whether alternatives were available for achieving the same technical solution), rather than looking at whether the space available for creative choices resulted in a sufficient amount of "creative expression" to warrant copyright.

Hence, the Court conflated the "space available for creative expression" with the "creative expression" itself. Arguably, the primary focus should rest on whether the whole "creative process", even if informed by external constraints and dictated by functional considerations, did not restrain the author's capacity to exert creative autonomy, but resulted in a sufficiently original "expressive form".

As noted below, French courts tend to adopt a similar approach to that followed by the Dutch Supreme Court, when determining the originality of fashion designs[578]. Accordingly, the appreciation of the work must be made globally. It does not matter if the design is composed of unprotected or commonplace elements, insofar as the combination of such elements is itself original.

Hence, the arrangement or combination of individual design components is sufficiently original if, despite the functional or technical constraints of the work, the author has been left with some room for creative and aesthetic choices.

If the range of alternative options was sufficiently broad, courts tend to declare that the work is original by default.

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[578] See, *inter alia*, Paris CA, decision of 6 November 2013, No. 12/12518; Paris CA, decision of 8 February 2012, No. 11/02407. Note that the same approach is usually followed by U.S. courts with respect to architectural works.

3. National Approaches Towards Copyright Protection of Works of Applied Art

In this section an overview of the conditions upon which works of applied art and industrial designs receive copyright protection in different jurisdictions is offered.

The term "applied art" appears only in some national laws[579], albeit without being defined. Hence, the importance of taking into account national case law and scholarly contributions to decipher its meaning.

3.1. "Partial Cumulation" Regime in Italy

As mentioned above, for a work of industrial design to enjoy copyright protection in Italy it should meet the "creative character and artistic value" requirement, set out in Article 2(10) of the Italian Copyright Act.

Whereas all intellectual creations shall meet the creative character requirement to be susceptible to copyright protection under Italian law[580], works of industrial designs shall also have an "inherent artistic value".

In the vast majority of cases such a stringent threshold is not met. This is considered to be in line with the legislative intent to confine copyright protection to "high-level" or "top-tier" industrial designs.

A higher threshold of copyright protection for works of industrial designs, on the one hand, limits the anticompetitive consequences ensuing from an expansion of the universe of protectable designs[581]. On the other, it does not render the protection conferred by design rights meaningless and devoid of any practical application[582].

Therefore, the "artistic value" requirement is relied on to channel most industrial designs away from copyright law, since they should belong in the realm of design law or fall in the public domain. However, how to determine which top-tier and high-level designs should, as a practical matter, be eligible for copyright protection has been the subject of much debate.

As noted in the next section, it is still under discussion if copyright protection should be limited to those high-level designs that pass the so-called "museum test" – i.e. designs that, being exposed in museums or art exhibitions, are likely to represent a reference point in the

[579] Among others: France, Germany, Greece, Denmark and USA.

[580] *I.e.* a work has "creative character" if it is bears the personal imprint of the author.

[581] Copyright's broad scope, long term, and freedom from formalities makes it unsuitable for protecting the interests typically involved in the field of industrial designs. Allowing copyright protection for a wide range of industrial designs would stifle innovation, competition and progress.

[582] Copyright protection might be privileged, since it is acquired upon the work's creation, without the need to comply with formalities.

cultural landscape – or should also be granted to top-tier designs that, however, do not significantly stand out from average industrial designs and are not capable of making history.

3.1.1. The "Artistic Value" Requirement

As noted in a recent decision from the Italian Supreme Court, an exhaustive and all-encompassing definition of "artistic value", which aspires to embrace this concept in all its facets, is lacking at national and European level[583].

In the absence of such a definition, a number of objective criteria have been established – through the gradual development of Italian case law – to appraise the inherent "artistic value" of a design.

Criteria of an objective character are considered to be easier for courts to apply, more trustworthy and predictable than subjective criteria. Hence, typically, Italian courts do not delve into considerations of the work's aesthetic merit[584] or the author's artistic intent, but consider the following three main factors[585].

The first factor is the recognition and appreciation of the design in the relevant cultural and institutional circles (i.e. art critics, museums and other cultural institutions)[586]. For this purpose, the claimant should introduce evidence that the design has been: exposed in art exhibitions; included in permanent art collections, either in museums or in other cultural institutions; recognized as a work of art, belonging to a specific art movement, by art critics; quoted in encyclopaedic editions or reviews of experts in the relevant filed; published in dedicated journals; granted awards[587].

The mere fact that a work has been exposed in a trade fair might not be sufficient to show its artistic value[588].

The second factor is "*the placement of the design in the art market*, as well as the particularly "*high valuation gained by the design in a purely commercial market*"[589]. Such criterion serves

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[583] Italian Supreme Court, decision of 13 November 2015, No. 23292, *Metalco Spa v City Design Srl.*

[584] Nonetheless, *see* the Court of Venice's decision of 4 February 2004, in *AIDA* 2005, n. 1032, [491], stating that the artistic value requirement should be intended as meaning a "*higher aesthetic value of the design*", which is capable of "*provoking aesthetic feelings*". *See* also the Court of Florence, decision of 6 August 2003, in AIDA, 2004, n. 987, [771]-[772]. Such a subjective approach towards "artistic value" has attracted severe criticism. See Spada; Auteri; Ghidini (2002), 267.

[585] The Italian Supreme Court in *Metalco* listed the three main factors that courts use is assessing the "artistic value" of a design. These factors appear to have major relevance also in earlier case law.

[586] On this *see* Bellia (2016).

[587] *See* also Court of Milan in *Cassina Spa v High Tech Srl*, decision of 17 February 2014, No. 2311, R.G. 37937/2011.

[588] Given the commercial nature of a trade fair. *See Metalco*.

[589] See *Metalco. See* also Bellia (2016).

to show that “artistic value” entails a different and added value to the product as compared to its functionality[590].

The third factor is the “*creation of the design by a famous artist*”[591]. This criterion, however, is not *per se* determinative; it is well possible that a well-known artist does not create a work of artistic value, as well as, on the contrary, that an unknown artist creates a work showing the requisite “artistic value”[592].

The three factors listed above suffer from obvious shortcomings.

In the first place, the first factor (“recognition by the artworld”) may prove inadequate when it comes to “young” designs that have just been made available to the public.

Most works of industrial design are not exposed in art exhibitions, included in art collections, or granted awards immediately after their disclosure. Time is needed for such works to gain due recognition and appreciation by the cultural and institutional circles. This, in turn, may lead to a denial of copyright protection at the time the work is created, contrary to Article 6 of the Italian Copyright Act.

Second, the parameters within which art communities perceive a work as “art” may change over time. Therefore, in the end, the eligibility for copyright protection perceived through the lens of the artworld teems with extensive uncertainties.

Hence, a test that imposes the recognition of a design by the cultural sector as a strictly “necessary” precondition for copyright protection has one main weakness: by requiring evidence of exposure in art exhibitions, museums, and other cultural institutions or publication in non-commercial dedicated journals[593], it disqualifies cutting-edge, high-level “young” designs that, albeit having an inherent artistic value, have not been recognised as “art works” yet.

By contrast, copyright protection is limited to industrial designs that meet the “museum test”, i.e. “historic” designs that significantly stand out from other top-tier designs and are recognised as such by the artworld[594].

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[590] Bellia (2016).
[591] *Id.*
[592] *Id.*
[593] *Id.*
[594] Works of industrial designs that are copyright protected in Italy, because they have gained recognition from the cultural circles, include, *inter alia*: the “Panton chair” designed by Verner Panton (Court of Milan, decision of 28 Novemebr 2006, in Giur. Ann. Dir. Ind., 2007, 530); the “Arco lamp” designed by Pierre and Achille Castiglioni (Court of Milan, decision of 29 December 2006, Giur. Ann. Dir. Ind., 2007, 587); the bed “Nathalie” designed by Vico Magistretti (Court of Milan, decision of 5 June 2012, upheld by Court of Milan, decision of 24 July, 2012, Riv. Dir. Ind, 2012, II, 418).

In a similar vein, the second factor of the test (i.e. the market valuation of the design) is not satisfactory as it produces a shift in focus from the "work" itself to the commercial strategies pursued by the designer to gain success in the marketplace.

Likewise, legal recognition as art should not depend on how much consumers pay to purchase the work.

The Italian Supreme Court in *Metalco* acknowledged the crucial role that "time" plays in determining the artistic value of a design. For this reason, the Court accommodated the concern that none of the three factors mentioned above should be regarded as a strictly "necessary" or "absolute" criterion; other (objective) factors might need to be taken into account to appreciate, on a case-by-case basis, a design's artistic value[595].

It should, however, be noted that it is by no means easy for lower courts to envision additional, objective and verifiable criteria.

As a consequence, judges may be tempted to express subjective evaluative judgements about the "artistic value" of industrial designs, relying on their artistic taste, rather than on supposedly objective rules and principles. This would result in arbitrary, inconsistent and unpredictable decisions.

Therefore, on the one hand, a more particularized and less rigid assessment of the "artistic value" requirement favours the grant of copyright protection to industrial designs, at least in those cases where recognition by the artworld and commercial success are still to come.

A looser approach towards "artistic value" would also be consistent with the current trend followed by German case law that has lowered the threshold of copyright protection for works of applied art, although requiring a level of creativity that justifies it to speak of "artistic" creation.

On the other hand, leaving room for the lower courts to ground their decisions on additional, indeterminate factors, might invite courts to make a subjective appraisal of artistic worth, beyond their legal expertise[596].

3.1.2. Artistic Value of 3D-Printed Fashion Designs

A brief overview of recent occurrences in the realm of the 3DP fashion industry endeavours to show that making copyright protection of industrial designs dependent on criteria taken

[595] The Italian Supreme Court expressly stated that the second and third requirements are not strictly "necessary". However, it implicitly recognized that not even the first – and most relevant – factor is categorically necessary. On this *see* Bellia (2016), 878.

[596] Expert evidence may assist judges in making an *ex ante* assessment of the design's "artistic value", whenever external recognition has still to come, keeping in mind, however, that experts often tend to disagree. *See* the Italian Supreme Court's decision of 29 October 2015, No. 22118.

from customs and practices that are not homogenous, and due to change over time, could give rise to controversial outcomes.

In the year 2013 a collection of 3D-printed lingerie was revealed at the Victoria's Secret fashion show. The same year, Iris Van Herpen unveiled her 3D-printed articles of clothing at the Paris Fashion Week. In Italy the mere display of fashion designs at a commercial fashion show would not be a sufficient condition to establish their eligibility for copyright protection.

In 2014, *Nervous System* created a 4D printed dress[597], called "Kinematics", which was then purchased by the Museum of Modern Art in New York, as a part of its permanent collection. This fashion design most likely would enjoy copyright protection in Italy, insofar as it meets the "museum test".

The Museum of Fine Arts in Boston commissioned *Nervous System* to design and 4D print another dress, which was then displayed as a part of the "#techstyle" exhibition[598]. The fact that a fashion design has simply been displayed in a temporary exhibition may not lead to a finding that it has an inherent "artistic value" under Italian law.

In 2016, the Metropolitan Museum of Art in New York, hosted an exhibition called "*manus x machina: fashion in an age of technology*", where a series of 3DP workshops were presented, and visitors "*could witness the creation of 3D printed garments during the course of the exhibition*"[599].

It is questionable whether a design created by means of 3DP during the course of an exhibition would enjoy copyright protection in Italy.

3.2. Germany: the *Birthday Train* Decision

Another country that for many years has followed a "partial cumulation" approach is Germany.

Up until 2013, German case law imposed a higher level of originality for applied art as compared to fine art[600]. According to the "Stufentheorie" doctrine ("doctrine of levels"), the originality standard was divided into three degrees, applicable to different types of works.

The first level of originality – applicable to works of fine art only – has always been very low. Under the so-called "Kleine Münze" (literally "small coins") theory, works of minimal creativity – such as plain drawings – could be deemed protectable as personal intellectual

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[597] 4D printing is an emergent technique that involves printing three-dimensional objects that automatically change shape once removed from the printer. *See* Griffiths (2013).

[598] *See* http://www.mfa.org/exhibitions/techstyle.

[599] *See* http://www.metmuseum.org/press/news/2015/ci-spring-2016-exhibition.

[600] *See* the Federal Court of Justice's decision of 22 June 1995, Case No. I ZR 119/93, 38 IIC 140 (1997) *Silberdistel* (silver thistle).

creations under German copyright law. On the contrary, for works of applied art to be original, they had to "substantially" exceed the average level of designer skills.

The key factor that enabled distinguishing between works of "purpose free" or fine art and works of "applied art" was the intended use of the design. Accordingly, German courts have traditionally classified as "applied art" those objects of utility that serve an intended functional purpose, but are designed in an artistic way (i.e. fashion designs, pieces of furniture, ornaments, and other objects of daily use)[601].

On the contrary, artistic works that do not serve a specific function other than providing aesthetic stimulation belong to the category of fine art (i.e. paintings, drawings, sculptures, and graphic works).

The rationale behind a more stringent originality test for works of applied art is explained in the *Silberdistel* decision of the German Federal Court of Justice, (Bundesgerichtshof, from now on "BGH").

Before the 2004 reform of the German Design Act, the protection conferred on designs by design law was substantially identical in nature to that available under copyright law. Thus, in order to avoid a complete overlap of protection, German case law established a hierarchical order between these two IPRs.

Insofar as a design already had to be original and stand out from unprotected average designs to be susceptible to design protection, a even more stringent level of individual creativity was required for gaining protection under copyright law, i.e. the "artistic creation" must "*clearly surpass works of average design*"[602].

In fact, to the extent that works of applied art were already sufficiently protected under design law, additional protection under the law of copyright was justifiable only if the level of originality exceeded that required by design legislation.

Hence, copyright was regarded as a higher-level protection system, applicable in the field of "applied art" only subject to additional qualifications[603].

The German Federal Court of Justice, in its decision of 13 November 2013, *Geburtstagszug* ("*Birthday Train*")[604] reversed its longstanding case law, holding that works of industrial design and applied art must be protected on the same footing as fine art.

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[601] *See* the Germany response to ALAI questionnaire (question 1(b)), "*Applied Arts under IP law: The Uncertain Border between Beauty and Usefulness*", available at: http://www.alai2016.org/downloads/.
[602] Leistner (2011).
[603] *Id.*, 233. See *Silberdistel*.
[604] Case No. IZR 143/12, *Geburtstagzug* ("Birthday Train").

The issue at hand in the main proceedings concerned the eligibility for copyright protection of the so-called “birthday train”, a wooden toy train, that consists of an engine and many wagons, on which one can attach candles and numbers.

In 1998, the claimant, an independent toy designer, designed the “birthday train” for the defendant, a toy manufacturer, in exchange for a fee of DM 400. Given the considerable success achieved by the design, the designer decided to sue the manufacturer for payment of an additional compensation.

The courts of first and second instance[605] declined to protect the wooden toy, arguing that it was not sufficiently original. The BGH overturned the decision of the Schleswig Appeal Court, holding that the toy was, in principle, eligible for copyright protection under German law[606].

According to the BGH a shift in German case law was necessitated by the reform of the German Design Act (“*Geschmackmustergesetz*”), which was carried out in 2004 in order to implement the DD.

If until 2004 copyright and design rights were almost overlapping IPRs, with different degrees of creativity to satisfy, the review of the German Design Act has introduced a *sui generis* protection regime for designs that is qualitatively different from copyright.

The previous requirements for protection of a design (i.e. “originality and a certain degree of creativity”) were replaced with the “novelty” and “individual character” requirements, in line with the DD. To bear individual character a design has to produce an overall impression on the informed user that is different from that produced by the previously known designs; it does not have to be creative[607].

Hence, as a result of the 2004 amendments to German design law, design and copyright protection do not conflict, but coexist as parallel schemes of protection that are equally applicable to applied art.

Neither the traditional hierarchical relationship between copyright and design rights, nor the resulting higher originality threshold for “works of applied art”, as opposed to “works of purpose-free art”, were justifiable any longer.

Accordingly, works of applied art should be eligible for copyright protection if they show a minimum of creativity, namely if they “*achieve a level of originality that – in the view of the*

[605] The Regional Court of Lübeck and the Higher Regional Court of Schleswig respectively.
[606] Hartwig (2014).
[607] Margoni (2013).

circles that are receptive to, and relatively familiar with, art – justifies it to speak of an "artistic" achievement"[608].

The decision to align copyright protection for all kinds of works was not taken in view of the current harmonization of copyright law, since a definition of "work" is still missing in the European *acquis*[609]. Moreover, Article 17(2) DD precludes a full harmonization of the copyright protection criteria for designs[610].

Hence, it is a decision owed to "*the changed function of a design right within the context of a purely national line of argument*"[611]. Moreover, the Court endeavoured to specify that not all works of industrial design that meet the "individual character" requirement under design law can also receive copyright protection, as the conditions for protection under both laws continue to be different[612].

First, to be eligible for copyright protection, a work of applied art should be artistically designed, beyond the form dictated by the intended purpose of use. In other terms, the aesthetic aspects of a design should not be due to its intended function, but based on artistic creativity[613]. Second, as noted by Ohly, the Court revived the "informed observer test", meaning that a work would only be protected if it is regarded as an "artistic creation" not by the ordinary observer tout court, but the ordinarily knowledgeable observer[614].

By the same token, to remove possible doubts and fears, the Court further explained that, although copyright may also cover works of applied art with a low degree of creativity, the scope of protection would be narrow for the works in question.

The implications of the "*Birthday Train*" decision have just started to unfold. Academic scholarship suggests that, as far as two-dimensional designs are concerned, the result will not be different from that would have been reached under the old law, since pictures are closer to pure art to which copyright protection is undisputedly granted[615]. Yet, the number of three-

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608 *Birthday Train*, [26].
609 *Id.*, [27] et seq.
610 *Id.*, [32].
611 Leistner (2015), 628.
612 *Birthday Train*, [39].
613 *See* the BGH's judgement in *Seilzirkus*, in which the court found that a climbing net for playground fell within the category of applied art, but was not susceptible to copyright protection because the outward appearance of the design was highly conditioned by technical requirements. *See* the Germany response to ALAI questionnaire (question 1(b)), "*Applied Arts under IP law: The Uncertain Border between Beauty and Usefulness*", available at: http://www.alai2016.org/downloads/.
614 The point of view is that of the public reasonably susceptible to the arts and reasonably familiar with artistic views. Ohly (2018) suggests that this test is not the same as the "informed user" standard in EU design law, but it is reminiscent of the restrictive approach to copyright protection endorsed between 1911 and 1995.
615 *Id.*

dimensional designs that are eligible for copyright protection in Germany may suddenly rise, thus having important repercussions for 3DP as well[616].

It must be noticed, tough, that when the case was remitted to the Higher Regional Court in Schleswig, copyright in the toy train was rejected on the ground that the claimant has not adequately exercised creative freedom and combined existing design elements in a sufficiently original manner[617].

Hence, at first glance it seems that the new, uniform threshold of copyright protection for both applied arts and fine arts will not necessarily have the effect of including many more works of industrial design – including 3D-printed ones – in the copyright realm.

The lower courts will still have to examine whether the aesthetic elements of the design are not compelled by its intended use, and evaluate, from the mind's eye of a "*public that is open to art and relatively familiar with views on art"*, whether the level of creativity justifies it to speak of an "artistic" creation[618].

On the other hand, some commentators recall numerous rulings, issued by the district courts in the wake of the *Birthday Train* decisions, which seem to suggest that an increasing number of works of applied art are now subject to copyright protection under the new originality threshold[619].

In particular, works such as a soccer league table, an airbrushed urn depicting a howling deer, and a graffiti tag were found eligible for copyright protection[620]. Yet, as is evident from these cases, infringement cannot be automatically established, due to the narrow scope of protection that is usually offered to industrial designs that show limited creative freedom.

The potentially far-reaching consequences of lowering the requisite level of creativity are thus mitigated. Arguably, the BGH's primary aim was to acknowledge the centrality of the "scope for creative freedom", whenever the subject matter under consideration is influenced by functional considerations[621].

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[616] Some commentators argue that the marked reduction in the originality threshold will have the effect to extend the so-called "Kleine Münze" doctrine to works of applied art. Accordingly, many more designs, showing a minimum level of creativity, will now benefit from copyright protection. *See* Fabbio (2013) and Leistner (2015), 628.

[617] Higher Regional Court in Schleswig, GRUR-PR 2015, 1 – *Geburtstagszug II*. Contrariwise, in the aftermath of the "Birthday Train" decision, copyright protection was granted to an urn for ashes representing a coloured deer on a background of a landscape, since no particular restriction on the scope for artistic creativity was found. OLG Köln, decision of 20 February 2015 – 6 U 131/14, "Airbrush-Urnen".

[618] *Birthday Train,* [26].

[619] Bolte (2017). Ohly (2018) suggests that, when courts are faced with two-dimensional designs, the result would not be different from that would have been reached under the old law, since pictures are closer to pure art to which copyright protection is undisputedly granted.

[620] *Id.*

[621] Leinster (2015), 629.

It must also be noticed that, although the Court deliberately refrained from finding that the introduction of a uniform minimum protection threshold was required by the current harmonization of copyright law, it nonetheless aligned German copyright law with recent case law from the CJEU, focussing on the space available for making free and creative choices. Hence, this decision gives a hint of possible future developments in the copyright-design interface at European level.

Yet, as explained below in more detail, the outcome of the originality assessment may be different depending on how the "room for creative freedom"-test is interpreted.

3.3. The French "Unity of Art" Approach

French copyright law protects "all works of the mind, whatever their kind, form of expression, merit or purpose"[622].

"Works of applied art" appear in a non-exhaustive list of works considered as works of the mind, set forth in Article L 112-2 (10°) of the French Intellectual Property code[623]. Moreover, the same Article mentions other works that are susceptible to be included in the category of "applied art", such as: articles of fashion (14°); works of architecture (7°); graphical and typographical works (8°).

Works that are not expressly referred to in the French Intellectual Property Code, but nonetheless fall within the scope of "applied arts", include, *inter alia*, works of industrial design, interior design, decorative art, and engineering design[624].

Under French law, the requirements for copyright protection of applied art are identical to the requirements for copyright protection of "fine" art. This principle is an elaboration of the theory of "unity of art" ("*l'unité de l'art*") developed by the famous jurist Eugène Pouillet.

As described by an eminent scholar "*the theory of "unity of art" has its basis in the refusal to make any distinction between "pure art" and "industrial art". It extends protection insured by the copyright law to all creations of form, even the most modest, those which, on the "lower" frontier of applied art, depend on what is called "industrial aesthetics". It finds its explanation — and, we think, its justification — in the idea that an adequate distinction is impossible between "major art" and "minor art", all criteria to which one may have*

[622] Article L 112-1 of the French Intellectual Property Code, Law no 92-597 of 1 July 1992.
[623] *Id*., Article L 112-2 10°.
[624] *See* the France response to ALAI questionnaire (question 1(b)), "*Applied Arts under IP law: The Uncertain Border between Beauty and Usefulness*", available at: http://www.alai2016.org/downloads/.

recourse to this effect being subject to the accusation of subjectivity or being powerless, in other ways, to solve the borderline cases"[625].

Therefore, this theory recognizes that art has a unitary character, and artistic creations may be embodied in any material support, including a utilitarian article. For copyright purposes, artistic merit is irrelevant, as well as whether a work is expressed in one form or another[626].

Thus, a wide range of works of applied art has been held protectable under French copyright law, *inter alia*: a salad basket, a bottle opener and a jumper model[627].

Traditionally, the originality requirement for works of applied art has not been onerous: French courts have considered it sufficient that the overall appearance of an item, which is the combination of various (protected/unprotected) components, is the result of arbitrary choices that bear the author's personality, irrespective of whether each component that makes up the item, when taken separately, belongs to the common stock of ideas.

The major restriction to copyright protection of works of applied art is represented by "purely" functional items. Such restriction is known as the "theory of multiplicity of shapes", whereby copyright protection exists only insofar as there is place for arbitrary shapes: if it is possible to conceive several shapes that can attain the same functional result, the shape is dissociable from its utilitarian result[628].

By way of example, in the recent case *Rautureau Apple shoes v Sonia Rykiel créations et diffusion de modèles*[629], the Tribunal de Grande Instance de Paris had to decide whether the claimant's boot (the ROCK PERFECTO model) was sufficiently original to be eligible for copyright protection.

The French court found that the combination of the various elements constituting the claimant's shoe (i.e. a centimetre height heel in the shape of a horse's hoof, a triangular side profile with a zip, and a pointed toe with a very sharp tip) resulted from an arbitrary choice[630]. None of these elements was necessitated by the shoe's function and, therefore, the ROCK PERFECTO boot model was eligible for protection[631].

In a similar vein, the Paris Court of Appeal, in *La Redoutte SA v Minelli SA*, found that the originality of a shoe model resulted from "*the choice of proportion and forms and the combination of the elements in such a manner that the model as a whole had its own*

[625] Finniss, (1964); Rickeston; Suthersanen (2012), quoting Eugène Pouillet (1894). *See* also Gaubiac (1982).
[626] *See* Article L 112-1 of the French Intellectual Property Code.
[627] For references, *see* Derclaye (2010), 318.
[628] Derclaye (2010), 120.
[629] Tribunale de Grande Instance de Paris 3ème Chambre 4ème Section RG12/16149, 25 September 2014.
[630] On this *see* Milchior (2015).
[631] *Id*.

physiognomy and demonstrated an aesthetic choice which reflected the imprint of the personality of its author"[632].

On the contrary, copyright protection was denied to the design of a karate glove, because the article's form was dictated by its function and could not be dissociated by the aim pursued[633].

By the same token, the design of an industrial pump could not benefit from copyright protection, since it merely mirrored the technical body of the pump as such, without any aesthetic or ornamental alteration having been made[634].

It must be noted that, up until recently, French courts have been inclined to apply a total and automatic cumulation rule, whereby a work could automatically enjoy both copyright and the *sui generis* design right under (almost) the same conditions of protection. Perfect cumulation has somehow blurred the novelty and originality requirements.

It is only in the last few years that case law has changed substantially, moving towards a partial cumulative protection, according to which the same industrial creation could receive a double protection regime provided that it fulfils the distinct and independent criteria of "novelty" and "individual character", on the one hand, and of copyright's "originality" on the other[635].

Transposing the considerations made so far to the 3DP context, it seems that, as opposed to other jurisdictions, most 3D-printed items that combine artistic and utilitarian features may be eligible for copyright protection in France, provided that the (not burdensome) originality requirement is met.

3.4. Works of Applied Art in the United Kingdom

It has already been mentioned that, while Section 52 CDPA has been repealed, the exception under Section 51 CDPA has been retained in law, so that *"copyright in a design document or model recording or embodying a design for anything other than an artistic work or a typeface"* is not infringed by the making of the three-dimensional object to the design.

This provision is of fundamental importance in the 3DP landscape, because a CAD file may be regarded as a design document recording a design[636]. In fact, "design document" is taken here to refer to "any record of a design", including data stored in a computer.

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[632] Paris Court of Appeal, decision of 6 December 2013, no 12/17382.

[633] Paris Court of Appeal, decision of 28 September 2005 [2005] PIBD no 820, III, 747.

[634] Rouen Court of Appeal, decision of 8 November 2007, *Pioneer Pump, Inc., Pioneer Pump, Ltd & Grem v Gorman Rupp & Hydro Fluide*.

[635] On this *see* Kahn (2018).

[636] Pursuant to Section 51(3) CDPA, "design" means "the design of any aspect of the shape or configuration (whether internal or external) of the whole or part of an article, other than surface decoration".

Scholarship has stressed that, "*in effect, this means that if a CAD file ..embodying a design, for anything other than an artistic work, is used for creating a 3D-printed product, it will be deemed to be a design document for that particular product and copyright will not be infringed by making an article to that design or by copyright an article made to the design*"[637].

Yet, the design drawing embedded in the CAD file would still be entitled to copyright protection, meaning that third parties would need the copyright owner's permission to reproduce and make the CAD file available to the public. It is also apparent that copyright will be infringed by 3D printing an item from a CAD file, if such item is an artistic work.

The category of "artistic works" protected under Section 4 CDPA includes "sculptures" – irrespective of artistic quality – and "works of artistic craftsmanship" ("WAC") – which implicitly require artistic quality.

In earlier decisions, courts have given the term "sculpture" a very broad definition, focussing mostly on the method of production of the work[638]. The New Zealand Court of Appeal, for example, considered the definition of "sculpture" to encompass the carved wooden model that was used to produce a Frisbee (but not the Frisbee itself)[639].

In a similar vein, in *Breville Europe Ltd v Thorn EMI Domestic Appliances Ltd*[640], moulds for making plates of a sandwich toaster were deemed copyright eligible. An approach to the issue placing particular emphasis on the process of making the work (such as carving, modelling or casting) appeared to be in line with the legislative intent as expressed in the statute, i.e. sculptures are to be protected irrespective of artistic quality.

Nonetheless, in more recent years, we have seen a reversal of this trend, with *Lucasfilm v Ainsworth*[641] acknowledging the danger that this approach would lead to overprotection of industrial designs within the copyright category of artistic works.

This last case is concerned with the IPRs in a series of artefacts created for use in the first *Star Wars* film ("*Episode IV: The New Hope"*), in particular the costumes of the *Imperial Stormtrooper* characters, i.e. "the white armour, including a white helmet which left no part of the face uncovered"[642].

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[637] Mendis (2013), 167.

[638] The term "sculpture" is not defined in the statute, except that it "includes a cast or model made for purposes of sculpture" (Section 4(2) CDPA).

[639] The Frisbee resulted from a mere plastic injection process.

[640] [1995] FSR 77. According to the definition in the Concise Oxford Dictionary "a "*sculpture" (or a cast or model made for the purposes of a sculpture) may be produced by chiselling stone, carving wood, modelling clay, casting metal or similar processes"*.

[641] *Lucasfilm Ltd v Ainsworth* [2008] EWHC 1878 (Ch); [2009] FSR 103.

[642] See *Lucasfilm* [2008] EWHC, [2] and [121].

Drawings and paintings, along with a clay model, of the *Imperial Stormtroopers* were first created. Hence, Mr Ainsworth – an artist skilled in vacuum-moulding plastic – was hired by Mr Lucas to produce the final plastic version of the costumes, based upon the pre-existing two-dimensional and three-dimensional versions.

Some thirty years after the film was released, Mr Ainsworth found the original moulds he had used to make the helmet and the armour. Thus, he decided to produce copies of such artefacts and offer them for sale from his website to US costumers.

The claimant, *Lucasfilm*, obtained a judgement for trademark and copyright infringement in the U.S., and sought to enforce this judgement in the UK[643]. One of the key issues at stake in the UK proceedings was whether the helmet and armour could qualify as "sculptures", within the meaning of Section 4 CDPA.

Clearly, if this was not the case, Mr Ainsworth could invoke the Section 51 defence, arguing that the drawings and the clay model provided to him constituted "design documents" and the reproduction of such design documents in three-dimensional objects did not constitute copyright infringement.

At first instance, Mann J extracted from previous authorities a number of guidance factors for determining what constitutes a "sculpture". Particular regard has to be had to the artist's intention: "*an artist (in the realm of the visual arts) creates something because it has visual appeal which he wishes to be enjoyed as such. He may fail, but that does not matter (no judgements are to be made about artistic merit). It is the underlying purpose that is important*"[644].

Therefore, "the intrinsic quality" of a sculpture is that of "*being intended to be enjoyed as a visual thing*" even if it has some other uses[645]. Hence, whilst a pile of bricks created by an artist, for artistic purposes (i.e. for a two-week exposition at the Tate Modern), should be regarded as a sculpture, the same pile of bricks created by a builder, for building purposes, should not[646].

On this basis, Mann J concluded that the *Stormtrooper* helmet and the armour did not enjoy copyright protection, because they were primarily functional items (i.e. to be worn as items of costume in a film, in order to identify a character and portray something about that character) that did not reflect the creator's artistic purpose[647].

[643] Aplin (2013), 86.
[644] *Lucasfilm* [2008] EWHC, [118] (vi).
[645] *Id.*, [118] (vii)
[646] *Id.*, [118] (viii).
[647] *Id.*, [121]-[122].

The Court of Appeal concurred to the finding that a soldier's helmet is an object of utility made for a practical purpose[648]. The functional nature of such an object is not altered by the fact that it is also used in the context of a film. Contrariwise, "*if the soldier's helmet appears on a bronze statue of a soldier, as part of an artistic representation of the man, no one would dispute that it is a sculpture, since it has no practical utility*"[649].

The difficulty to devise a comprehensive definition of "sculpture" led the appellate Court to endorse the so-called "elephant test" of "knowing one when you see it"[650]. Hence, the result of the Court's analysis is that Mann J did not err in adopting a "multi-factorial approach", with the creator's intention being one of the relevant factors in determining whether a creation qualifies as an artistic work[651].

The UK Supreme Court[652], in upholding the lower courts' decisions, took the view that the Star Wars helmet was merely a utilitarian article, which served to portray a character in a film[653]. Yet, the Supreme Court was not enthusiastic about the Court of Appeal's "elephant test" ("knowing one when you see it"), according to which the qualification as "artistic work" is simply a matter of "common sense"[654].

In this respect, the Court pointed out that: "*any zoologist has no difficulty in recognizing an elephant on sight*", whereas a "*judge, even one very experienced in intellectual property matters, does not have some special power of divination which leads instantly to an infallible conclusion*"[655].

Moreover, the Supreme Court disagreed with the Court of Appeal's view that the legislative history of the relationship between copyright and designs does not provide assistance in reaching a conclusion. Rather, it shows that "*there are good policy reasons for protecting three-dimensional objects in a graduated way, according different periods of protection to different classes of works"* (i.e. artistic works, works with "eye appeal" and functional objects)[656]. Hence, the Court should not "*encourage the boundaries of full copyright protection to creep outwards*"[657].

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[648] *Lucasfilm Ltd v Ainsworth* [2009] EWCA Civ. 1328; [2010] FSR 10.
[649] *Id.*, [75]-[76].
[650] *Id.*, [77].
[651] *Id.*, [55].
[652] *Lucasfilm Ltd v Ainsworth* [2012] 1 *AC* 208.
[653] *Id.*, [44].
[654] Pila (2010), 240.
[655] *Lucasfilm* [2012] 1 *AC* 208, [47].
[656] Pang (2012).
[657] *Id.*, [48].

As a conclusion, the UK courts in *Lucasfilm* drew the fine line between the notion of a sculpture, on the one hand, and the notion of a design, on the other: *"a sculpture has, as a part of its purpose, a visual appeal, in the sense that it might be enjoyed as a visual thing alone"*, whether or not it has another purpose as well[658]. Artistic merit or worth is irrelevant; the underlying purpose is what matters the most.

The process of fabrication and the material used are not determinative: i.e. the fact that a functional item is carved out of wood or stone, rather than 3D-printed, does not turn it into an artistic work[659]. For all such reasons, a sandwich toaster mould or a Frisbee model are excluded from this copyright category, being purely functional items.

Yet, with those important considerations in mind, it is not always easy to categorize items that either have utilitarian purposes as well as artistic qualities. Such items may qualify as "sculptures" if they were primarily created for their visual aspect (i.e. to be enjoyed for that purpose alone) or as "designs" if they were primarily created as useful items that also have a visual appeal.

Accordingly, 3D-printed figurines, manufactured as toys to be used in a board game, will not be regarded as items of sculptures for the purposes of the CDPA. On the contrary, a 3D-printed statuette that is created primarily to be admired as a visual thing may fall within the definition of a "sculpture", albeit it is also used as a functional object (i.e. as a doorstopper).

It appears that an inquiry into the creator's purpose is not always easy to make. Furthermore, in a given case, the scope of protection accorded to "sculptures" and to "WAC" may potentially overlap. For such a reason, it is to this last subcategory of artistic works that we now turn.

As it is the case for sculptural works, a comprehensive definition of WAC is not present in the statute[660]. To fall within this copyright category, a creation shall satisfy the requirements of "artistic quality" and "craftsmanship".

Various judicial authorities have addressed the question of what is meant by "artistic quality"[661]. As argued by scholarship, "*this approach is unusual in copyright law because it*

[658] *Lucasfilm* [2009] EWCA Civ 1328 per Mann J.

[659] The Supreme Court upheld the multi-factorial approach developed by Mann J in *Lucasfilm* [2008] EWHC, [118].

[660] *See* Section 4(1)(c) CDPA. The British copyright legislation prior to 1911 only protected artistic woks (i.e. works of fine art).

[661] *I.e.* the quality of providing pleasure or satisfaction, whether emotional or intellectual. *See George Hensher Ltd v Restawile Upholstery (Lancs)* Ltd [1976] AC 64.

requires the courts to consider whether the work satisfies the qualitative threshold of being artistic"[662].

Thus, "*judges have resorted, variously, to tests based on the views of a substantial section of the public, different types of expert evidence and the intention of the author*", as well as to tests in which judges themselves ought to examine the artistic merit of the work[663].

For example, in *Hensher v Restawile Upholstery*[664], Lord Reid, in deciding whether a chair was eligible for copyright protection as a work of *artistic* craftsmanship, considered it important to ask whether a "*substantial section of the public admires or values the work for its appearance*"[665].

In Lord Morris' opinion the question of what is or is not artistic should be addressed in an objective and detached way: the intention of the author may be of aid, but the question is ultimately one for the courts to answer, guided by expert evidence[666]. On the contrary, Lord Kilbrandon argued that the "*conscious intention of the craftsman*" should be "*the primary test of whether a product is a work of art or not*"[667].

Lord Simon ultimately concluded that it is more pertinent to ask if the author of the work is an artist-craftsman, and "*the most cogent evidence is likely to be either from those who are themselves acknowledged as artist-craftsmen or from those who are concerned with the training of artist-craftsmen (i.e. expert evidence)*"[668].

The difference of judicial opinion in *Hensher* testifies to the difficulty of devising a uniform test to determine if a work is "of a quality making it capable of being described as artistic"[669]. Other courts have shared the confusion evidenced in *Hensher* about what constitutes "artistic quality"[670].

Interestingly, in *Burge v Swarbrick*[671], a case concerned with the design of a high-performance racing yacht (the JS 9000), the High Court of Australia adopted far a more objective test to determine whether a work may qualify as a WAC[672].

In the Court's opinion, the determination of what can and cannot amount to a WAC "*does not turn on assessing the beauty or aesthetical appeal of work or on assessing any harmony*

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[662] Bently; Sherman (2009), 78.
[663] Masiyakurima (2016), 514.
[664] *Hensher*, [116].
[665] Id., *per* Lord Reid, [54].
[666] *Id., per* Lord Morris [57].
[667] *Id., per* Lord Kilbrandon [98].
[668] *Id., per* Lord Simon [94].
[669] *Id*.
[670] *Inter alia, Merlet v Mothercare P.L.C.* [1984] 2 I.PR 456, 465.
[671] [2007] *HCA* 17, (2007) 234 *ALR* 204.
[672] *See, inter alia*, Thomson (2010), 118.

between its visual appeal and its utility"; rather, it "*turns on assessing the extent to which the particular work's artistic expression, in its form, is unconstrained by functional considerations*"[673], and whether "*there is considerable freedom of design choice relatively unconstrained by the function or utility of the article*"[674].

On the facts of the case, the Court found that the design of the JS 9000 was not a WAC, since it was dictated by utilitarian and commercial considerations that limited the scope for real or substantial artistic effort[675].

One can immediately notice that such a test of "artistic craftsmanship" bears some resemblance with the test of copyright's originality formulated by the CJEU. The thread running through both tests juxtaposes functional constraints to the room available for creative choices. Moreover, both tests appear to ban the use of qualitative criteria, such as aesthetic merit or worth.

In the UK, much controversy also surrounds the additional requirement of "craftsmanship". In the first place, there are contrasting judicial approaches to whether "craftsmanship" connotes only something hand-made.

In this respect, one should always remember that the work category of artistic craftsmanship was introduced under the influence of the Arts and Crafts movement, as a reaction to the detrimental impact of the Industrial Revolution on decorative arts[676]. The idea was to confer protection to those artworks that were the result of a process combining both craft skills and artistic intent in the process of creation, to be distinguished from works of industrial design.

The "artist-craftsman" intends to create a work of art and expresses his or her creative ability in the "making", not simply by executing the instructions contained in a pre-existing technical drawing. A piece of art is something unique and durable, which does not encompass prototypes or models created throughout the manufacturing process[677]. Moreover, the traditional understanding of WAC is that, if the article is industrially made, then there will be neither "artistry" nor "craftsmanship".

Therefore, the question should be answered whether producing an item by means of 3DP would preclude its qualification as a work of "craftsmanship". Noteworthy, the view taken by Lord Reid's in *Hensher* disqualifies all 3D-printed items, by requiring a WAC to be a

[673] *Burge*, [83].
[674] *Id.*, [75].
[675] *Id.*, [84]-[85].
[676] Pila (2008). *See* also Masiyakurima (2016), 511-512, raising the argument that the Arts and Crafts Movement did not push for copyright in works of applied art, and the real catalyst was the need to implement the "applied art" provision of the Berne Convention.
[677] Van Caenegem (2007), 171.

"durable, useful, handmade object"[678]. Subsequent case law, however, disavowed Lord Reid's approach, advocating that there is no reason to equate "craftsmanship" with "handmade" or "hand-crafted"[679]. To hold otherwise would be at odds with modern manufacturing processes and technological development.

Interestingly, in *Coogi Australia v Hysport International*[680] – a case concerning a multi-coloured fabric, with a highly textured surface, which has been created using a computer-controlled knitting machine – Drummond J concluded that WAC are not confined to hand-made objects.

Many designs are capable of being WAC because they have real aesthetic qualities, even if they are mass-produced and computer-made, without employing traditional "craftsmanship techniques".

As Drummond J pointed out: "*there is no necessary difference between a skilled person who makes an article with hand-held tools and a skilled person who uses those skills to set up and operate a machine which produces an article. Such an article can still be a work of craftsmanship even though the creator has used a highly sophisticated computer-controlled machine to produce it, if nevertheless it is a manifestation of the creator's skill with computer controlled machinery, knowledge of material and pride in workmanship*"[681].

Hence, nothing in principle precludes a 3D-printed item from being a WAC. Taking the example of 3D-printed artistic chocolate products, scholarship suggests: "*a 3D printer is simply another type of tool for producing a WAC*". Hence, "*it is difficult to see why producing a chocolate by way of a 3D printer precludes this category*"[682]. Moreover, 3DP has the capacity to personalize production, distinguishing it from mass-production.

There are also controversies in case law whether, in order to qualify as a WAC, a work should be the product of a single person who combines both artistic and craft skills (i.e. an "artist-craftsman")[683], or it is enough that it meets the two criteria of being a work of craftsmanship having the requisite artistic quality.

This last issue is of extreme importance to understand whether copyright may subsist in works that are created by means of 3DP technologies. In fact, in most cases, a 3DP process is segmented in two different phases. The person who exhibits creative skills and artistry in designing an object, with the help of a CAD modelling program, does not also participate in

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[678] *Hensher, per* Lord Reid, [77E]
[679] *Hensher, per* Lord Simon, [90].
[680] *Coogi Australia Ltd v Hysport International Pty,* 86 FCR 154 (1998) (*per* Drummond J).
[681] *Id.*, [258]-[259].
[682] Li; Mellor; Griffin; Waelde; Hao; Everson (2014), 327.
[683] This was the opinion of Lord Simon in *Hensher*, [94].

the production process; rather, it delegates the actual print to an intermediary that is skilled with 3DP technologies and has knowledge of 3DP materials.

Hence, whilst the designer conceives the design, the intermediary "executes" it (i.e. by selecting the printing materials, inserting the printing settings and running the program that instructs the 3D printer on how produce to the desired output).

In such a case, the artistic element is more referable to the design embedded in the CAD file, whereas the craftsmanship element is more referable to the way in which the work is executed by way of a 3D printer[684]. It must be noted, however, that mere execution of instructions provided by third parties does not amount to authorship[685].

Therefore, a controversial issue is inevitably whether craftsmanship attracting copyright must be provided by the same person who supplies the artistic element (i.e. the CAD file's designer)[686]. This seems to be approach adopted by Clauson J in *Burke v Spicer's Dress Designs*[687].

The preferable view, however, is that a work can be one of "artistic craftsmanship" even if the requirements of "artistry" and "craftsmanship" do not originate from the same person. This was the opinion of the High Court of New Zealand in *Bonz*[688], a case concerning the production of hand-knitted woollen sweaters, where the designer (i.e. the artist) and the hand-knitters (the craftsmen) were different persons.

Tipping J found that "*for a work to be regarded as one of artistic craftsmanship it must be possible fairly to say that the author was both a craftsman and an artist. A craftsman is a person who makes something in a skilful way and takes justified pride in their workmanship. An artist is a person with creative ability who produces something which has aesthetic appeal. It is not necessary for the same person to conceive and execute the work. If two or more people combine to design and make the ultimate product, there is no reason why the ultimate product should not be regarded as a work of artistic craftsmanship*"[689].

Drummond J, in *Coogi Australia*, took the same view, holding that once it is accepted that WAC are not confined to hand-made objects, "*there is no reason why it should be essential*

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[684] *See Sheldon & Hammond Pty Ltd v Metrokan Inc*., 135 FCR 34 (2004), [70], citing Professor Rickeston.

[685] A WAC presupposes the manifestation of artistry in the actual making of the object, which is not to be found in case third-party instructions are implemented in the execution of a work.

[686] If so, mass-produced articles would be necessarily excluded from copyright protection.

[687] [1936] 1 *Ch* 400, [408].

[688] *Bonz Group v Cooke* [1994] 3 *NZLR* 216 (High Court of New Zealand).

[689] *Bonz Group,* [224]. Also confirmed by the High Court in London in *Vermaat & Powell v Boncrest* [2001] FSR 5.

for such a work to be the product of the efforts of a single person, i.e. of an artist-craftsman"[690].

Interestingly, his Lordship took the view that Mr Walker, the computer-programmer and knitting technician employed by Coogi, could be fairly described as a craftsman, and the product of his work as a WAC.

A crucial aspect of Drummond J's finding was that Mr Walker had contributed significantly to both the creation of the XYZ design and the production of the first run of fabric to the XYZ design. Hence, the procedure by which the fabric was manufactured could not be separated into two distinct processes: the one design and the other production.

Not only had Mr Walker participated in the early stage of the development of the design; he had also written the computer program – comprising both the graph for the design and the instructions for the knitting machine – and, thereafter, experimented with Coogi's computer-controlled knitting machine, running the computer program he has created to produce trial runs of fabric. Hence, "*in the course of the final phase, he made adjustments to both the program and the knitting machine in order to arrive at the stage where he had the program in final form and the machine set up to produce the fabric"*[691].

Having brought the analysis of case law so far, one can subscribe to the idea that, for a work to qualify as a work of "artistic craftsmanship", the artist and the craftsman need not be the same person, although there must be a proper connection between them. The artist should be sufficiently involved in the actual process of the manufacture of the object.

Hence, in a 3DP process involving both a designer (i.e. the person who creates the CAD model) and an intermediary (i.e. the person entrusted with the task of printing the item), as a preliminary step, the question should be answered whether the designer's supervision over, and involvement in, the manufacturing process is of such quality, intensity and consistency required to establish artistic craftsmanship.

In other terms, there should be a sufficiently strong nexus between the design process and the actual print of an item. Hence, assuming that a 3D-printed article satisfies the notion of WAC, being craftsmanship of the required artistic quality, the respective contributions of the designer, on the one hand, and the manufacturer on the other, are decisive to resolve the critical issue of authorship (and, potentially, joint authorship) of such a work.

Allegedly, the designer could fairly be described as the "artist-craftsman" (and, potentially, as the sole author of the work) if, in conceiving the CAD model, he or she consciously takes into

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[690] *Coogi Australia,* [256]-[259].

[691] *Id.*, [169]-[170].

account the production process (i.e. the properties of 3DP materials and the ways in which a 3D printer could be used to achieve a determined end-result) and later uses his or her skills and knowledge in setting up the 3D printer and monitoring and adjusting the printing settings[692].

But what would the consequences be in legal terms if the designer does not participate in the operation of the 3D printer that makes the work? Should the designer be physically present in the 3DP factory in the course of the manufacturing process to establish sufficient authorship on his or her part? Would it suffice to say that his or her mind was adequately engaged during the act of production[693]?

Following *Sheldon*, the notion of authorship of craftsmanship does not seem to be satisfied merely by the giving of instructions to a manufacturer[694].

To conclude, the uncertainty surrounding the requirements of “artistic quality” and “craftsmanship” may have deep implications in the 3DP environment, thus making it difficult to predict whether a 3D-printed item qualifies as a WAC in the UK.

4. The Pros and Cons of a Uniform Originality Standard for Works of Applied Art

As one may detect from the analysis carried on so far, the degree of protection available for works applied art through copyright differs considerably across the EU. Nonetheless, a common thread runs through some EU Member States whenever they attempt to refashion the copyright protection criteria for applied art.

It has been noted that confusion in this area has been aggravated by *Flos*, a decision that bristles with uncertainties. In particular, it is not clear whether the net effect of *Flos* and recent case law of the CJEU that elaborates on the originality standard (*Infopaq, BSA, FAPL, Painer, Football Dataco*) is that EU Member States must now protect all works of industrial design and applied art for the full term, provided that they are the author’s own intellectual creation[695].

[692] *See Coogi Australia.*

[693] *See* the Counsel for Hysport’s opinion in the *Coogi Australia* case. Note that this issue does not concern only WAC, but all copyright works that are executed following the instructions given by another person.

[694] *Sheldon*, [82].

[695] The CJEU in *Painer* [96] proclaimed that “*the extent of copyright protection should not depend on possible differences in the degree of creative freedom in the production of various categories of works”*. From such a statement, one may infer that the protection conferred to applied arts should not be inferior to that enjoyed by other works. It must be noted, however, that *Painer* did not concern the originality of applied art, but of portrait photos as compared to other photographic works.

This seems to be the opinion of the Advocate General *Jääskinen* in Case C-5/11, *Criminal Proceedings against Titus Alexander Jochen Donner*[696]. That line of reasoning would render Article 17(2) DD meaningless, considering that Member States would lose their discretion to determine the conditions for copyright protection of designs, including the requisite level of originality.

The implications of the CJEU's case law have only recently started to unfold. In the *Tripp Trapp* judgements, the Dutch Supreme court assumed that, in the light of *Infopaq* and subsequent cases, the protection criteria have now been harmonized for all the subject matter covered by copyright, including works of applied art.

In Germany, following the BGH's decision in "*Birthday Train"*, the level of originality necessary for copyright in works of applied art has been lowered. Yet, the German Supreme Court did not go so far as to adhere to a harmonized concept of "work".

In Italy, while the "*artistic value*" requirement has been retained in the Copyright Act, recent case law seems to accommodate grater flexibility for lower courts that have to determine when such a requirement is fulfilled. The exposition in museums or permanent art collections is not presented as a "necessary" condition in order for a design to acquire copyright protection.

In the UK, Section 52 CDPA has now been repealed to give the full term of copyright protection to industrially manufactured artistic works. Still, the section 51 defence and the "artistic quality" requirement for works of artistic craftsmanship have been retained in the CDPA.

Therefore, as compared to the past, certain countries seem to require looser, rather than stricter, requirements for applied art to attract copyright. By the same token, it is licit to expect future decisions of the CJEU clarifying that copyright protection of works of applied art is exclusively dependent on the "author's own intellectual creation" requirement.

However, the EU judiciary should not ride roughshod over legislative choices. It is up to the EU legislature to take an express position on the copyright-design interface, and clarify the degrees of freedom remaining for national choices under Article 17 and 96 of, respectively, the DD and the DR.

Policy-makers should balance potential benefits for right holders and consumers resulting from full harmonization of the copyright protection criteria against potential impacts on competition, progress and innovation.

[696] [2012] EU:C:2012:370, [27]-[31].

In fact, the adoption of a uniform "originality" standard for works of applied art has a number of obvious advantages. First, treating applied art according to a single standard, applicable in all EU Member States, may achieve greater uniformity and foster the smooth functioning of the Internal Market.

Second, it may avoid the nebulous tests that a number of Member States employ for copyright protection of works of applied art, the most notorious examples being the tests that courts should follow in Italy – in pronouncing on the "artistic value" inherent in industrial designs – or in the UK – in pronouncing on the "artistic quality" of WAC.

In fact, a higher threshold of originality, demanding that works of applied art or industrial design must possess the requisite "artistic quality", "artistic value" or "artistic character", presents the following insurmountable challenges: what point of view should be used in making such an evaluation? Which factors need to be taken into account to prove that the work is sufficiently "artistic"?

A test that calls upon judges to assess the work's artistic value or quality risks implying judicial prejudice or discrimination. It may invite judges to engage in intensely evaluative judgements that go beyond their legal expertise and are premised on subjective notions of artistic merit or purpose.

As noted by expert scholars, "*judgements on quality, merit and aesthetics are not useful in legal discourse, because they are susceptible to variation between different persons and, for that reason, cannot properly inform legal interpretation*"[697].

Therefore, the multiple views that judges may have on "artistic value" or "artistic quality" issues entail legal uncertainty that unfairly prejudices designers and creators of applied art. In fact, creators of works of fine art will not be similarly prejudiced, because their works are eligible for protection in a much more predictable way.

A test that relies on the recognition of the work within the art sector risks to deny copyright protection to "young" creations that, albeit having an inherent artistic value or quality, have not obtained external recognition and valuation yet. Moreover, the recognition of a work as "art" by experts in the field may change over time.

A test that relies on the opinion of a substantial section of the public to resolve "artistic quality" or "artistic value" issues may have scarce probative value. As noted above, it may invite philistinism, meaning that a person who is hostile or indifferent to culture and the arts

[697] Van Gompel; Lavik (2013).

may easily reach the conclusion that a creation should be treated as an "art work", without really knowing why.

Additional shortcomings stem from the cost of expert witness testimonies or survey opinions. By the same token, the point of view of the "average observer", being a legal fiction, endows courts with a broad margin of appreciation in evaluating the work's artistic value or quality.

Finally, a test that centres on the "intention of the author" when he or she created the work does not seem reliable and predictable either[698]. When determining a work's eligibility for protection, the focus should be on the nature of the work itself, whereas the motive inspiring the author should carry no weight. In fact, it is not easy for a court to dig into the author's subjective sphere. Judges may find that there is more than just one intention behind the creation of a work.

Moreover, as underlined by Masiyakurima, the creator's intention test presents the following insurmountable challenges: first, it leads authors to exaggerate their intentions or to colour their recollections; second, it proves inadequate in case the author dies before disputes involving his/her work[699].

Having made such remarks, the question whether it is advisable from a policy perspective to apply the "author's own intellectual creation"-test to works of applied art and industrial design, in the same way as with all other works, should also be carefully addressed.

This policy option may have a deep impact on the manufacturing industry, at least in those Member States that have set higher limits for works of applied art to attract copyright. In fact, the "author's own intellectual creation" is not a high bar to reach.

On the whole, a minimum level of creative input is required to attract copyright[700]: the making of free and creative choices in the production of the work. But what does that mean in practical terms, when it comes to applied arts?

The answer to this question hinges on the manner in which the "author's own intellectual creation" requirement is interpreted and applied. In fact, as the next section will show, the EU originality requirement may attract rival interpretations.

A too loose interpretation, leading to an overgeneralized protection of applied arts and industrial designs trough copyright law, when protection under design law is already available, may have detrimental repercussions on the market and on businesses' ability to innovate.

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[698] The U.S. Supreme Court has recently rejected this test. *See* infra.
[699] Masiyakurima (2016), 515.
[700] Van Gompel (2014), 99.

5. Rival Interpretations of the EU Originality Requirement

5.1 The "Creative Collection"-test

In *Infopaq*, the CJEU clarified that words as such do not constitute protected elements[701]. However, "*it is through the choice, sequence and combination of those words that the author may express his creativity in an original manner and achieve a result which is an intellectual creation*"[702].

This decision testifies that copyright's originality is moving towards a "creative collection"-test[703] . – as van Gompel defines it – namely a test that asks whether the choice, arrangement, or combination of the whole range of (protected/unprotected) "elements" or "units" composing the work expresses the author's creativity in an original manner.

This test, however, encounters the following main difficulty when applied to works of applied art and industrial design: how to establish which are the "units" or "elements" that have been selected by the author to create the work. Trying to split up the design of a useful article in individual components is a difficult task, as exemplified by US case law elaborating on physical and conceptual separability[704].

It is much easier to think of a literary work as made up of individual units, than a work of applied art or industrial design[705]. In fact, the latter combine utilitarian aspects, which are subject to more stringent constraints – such as functional or technical restraints, the cost of production, and the rules of physics and mechanics – with decorative features leaving more room for creative freedom. These elements intermingle in different degrees.

In practice, to escape from this difficulty, courts tend to appreciate originality on the basis of the overall impression of the work, which results from the assembly of different (protected/unprotected) elements, and not by an examination of each individual component.

Then, to resolve the question whether the selection, combination or assembly of such elements is sufficiently original for vesting copyright, courts tend to examine whether, despite the functional or technical constraints of the work, the author has been left with some space for creative freedom when creating the work.

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701 Case C-5/08 *Infopaq International A/S v Danske Dagblades Forening* [2009] ECR I-6569, [46].
702 *Id.*, [45].
703 Van Gompel (2014), 120.
704 *See* below.
705 Van Gompel (2014), 120.

Hence, if some room for making creative choices existed, due to the fact that the author could choose among different equivalent options during the creative process, courts tend to give for granted that the resulting choices have led to an original production by default[706].

This approach reduces the originality test to what can be best defined as the "room for creative freedom"-test. The next section attempts to explain the reasons why such a test may prove inadequate when dealing with applied arts and industrial designs.

5.2. The "Room for Creative Freedom"-test

The CJEU in *BSA*[707] and *FAPL*[708] has explicitly recognised that copyright does not extend to elements of the work that "leave no room for creative freedom". It is, however, suggested that the margin of the creator's freedom should be distinguished from how such freedom is actually exerted.

In fact, a test that centres on the creative space at the disposal of the author in the course of the creation of the work, if applied in a lenient way, may lead to the conclusion that almost every work of applied art is sufficiently original for copyright purposes.

In fact, some creative space exists nearly always, except where the article's form is entirely dictated by either functional or technical considerations. Even a small variation to the design of a useful article may be regarded as an original contribution.

Hence, relying heavily on the "room available for creative freedom", without looking at how such freedom has been used, may have negative repercussions. This observation has been made by van Gompel, noting that: "*while the existence of creative space is a prerequisite for an author to make an original creation, this does not itself lead to the conclusion that the creation must therefore also be original. Instead ... courts should distinguish the presence of creative space from how it is used"*[709].

For example, the Dutch Supreme Court in the *Tripp Trapp* judgements looked at the creative space available for the designer to conclude that a highly technical design that consisted of a combination of individually unprotected elements was sufficiently original, because alternatives were available for attaining the same technical solution[710].

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706 Hugenholtz (2012), 47, 3.4.4.

707 Case C-393/09 *Bezpečnostní softwarowá asociace v Ministerstvo kultury* [2010] ECR I-13971, [48]-[49].

708 Joined Cases C-403/08 and C-429/08 *Football Association Premier League Ltd. V Karen Murphy* (CJEU Grand Chamber, 4 October 2011), [98].

709 Van Gompel (2014), 121.

710 This line of reasoning reflects the approach traditionally followed in France, exemplified by the abovementioned decision of the Tribunal de Grande Instance de Paris in *Rautureau Apple shoes v Sonia Rykiel créations et diffusion de modèles.* In this last case, the Court held that the combination of the (common and basic) design elements of a shoe model was sufficiently original for vesting copyright, since it resulted from the

That line of reasoning is unsatisfactory and worrisome, because it extends copyright protection of applied arts too far. For instance, in the context of 3DP, a similar loose interpretation of the originality requirement may lead courts to accept copyright in most customized designs.

Nonetheless, a more careful inquiry into how customization is carried out may suggest that users do not exercise free and autonomous choices. In fact, in most cases, when customizing the design of a useful article available on an online platform, the user can select expressive features – such as form, size, colour, or proportions – from an array of alternative options, in order to make a slight variation to the pre-existing design.

Nonetheless, the mere selection of features of appearance from a pre-defined set of choices does not result in an "intellectual creation"[711]. Hence, the way in which customization takes place may show that, even though some choices are actually involved, such choices are not "creative".

Likewise, an examination of the design process may reveal that some elements of the design were actually the result of technical knowledge or know how, and some others were highly dictated by functional considerations.

In fact, the customization of existing designs is done – by the user herself or by the 3DP platform at the behest of the user – through the use of specialised software, which presupposes a certain degree of technical expertise.

Moreover, functional and technical constraints that may restrict the user's creative freedom in the course of customization include, *inter alia*: the quality of the software, the chosen modelling technique, the chosen method of production, the printer's dimensions, the filaments to be used and the cost of production.

Such constraints to creativity should not be a reason to believe that the user can never exercise a certain degree of freedom, by making free and creative choices of some kind. Within these constraints the user can still exert his or her personal autonomy in the customization of the work.

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author's own, subjective and arbitrary choice. Interestingly, defendant *Sonia Rykiel* argued that the mere combination of previously known elements, which were by themselves unprotected, could not establish the originality of a work, as it failed to reveal the existence of a *creative process*.

[711] The involvement of users in customizing products does not render them "authors" in the same way as architects' clients, who suggest some of the aspects of the architectural plans, which are then executed by the architect, are not regarded as joint "authors". The clients usually contribute ideas, suggestions and corrections to the plans that do not amount to authorship; the architect controls how these ideas are incorporated in the final project. Moreover, the client's contribution to the overall design is normally *de minimis* in nature as well as foreseeable and expected. See *Aitken, Hazen, Hoffman, Etc. v Empire Const. Co*., 542 F. Supp. 252 (D. Neb. 1982).

However, to determine whether a customized item is eligible for copyright protection, it cannot merely be examined whether the user could choose among apparently equivalent and alternative options, in the selection and arrangement of the design elements.

To prove originality the question should rather be answered whether the user has actually exercised creative choices, throughout the entire creative process, which resulted in a sufficiently original expressive form.

As scholarship argues, "creative constraints", rather than the "room for creative choices", should lie at the heart of the originality analysis[712]. An approach to copyright's originality that centres on the space available for creative freedom must be accompanied by a clear appraisal of how the creative process has been carried out in practice[713].

The creative process may reveal that, although in theory alternative options were available for attaining the same functional purpose, the user has been restricted in some way in the course of the creative process, for example by the fact that customizable options were already pre-selected or highly conditioned by the quality of software, the 3D printer's capabilities or the available filaments.

To conclude, one should not loose sight of the possible negative effects of overprotecting industrial designs, given that the same creation may already attract protection under design law. The extension of copyright to (almost) the entire range of industrial designs will inevitably have anticompetitive consequences, and restrain progress and innovation in the field.

It should, in fact, be noted that only a limited number of undertakings operating in the sector of applied art invest heavily in R&D. Most undertakings, instead, tend to reproduce existing styles and models, making some small alterations to already existing designs.

The development of 3DP technologies maximizes this eventuality. Hence, circumscribing the ambit of "applied art" that truly deserves the broad and long-term protection conferred by copyright is of pivotal importance to the exploitation of 3DP.

5.3. Technical and Functional Constraints in the Course of the Creative Process

The CJEU clarified that when an expression is determined by technical or functional rules, constraints or considerations, the author cannot exercise his creativity in an original manner,

[712] Van Gompel (2014).

[713] *Id.*

by making free and creative choices, and achieve a result that is his or her own intellectual creation[714].

In practice, the challenge is to set the borders beyond which external constraints curb creativity to the point of depriving the maker of the status of author. For example, in the 3DP context, the following functional or technical considerations put restraints on the author's creative freedom.

In the first place, there are some "digital constraints". There is a thin line between those digital design models that are mostly products of know-how (for instance, a scanned representation of an object that is subject to post-processing techniques) and those that are not the result of simple application of know how, but reveal an authorial contribution.

In the latter case, the modelling software (CAD software) and slicing software (CAM software) impose constraints during the design process. These computer programs may restrain creative freedom to the extent that they also require some technical knowledge[715].

Then, different modelling techniques provide the designer with either a stricter or wider freedom for creative choices. For examples, the creation of a CAD model by means of 3D solid modelling software is done through the assembly of pre-rendered shapes, such as cones, spheres, cubes or cylinders. This can be seen as an additional restriction to creative freedom, since most choices are based on pre-programmed instructions.

Instead, the range of choices available for the designer using surface modelling software is broader, to the extent that he or she can specify the edges and surfaces (also curved surfaces) defining the external boundaries of the object, and create more "free-form" shapes.

The quality of the end product largely depends on the quality of the software. In this respect, 3D solid modelling enables to draw a high-quality representation of the object, which also includes the internal details of the item, whereas surface modelling draws a more abstract and less realistic representation, which merely describes the external aspects and aesthetics of the product design.

The printer's dimensions, together with the limited range of filaments that can be used with a certain type of printer, similarly restrain the designer's creative freedom.

Correspondingly, the choice of the print material influences the design process to a considerable extent. In fact, in the course of the design process, the designer should give

[714] *BSA*, [48]-[49]; *FAPL,* [98]; *SAS*, [39].

[715] 3D solid modelling technique is easier and more intuitive to use than wireframe of surface modelling techniques.

thought to the properties of the material – strength, flexibility, stress capabilities, heaviness, smoothness, etc. – and stick to specific material-related design rules.

For example, if the designer knows that he/she wants to print the object in ceramics, she would need to take into account the following material-related recommendations: "*supporting overhanging parts, strengthening elements that are sticking out, and rounding off corners*"[716].

Thereafter, the selection of the optimal "slicer settings" represents an additional rule or constraint in the 3DP process. In fact, the CAM software or "slicer" generates the coded instructions for the printer ("the G-code") on the basis of the slicer settings that the designer chooses. These settings, in turn, hinge on the nature of the product, the filaments to be used, and the 3D printer itself.

Finally, the fact that the ultimate 3D-printed article also serves a utilitarian purpose, being a work of applied art, places some stricter creative constraints on the author's freedom. For instance, while footwear designs may have some decorative features and be aesthetically pleasant, they are ultimately restrained by the utilitarian purpose of the object.

The ways in which the elements composing a shoe (i.e. the outsole, insole, heel, upper, and toe box) can be designed, in order to be fit for purpose, are not infinite. Even if some room for creative and aesthetic choices exists, the shoe must still be suited to perform a specific function.

Moreover, while it is true that the elements constituting a shoe can be arranged and combined in disparate ways, in the end, they must respect the general physiognomy of a shoe: i.e. they must be placed in a specific position to carry out their own particular functions.

It should also be noted that technical and functional constraints change over time, as they keep pace with technological development. For example, on the one hand, a more sophisticated computer program that automatizes most of the designer's decisions in the course of the design process may place a strain on the author's creative autonomy.

On the other hand, the refinement of AM technologies may narrow down the types of constraints that emerge during the manufacturing process (i.e. the level of knowledge and know how required to construct the product may be lower; the printer may be of better quality and have bigger dimensions; the range of filaments that a printer can use may be wider).

5.4. Final Remarks on the Originality Requirement

[716] *See* Fabian (2017).

As a conclusion, when determining the originality of 3D-printed works of applied art, courts will have to disregard those elements of the work that do not result from the author's free and autonomous choices. This is the case where technical or functional rules, constraints or considerations impose fundamental limits on the author's creativity and personal autonomy in the course of the creative process.

Much of the difficulty, however, may arise from an unclear understanding by courts of 3DP processes. Potential lack of technical knowledge may have the effect of restricting judicial approach towards originality to the examination of the space available for making personal and creative choices, rather than the manner in which such choices have been exercised.

Nonetheless, as suggested in scholarly work, whether the originality requirement is met must depend on whether "*the author has made use of the creative space to produce an intellectual creation that can be considered the author's own*"[717].

Hence, in applying this originality test, courts must take into account the creative process carried out by the designer. In practice, the difficulty remains where to draw a line beyond which technical or functional considerations, rules or constraints render the expression ineligible for copyright protection.

In fact, depending on whether the originality test is more broadly or more narrowly construed, the choices underlying the designs of 3D-printed articles may or not be seen as essentially determined by technical considerations, leaving the designer with or without freedom to create an original work.

If works of applied art were to be treated on par with other categories of works, following *Infopaq* and subsequent case law, this would imply a rather low threshold of copyright's originality. Hence, copyright would probably be conferred on most 3D-printed works of applied art and industrial design within the EU.

6. Protection of Applied Art Under U.S. Law

Under U.S. law, works of applied art are expressly included among the subject matter of copyright, within the broader category of "*pictorial, graphic or sculptural"* ("PGS") works, but are not defined in the 1976 Copyright Act ("Copyright Act")[718].

At the same time, the statute distinguishes PGS works – as defined by Section 101 and eligible for copyright protection under Section 102(a) – from "useful articles" that are not

[717] Van Gompel (2014), 138.
[718] 17 U.S.C. §101.

copyrightable. A useful article is defined as an article having "*an intrinsic utilitarian function that is not merely to portray the appearance of the article or to convey information*" [719].

Section 101 of the Copyright Act specifies that "*the design of a useful article, as defined in this section, shall be considered a pictorial, graphic, or sculptural work only if, and only to the extent that, such design incorporates pictorial, graphic or sculptural features that can be identified separately from, and are capable of existing independently of, the utilitarian aspects of the article*".

The statute further postulates that the right holder of a PGS work has the exclusive right to reproduce such work "in or on" any kind of article, whether useful or not[720]. This, in turn, means that if a pre-existing PGS work is applied to, or incorporated in, a design of a useful article, its status as a PGS work remains untouched, unless the form of the artistic work is modified to fulfil the article's useful function[721]. In the latter case, the PGS work is turned into a useful article, which will be subject to the separability test for assessing the subsistence of copyright.

Therefore, availability of copyright protection for industrial designs that, in addition to being useful, incorporate artistic features, rests on the doctrine of "separability". The U.S. Copyright Office has traditionally employed two different tests for such an assessment: the physical and conceptual separability tests[722].

The notion of physical separability is easier to grapple with than conceptual separability: it applies to features that can be physically removed from the useful article by ordinary means, without altering the utilitarian aspects of the article[723].

The Office proposes the example of a decorative hood ornament on an automobile[724]. Likewise, the *Mazer* case – concerning the statuette of a dancer used as a lamp base – represents a clear example of how an artistic work (i.e. a sculpture), which is incorporated into the design of a useful article (i.e. a lamp) can be physically removed from the utilitarian aspects of the article and, nonetheless, be capable of standing by itself as a work of art[725].

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[719] 17 U.S.C. §101. Significantly, the statute does not identify useful articles as those articles whose *sole* intrinsic function is utility. Professor Ginsburg observes that, as a result, even a highly decorative item with a single utilitarian function falls within the definition of useful article and, therefore, has to meet the separability standard. *See* Ginsburg (2016), 10.

[720] 17 U.S.C. §113(a).

[721] Ginsburg (2016), 3.

[722] The Compendium of U.S. Copyright Office Practices (Third Edition 2014), 924 et seq. As noted below, the S.Ct. in *Varsity Brands* rejected this distinction.

[723] See *Chosun Int'l, Inc. v Crisha Creations*, Ltd., 413 F. 3d 324, 329 (CA2 2005).

[724] The Compendium of U.S. Copyright Office, 924.2 (A).

[725] *Id.*

The result under the physical-separability test may vary depending on how the object is made. Taking the *Mazer* case as an example: if the statuette is made first, before putting the lamp shade on top of it, it would be protected; if the artist makes the statuette as the lamp base itself ("*perhaps by putting wiring through the body of the dancer"*), it would not be protected[726].

Following the Copyright Office's traditional approach, conceptual separability requires, instead, that the PGS features of an article be capable of being "*imagined separately and independently from the useful article, without destroying the basic shape of that article"*[727].

Thanks to this conceptual exercise one should be able to perceive that the "*artistic features and the useful article could both exist side by side, as two fully realized, separate works (i.e. an artistic work and a useful article)"*, as is the case for, among others, an artwork printed on a t-shirt or a drawing on the surface of wallpaper[728].

U.S. courts have had difficulty in adopting a uniform approach towards *conceptual* separability, when called upon to draw the fine line between art and non-art[729]. It suffices to say that the Sixth Circuit in *Varsity Brands*[730] enumerated nine versions of the test for conceptual separability, in addition to its own.

As noted below in more detail, the Supreme Court in *Varsity Brands* abandoned the distinction between "physical" and "conceptual" separability. In the Court's view, "*the statutory text indicates that separability is a conceptual undertaking"*[731].

Following the Court's approach, separability does not require the useful article that remains after the artistic features have been imaginatively separated to be "*a fully functioning useful article at all, much less an equally useful one"*[732]. For such a reason, the physical-conceptual distinction is unnecessary[733].

6.1. The "Separability" Rule

The overarching justification underlying the "useful article doctrine" relates to the risk that copyright, with its low protection threshold and much longer duration, might well be preferred over patent protection as the primary means for protecting functional items[734].

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[726] Keyes (2008), 120.
[727] The Compendium of U.S. Copyright Office, 924.2 (B).
[728] *Id.*
[729] *Brandir Int'l, Inc. v Cascade Pac. Lumber Co.*, 834 F.2d 1142, 1142 (2nd Cir. 1987).
[730] At [476].
[731] *See* the S.Ct. in *Varsity Brands*, [15].
[732] *Id.*, [13].
[733] *Id.*, [15].
[734] This emerged as the legislative intent throughout the Copyright Act's legislative history. *See* Moffat (2013), 10.

This, in turn, would undercut the role of the patent system in fostering technological progress, considering that an invention would not be available for free copying as soon as the patent expires, but only 70 years after the patent holder's death.

The idea that there is a sharp boundary between copyright and patent is however blurred by works of industrial designs, i.e. works that serve both functional and aesthetic purposes. Clearly, these useful articles have a strongest' claim to copyright protection than purely functional items. Thus, the interaction between copyright and patent (i.e. design patent) has proved far more intricate in this area, turning on the "separability" of the aesthetic and useful aspects of an article.

The separability threshold sets a higher bar than the idea/expression "merger" doctrine, since the availability of alternative designs for the same article is not sufficient to assert copyright[735].

Upon closer inspection, one will notice that the notions of "physical" and "conceptual" separability are not expressed in the 1976 Copyright Act, but emerge from the legislative history accompanying the Act.

The "conceptual separability" notion was brought to the fore by the House Judiciary Committee on the occasion of the legislative revision leading up to the passage of the 1976 Copyright Act[736]. Hence, since the entry intro force of the 1976 Copyright Act, US courts have struggled to formulate a unitary and consistent "conceptual separability"-test. Pre-*Varsity* case law shows the protracted lack of agreement among courts on the conditions under which the copyrightable features of a useful article can be "conceptually" separated from the article itself[737].

The language used in different cases is not always easy to grasp or founded in the Copyright Act or legislative history[738]. To complicate the scenario even more, courts have sometimes blended their own approach with the multiple approaches taken in other cases[739].

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[735] Ginsburg (2016), 2.

[736] See the House Report of 3 September 1976, H.R. Rep. 94-1476 at 55.

[737] Various judicial approaches towards "conceptual separability" include: the "primary versus subsidiary" standard developed in *Kieselstein-Cord v Accessories by Pearl, Inc.* 632 F.2d 989 (2d Circ. 1980); the "superimposition" approach, developed in *Carol Barnhart, Inc. v Economy Cover Corp*., 773 F.2d 411 (2nd Cir. 1985); the "ordinary-observer" and the "temporal displacement" approaches developed by Judge Newman in his dissenting opinion in *Carol Barnhart;* the "design-process" approach first developed in *Brandir Int'l, Inc. v Cascade Pac. Lumber Co*., 834 F.2d 1142, 1151 (2d Cir. 1987) and subsequently employed in other cases, such *Pivot Point Int'l v Charlene Prods., Inc.* 372 F.3d 913 (7th Cir. 2004).

[738] For instance, "primary ornamental aspect" *vs* "subsidiary utilitarian function" or "inextricably intertwined".

[739] *See Pivot Point.*

The Supreme Court's decision in *Varsity Brands* addressed the question of which should be the most appropriate test for determining when the Section 101's requirements ("separate identification" and "independent existence") are met.

Yet, as Ginsburg suggests, "*the Court has not succeeded in untangling the 'knots' into which the lower courts have twisted themselves*"[740]. In particular, whilst clarifying the treatment of "surface decorations", *Varsity Brands* leaves a certain degree of ambiguity as to whether the overall form of an object can be protected.

Before getting to the core of the Supreme Court's decision, in the next section, attention will be given to the viewpoints and concerns expressed by some stakeholders, in response to the Sixth Circuit's decision in *Varsity Brands*.

It emerges that companies involved in various aspects of 3DP have been active, arguing for limited copyright in works of applied art, whereas right holders, such as commercial designers, pressed for broader protection of such works.

As far as the infringement analysis is concerned, this dispute highlights *"a conflict between the open culture of the Maker Movement, and the closed culture of copyright industries*"[741].

7. The Views of Stakeholders on the "Separability" Doctrine

On 2 May 2016, the Supreme Court accepted to review the ruling by the U.S. Court of Appeals for the Sixth Circuit in *Star Athletica, LLC v Varsity Brands, Inc.*

In July 2016, a range of private companies, organizations and associations involved in various aspects of 3DP submitted an *amicus brief* in support of petitioner Star Athletica arguing that copyright protection of a useful article's design features, without a stringent separability test, will stifle and dampen grassroots creativity – contrary to copyright general goal "to promote the progress of science and useful arts"[742] – and consequently have a negative effect on the economy[743].

The first argument put forward by 3DP companies in their brief to the Supreme Court is that legal uncertainty over "conceptual separability": increases barriers to entry; alters the balance between the interests of right holders and those of innovators, companies and users engaged in 3DP, by pushing the scope of copyright protection too far and bringing objects that should

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740 Ginsburg (2018).
741 Rimmer (2017), 54.
742 U.S. Constitution, Art. I, § 8, cl. 8.
743 *See* Brief of Amici Curiae *Formlabs Inc. et al.*, 17.

remain outside copyright within its reach; stifles innovation and creativity on the part of secondary users; increases copyright infringement lawsuits and related costs[744].

It bears repeating that most 3D-printed items are based on pre-existing designs. Users tend to share, download and customize designs of useful articles that are available on 3DP platforms. By doing that, they rely on an expectation that such designs are generally not subject to copyright protection.

3DP platforms, such as Shapeways or Thingiverse, host thousands of 3D digital models for a variety of articles that often combine both artistic and functional features. Sometimes, these articles are printed and sold through the same 3DP platforms[745].

As 3DP grows, such platforms may have to respond to takedown notices of alleged copyright infringement filed by the owners of designs of useful articles who believe such designs are copyrighted. Upon receiving such notices, platforms will have block access to allegedly infringing material.

Hence, both users and 3DP platforms that operate within the shadowy boundaries of "conceptual separability" could become frozen by fear of copyright infringement lawsuits. Therefore, from their perspective, determining the exact scope of copyright protection for the appearance of useful articles, and the related issue of infringement, is essential.

The brief further notes that "*consumer-driven 3DP is creative, innovative and greatly dependant on copying and derivation to which copyright may be the gatekeeper. Many 3D-printed products .. are primarily utilitarian but involve aesthetic elements. Sharing useful 3D designs, and the productive consumer output that results from that sharing and innovation, could be thwarted by an overbroad rule of copyright*"[746].

Hence, in support of this claim, the brief gives examples of creative industries that succeeded despite the lack of strong copyright protection. First, in the fashion industry, absent copyright protection for most clothing designs, designers always have to "*come up with new and more*

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[744] *Id.*

[745] *Shapeways, Inc.* prints and sells millions of 3D-printed objects through its platform and, therefore, it "*will often be called on to navigate the landscape of conceptual separability*". *See* brief on writ of certiorari to the United States Court of Appeals for the Sixth Circuit, in the case of *Star Athletica v Varsity Brands*, in support of Petitioner, submitted by *Public Knowledge*, *the International Costumers Guild*, *Shapeways, Inc.*, *the Open Source Hardware Association*, *Formlabs Inc.*, *Printrbot Inc.*, *the Organization for Transformative Works*, *the American Library Association*, *the Association of Research Libraries*, *the Association of College and Research Libraries* as *Amici Curiae* (July 2016), *available at:* https://www.publicknowledge.org/assets/uploads/documents/brief-star-athletica-merits.pdf.

[746] *Id.*, 16.

creative designs to stay ahead", most of the times "*borrowing ideas from existing clothing"*[747].

Similarly, in the food industry, comedy industry and the Internet-age typeface industry, the lack of broad copyright protection, and the related freedom to borrow from existing creations, considerably spur innovation[748].

Hence, the brief contends that design patent law is the "*proper avenue of protection"* for the appearance of useful articles: "*strictly requiring a clear showing of conceptual separability before permitting copyright in useful articles will ensure that intellectual property protection is channelled in the proper direction*"[749].

In response to Star Athletica and *Amici Curiae*, the Council of Fashion Designers in America, Inc. ("CFDA") – a non-profit trade association whose members include more than 500 well-known fashion and accessory designers – submitted an *amicus brief*, arguing that broader copyright protection is vital for the U.S. fashion industry to grow[750].

The brief notes that a finding in favour of Star Athletica would "*have a swift and deleterious effect on United States fashion industry, leaving fashion designers defenceless against copyists and, thus, undermining their incentive and ability to continue pursuit of creating innovative original designs*"[751].

The brief further considers that "*as with other creative industries, fashion design involves a substantial investment of money and time".* In contrast, *"copyists ... by avoiding the costs and risks of design, earn huge profits by selling their high-volume pirated designs at a discount to the original. The availability of these discounted copies results in a market reduction in sales of the original*"[752].

As noted in the next section, the Supreme Court ruled in favour of Varsity Brands and found that the design features were conceptually separable from the cheerleading uniforms themselves. The Court held that the Congress' intent was not to entirely exclude industrial designs from copyright (i.e. to channel IP claims into design patents), but to provide limited protection for certain features of industrial designs.

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[747] *Id.*, 23-25. This demonstrates the so-called "piracy paradox": rampant copying does not seem to hinder creativity in clothing, and indeed appears to facilitate that creativity.

[748] *Id.*, 25 et seq.

[749] *Id*., 38.

[750] Brief on writ of certiorari to the United Stated Court of Appeals for the Sixth Circuit in case *Star Athletica, LLC v Varsity Brands, Inc.* submitted by the Council of Fashion Designers of America, Inc. as Amicus Curiae in support of respondents.

[751] *Id*., 2.

[752] *Id*., 9.

"*Design patent and copyright are not mutually exclusive*": hence, "*approaching the statute with presumptive hostility toward protection for industrial design would undermine Congress' choice*"[753].

In any event, the Court further clarified that copyright does not extend to clothing designs generally; "*the shape, cut, and physical dimensions*" of a useful article are not as such eligible for protection[754]. Therefore, the Copyright Act protects two-dimensional or three-dimensional artworks even when incorporated into the designs of useful articles (such as clothing), but does not protect useful articles as such.

8. The Supreme Court's Decision in *Varsity Brands*

In its decision of March 22, 2017, in the *Varsity Brands* case, the Supreme Court elaborated a two-pronged test for implementing the "separate-identification" and "independent-existence" requirements under Section 101.

The Court found that "*a feature incorporated into the design of a useful article is eligible for copyright protection only if the feature (1) can be perceived as a two- or three-dimensional work of art separate from the useful article and (2) would qualify as a protectable pictorial, graphic, or sculptural work – either on its own or fixed in some other tangible medium of expression – if it were imagined separately from the useful article into which it is incorporated*"[755].

In sum, "*a feature of the design of a useful article is eligible for copyright if, when identified and imagined apart from the useful article, it would qualify as a PGS work either on its own or when fixed in some other tangible medium*"[756].

In fact, *"§101 is, in essence, the mirror image of §113(a). Whereas §113(a) protects a work of authorship first fixed in some tangible medium other than a useful article and subsequently applied to a useful article, §101 protects art fixed in the medium of a useful article*"[757].

Copyright protection extends to PGS works "*regardless of whether they were created as freestanding art or as features of useful articles"*[758].

Moreover, the Supreme Court rejected the petitioner's argument that a feature may "exist independently" only if it can "*stand alone as a copyrightable work* and *if the useful article from which it was extracted would remain equally useful"*[759].

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[753] S.Ct. in *Varsity Brand*, 17.
[754] *Id.*
[755] *Id.*, 1.
[756] *Id.*, 10.
[757] *Id.*, 8.
[758] *Id.*, 8

In fact, according to petitioner Star Athletica, the statute protects only artistic features that have "*no effect whatsoever on a useful article's utilitarian function*"[760]. Therefore, petitioner argued that Varsity's designs were not protected because they were "*necessary to two of the uniform's "inherent, essential, or natural functions" – identifying the wearer as a cheerleader and enhancing the wearer's physical appearance*"[761]. Petitioner also contended that the useful article with the artistic features removed (i.e. a plain white uniform) would not be equally or similarly useful.

The Supreme Court considered this sort of inquiry unnecessary. The focus of the separability inquiry should rest on the extracted PGS features and not on the useful article that remains after such features have been (imaginatively) removed[762].

In fact, the statute does not require that the remaining article be equally or similarly useful without such artistic features. Nor does it rule out an artistic feature of a useful article just because it makes that article more useful. This view would be inconsistent with the statutory text that protects "applied art"[763].

Hence, following this newly elaborated test to the case under scrutiny, the Supreme Court concluded that the "surface decorations" of the cheerleading uniforms were separable from the uniform itself; on the contrary "the shape, cut and dimensions" of the uniform were not protected[764].

Finally, the Court clarified that it was merely deciding the appropriate test for separability; it expressed no opinion, instead, on whether the designs in the case at hand met the originality requirement.

Justice Ginsburg, concurring in the Court's judgement but not in its opinion[765], stated that the designs elements at issue were not "designs of useful articles" in the first place; they first existed as standalone, copyrightable "pictorial" or "graphic" works, and were only subsequently *reproduced on* useful articles (i.e. the uniforms)[766].

Pursuant to Section 113(a) of the Copyright Act, Varsity Brands had the exclusive right to reproduce its own works of graphic art "in or on any kind of article, whether useful of otherwise", including a cheerleading uniform.

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[759] *Id.*, 12.
[760] *Id.*, 14.
[761] *Id.*, 13.
[762] *Id.*
[763] *Id.*, 14.
[764] *Id.*, 12.
[765] Ginsburg J, concurring in Judgement *Star Athletica.*
[766] *Id.*, 1.

The status of Varsity's designs as freestanding "graphic works" made the separability inquiry unwarranted and superfluous[767].

In his dissenting opinion, Justice Breyer posited that the preferable approach towards separability is to ask whether, when imagining or otherwise conceptualizing the claimed feature, the picture or image so conceived is or not a replica of the useful article itself[768].

By way of explanation, if one conceives the image of the shape of a spoon or a candleholder, such image necessarily replicates the useful articles itself (i.e. the spoon or the candleholder), because the article's shape is interwoven with the article as such, hence it is not separable[769]. Differently, the mental picture of a floral graphic design does not necessarily replicate the useful article to which it is applied, thus it is separable[770].

In the opinion of Breyer J., such an approach will avoid the shortcomings of the test devised by the majority, i.e. *"whether the design can be imagined as a "two- or three-dimensional work of art*"[771]. In fact, as Breyer J points out, "*virtually any industrial design can be thought of separately as a "work of art*"; it is nearly always possible to imagine industrial designs as independent works of art, as Marcel Duchamp's ready-mades reveal.

Justice Breyer's concern is that, following the majority holding, a substantial number of industrial designs will now gain copyright protection, since the fact that they can be imagined as independent works of art would suffice.

It must be noted, however, that the majority opinion aptly specified that, in order to qualify as a separate PGS work, "*a feature cannot be itself a useful article or a part thereof"*[772]. Accordingly, it is not possible to claim a "*copyright in a useful article merely by creating a replica of that article in some other medium"*[773]. As the next section outlines, this will limit the reach of copyright protection to certain design features only.

8.1. Overall Shape *vs* Individual Components

U.S. courts have long recognised that copyright protection does not extend to the design of a useful article as a whole, as was the case for a torso mannequin[774], a sculptural bicycle rack[775], a hookah's water container[776].

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767 *Id.*,1.
768 *Id.*, 5.
769 *Id.*, 5.
770 *Id.*
771 *Id.*, 6.
772 *Id.*, 7-8
773 *Id.*
774 *Barnhart*, [198].
775 *Brandir*, [200].

By the same token, the Copyright Office has found it impossible to consider "*the overall shape or contour of a useful article"* as conceptually separable, because "*removing it would destroy the basic shape of the useful article*"[777]. In other terms, the useful article's shape is one and the same; even where distinctive and aesthetically pleasant, it still accomplishes a utilitarian function.

The Supreme Court's decision likewise seems to rule out copyright to the overall shape or configuration of most useful articles, although aesthetically satisfying and valuable. Let's further elaborate on this statement.

On the one hand some of the Supreme Court's statements seem to undercut the patent/copyright divide, holding that the scope of protection of "applied art" could also cover some functional aspects. Interestingly, the Court rejected the petitioner's argument that Congress intended to categorically exclude industrial designs from the copyright realm, by channelling them into design patents[778].

In the Court's view, Congress' intent was rather to limit copyright protection to certain features of industrial designs. Such features may also contribute to determine the product's overall function, not being "solely artistic" features[779].

Following the Court's reasoning, one can in theory conceive an increased number of industrial designs – which are both aesthetic and functional – suddenly falling within the copyright's reach. Yet, a more careful examination of the Court's ruling indicates that this will not necessarily be the case, especially if the claimed design is not a PGS "feature", but the overall article's shape. This is so because PGS design elements that qualify for copyright protection cannot be the useful article itself or a part thereof[780].

Imaginatively removing the design's shape, and then applying it to another medium, most likely would replicate the useful article itself or part of it[781]. If this is the case, separability

[776] *Inhale, Inc. v Starbuzz Tobacco, Inc.*, 793 F.3d 446 (9th Cir. 2014). See also the 4th Circuit's decision in *Universal Furniture Int'l, Inc. v Collezione Europa USA, Inc*., 618 F.3d 417, 433 (4th Cir. 2010), stating that the superfluous, non-functional, and decorative elements of a piece of furniture can be identified separately from the utilitarian aspects of the furniture, whereas the entire shape of the furniture cannot.
[777] Compendium of U.S. Copyright Office (2014), 924(2)(B).
[778] According to petitioner's reasoning, Congress has determined that copyright, with its long term and wide scope of protection, as well as the absence of formalities, is not the appropriate vehicle to protect industrial designs.
[779] At [371].
[780] Assuming that the product's shape could be categorized as a PGS "feature" and that the Court's list of uncopyrightable elements ("the shape, cut and dimensions") is not a general and clear-cut exclusion. On this see Ginsburg (2018) noting that "*the announced rule that 'to qualify as a pictorial, graphic, or sculptural work on its own, the feature cannot be itself a useful article' appears to preclude the PGS status for the full shape of most useful articles*", with the exception of representational shapes.
[781] *Id.*

cannot be established, notwithstanding the fact that the article could be differently shaped and still achieve the same functional purpose.

As Ginsburg observes, the new test elaborated by the Supreme Court will lead to the same "representational art-favouring results" than those obtained under prior case law. Any shape of a useful article, even where expressive and representational, plays a role in attaining the product's function. However, following *Varsity Brands*, it is plausible to argue that an arbitrary or representational shape – regardless of whether it is "solely artistic" – more likely will gain copyright protection as compared to a shape that follows directly from the article's function.

On the facts, the Supreme Court confirmed that only the surface decorations ("the stripes, chevrons and colour blocks") applied to the cheerleading uniforms were PGS features eligible for copyright protection, not the overall design ("shape, cut, and physical dimensions") of the uniform.

It is however argued that the Court fell short of providing clear guidance on how its analysis should apply when the claimed design concerns the article's form or shape, rather than two-dimensional ornamental designs.

In their submission to the Court, 3DP companies made the point that a clear and predictable test for conceptual separability is indispensible. Arguably, the much-awaited decision from the Supreme Court in the *Varsity Brands* case has not brought complete clarity in such a convoluted domain.

8.2. Copyright Protection for Artistic Features Enhancing the Article's Utilitarian Function

Before the Supreme Court's ruling in *Varsity Brands*, a plausible view was that the Copyright Act protects only "*solely artistic*" features that have "*no effect whatsoever on a useful article's utilitarian function"*[782].

Accordingly, to the extent that design components, while attractive on their own, affect the useful article's function, they cannot be said to be conceptually separable. In fact, features that are incorporated into the article's utilitarian aspects cannot maintain separable identification and existence[783].

[782] S.Ct. in *Varsity Brands*, 14

[783] On the uncopyrightability of dual-nature design features (i.e. features that are simoultanesouly expressive and functional), *see* Buccafuso; Fromer (2017).

The Supreme Court's decision in *Varsity Brands* dismissed such an approach towards separability, by holding that "*an artistic feature that would be eligible for copyright protection on its own cannot lose protection simply because it makes the article more useful"*[784].

In other terms, because the Court rejected the view that "a *useful article must remain after the artistic features have been imaginatively separated from the article"*, the protectable features may also be those that play a certain role in the article's function[785].

This point can be best illustrated with examples drawn from different industrial sectors. The first example is taken from the footwear industry.

3DP is revolutionizing the way a company such as *Nike* designs and manufactures footwear. In fact, from 2013 until present, Additive Manufacturing technologies have been increasingly used to produce components of athletic shoes.

Nike has released two pairs of football boots ("Nike Vapor Laser Talon" and "Vapor HyperAgility") with a 3D-printed cleat plate that provides optimal traction on football turf, helping the football athletes to decelerate and change direction quickly[786].

Thereafter, the company entered into collaboration with the gold-medal winning American sprinter Allyson Felix, with the aim of creating a new sprint spike built specifically for the races' requirements[787]. Hence, in 2016, Nike created the "Zoom Superflyknit" racing shoe, which was specifically adapted to the athlete's stride, biomechanics and footwear preferences.

In the near future, Nike intends to market 3D-printed, custom-made athletic shoes. The company has announced that it intends to use 3DP for manufacturing new cushioning systems tailored to an individual's need[788].

Moreover, Eric Sprunk, Nike's Chief Operating Officer, announced that, based on what the company is already doing with Flyknit, "*the ability for consumers to 3D-print a pair of sneakers is close at hand*"[789]. Consumers will soon have the opportunity to purchase, from Nike's official websites, CAD files embedding the designs of sneakers, and then 3D-print them either in their homes or at a Nike store[790].

A pair of athletic shoes is a useful article, since it enables the wearer to perform a certain activity, such as walking, running, and other athletic performances, while wearing it.

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[784] S.Ct. in *Varsity Brands,* 14.
[785] *Id*., 14-15.
[786] *See:* http://news.nike.com/news/nike-debuts-first-ever-football-cleat-built-using-3d-printing-technology.
[787]*See:* http://news.nike.com/news/allyson-felix-track-spike.
[788] McKenna (2016).
[789] Bain (2015).
[790] *Id.*

Nonetheless, the footwear design may also incorporate significant ornamental features. Hence, in principle, some of its features may be protected through copyright law as a work of applied art.

What to treat as aesthetic or ornamental, as opposed to functional, for purposes of footwear design may be extremely complex. Certain design elements of Nike footwear may be regarded as purely functional, whereas some others as purely expressive.

Clearly, shoes components such as a cleat plate, a particular cushioning system[791], or a new sprint spike are purely functional, since they affect the performance of the footwear and serve mechanical ends, such as running faster, enhancing traction or preventing injury.

These elements are not eligible for copyright protection as a matter of law. At maximum Nike should apply for a utility patent, provided that the requirements for protection are met.

Contrariwise, a logo (such as the Nike's "Jumpman" logo), in principle, may be regarded as a graphic work applied to a useful article[792]. As we have noted, pursuant to Section 113 (a) of the Copyright Act, the owner of copyright in a PGS work has the exclusive right to reproduce it "in or on" any kind of article, whether useful or otherwise.

Hence, it may well be that some design elements, which pre-existed as an independent work of art, will continue to enjoy copyright protection after being applied to, or incorporated in, the overall shape of the footwear.

Yet, other design elements – such as a zipper or a strap – may be both functional and expressive. The same may be true for a distinctive pattern etched on the bottom of, or underneath the, shoe: apart from being visually appealing, it also provides added traction for the athlete to avoid slipping during running.

Following *Varsity Brands*, copyright protection is not excluded *tout court* for those PGS features that contribute to the article's function. In the example under scrutiny, the question should be rather answered whether the zipper, the strap, and the distinctive pattern incorporated in the footwear design "*would have been eligible for copyright protection …* (as PGS works had they) *originally been fixed in some tangible medium other than a useful article*[793].

[791] In 2006, Nike has sued Adidas-Salomon AG for patent infringement, before the U.S. District Court for the eastern District of Texas, claiming that the defendant has copied Nike's "Shox" cushioning, which was patented with the U.S. Patent and Trademark Office. *See* http://news.nike.com/news/nike-files-patent-infringement-action-against-adidas.

[792] Note that in principle trademarks and logos can qualify for copyright protection under U.S. law, although marks composed of words, short phrases or common designs may not be sufficiently original to be protectable.

[793] S.Ct. in *Varsity Brand*, 8.

This is to show that, in the wake of *Varsity Brands*, an athletic apparel industry, such as Nike, have an increased opportunity to claim that the artistic features of its footwear support a valid copyright under U.S. law, even though they were first created as features of useful articles, rather than freestanding art[794].

The second example is taken from the car-manufacturing sector. The start-up Divergent 3D released its first 3D-printed sports car ("the Blade") in 2015, and has continued to use 3DP methods to manufacture car components ever since[795].

In 2017, the company released the "Batship Sports Car", which was built using metal powder fused by laser ("quad-laser direct metal laser sintering") [796].

Once again, whether the two cars at hand contain protectable design features is a thought provoking issue. In *DC Comics v Towle*[797], the District Court found that Batman's vehicle – the Batmobile – contains purely expressive design elements that can be separated from, and exist independently of, the underlying car.

In particular, "*the 1989 Batmobile's entire frame, consisting of the rear exaggerated, sculpted bat-fin and the mandibular front, is an artistic feature that can stand on its own without the underlying vehicle*"[798].

Hence, "*the underlying vehicle would still be a car without the exaggerated bat features. Further the Batmobile's wheels each contain a hubcap containing a bat sculpted from metal, which can literally stand on its own without the underlying wheel*"[799].

Similarly, the high-tech super-cars manufactured by Divergent 3D are entirely distinguishable from an ordinary automobile. Each and every car component – i.e. the window frame, the hood, the doors, the bumpers, the headlights, the taillights, and the trunk – has some exaggerated features. It can be argued, however, that some of these features are not purely ornamental, but serve also functional purposes, such as increasing aerodynamic performance and speed.

Before the Supreme Court's decision in *Varsity Brands*, one could have claimed that the expressive aspects of the car that are influenced by utilitarian concerns are screened out of copyright protection. Accordingly, copyright protection should only cover the purely

[794] Note that this may be true even if the apparel industry does not use 3DP as a manufacturing technique.
[795] *See* http://www.divergent3d.com/.
[796] For a picture of the "Batship" vehicle, *see*: http://thetechlicense.com/2017/01/07/batshit-3d-printed-sports-car-lazer-melted-metal/.
[797] *DC Comics v Towle* 989 F.Supp. 2d 948 (C.D. Cal. 2013). *See* below the Ninth Circuit's decision in *DC Comics v Towle*, 802 F.3d 1012 (9th Cir. 2015), in which the Court confirmed that the *Batmobile* is itself eligible for copyright protection as a character.
[798] *Id.*, [970].
[799] *Id.*

expressive PGS features of the automobile, to the extent that such features can stand on their own without the underlying car *and* the underlying vehicle can still be a an equally functional car without such features.

Following the Supreme Court's decision in *Varsity Brands*, whether Divergent 3D's cars would or would not be equally or similarly functional without the removed ornamental features is no longer relevant.

Arguably, the PGS features of such cars are now entitled to copyright protection, even though they were first created as features of the designs of useful articles, making the vehicles more useful.

9. The "Left Shark" Controversy

While Katy Perry was performing at the 2015 Super Bowl show, a backup dancer wearing a shark costume ("Left Shark") gave an improvised performance. Since then, the character of the Left Shark achieved widespread popularity and became a real "cultural phenomenon"[800].

The artist Fernando Sosa created a printable digital model of a Left Shark figurine, and offered it for sale on Shapeways**.** On February 3, 2015, Katy Perry's lawyers sent a letter to Shapeways – presented as a cease and desist letter – demanding the 3D model be taken down. The lawyers argued that the unauthorized display and sale of the figurine infringed copyright in the shark costume that Katy Perry owned[801]. In response, Professor Christopher Sprigman, from NYU, who represented Sosa, sent a letter to Katy Perry's lawyers, pointing out that the legal merits of the copyright claim seemed very weak[802].

First there was a question as to whether a costume may be copyrightable. In Sprigman's opinion, courts have generally excluded this possibility, due to the fact that costumes are useful articles. Hence, there is no reason why the Left Shark costume should be treated differently[803].

[800] Katz (2016).
[801] Rimmer (2017), 56.
[802] Sosa (2015).
[803]The question should rather be answered whether, under the separability test, the expressive features of the *Left Shark* costume could be identified separately from, and exist independently of, its utilitarian aspects. *See*, *inter alia, Animal Fair Inc. v Amfesco Industries. Inc. 620 F.Supp 175* (D.C. Minn. 1985), *aff. d without op*., 794 F.2d 678 (8th Cir. 1986), the courts upheld copyright in a slipper resembling a bear's foot, because all of the design aspects of the plaintiff's slipper (i.e. "*the impractical width and shape of the BEARFOOT sole, the artwork on the sole, the particular combination of colours, the profile of the slipper, the stuffed aspect of the slipper, and the toes"*) were unrelated to the slipper's function. *See* also Copyright Office, Library of Congress, *Policy Decision: Registrability of Costume Designs* (29 October 1991), available at: https://www.copyright.gov/history/mls/ML-435.pdf.

Second, it was not clear who was the copyright owner, if it were to exist. Did Katy Perry design the Left Shark costume herself? Did the designer of the costume transfer any copyright interest to Katy Perry?

In a similar vain, *Shapeways*'s lawyer, Micahel Weinberg, was sceptical that the lawyers' letter was "backed up by any law" [804]. He presented the same arguments as Professor Sprigman, and he further contented that the letter sent by Katy Perry's lawyers to Shapeways was not a properly formatted DMCA takedown notice: a reference to the allegedly infringing work was missing and, more importantly, the person who sent it (Katy Perry) was not the actual owner of the copyright in the costume.

Fernando Sosa was not intimidated by the controversy. As Rimmer points out, Sosa is "*offering a wide range of versions of Left Shark on his Political Sculpture site. As well as a traditional 'Left Shark', Sosa has also a 'Drunk Shark', a 'Pink Drunk Shark', a 'Customised Left Shark', a 'Cease and Desist Left Shark', a 'Left Sharknado', 'Come at me Bro – Left Shark', and 'Left Shark Lawyer', with a moustache"*[805].

The present dispute raises various copyright-related issues, including proof of ownership, and the exercise of "*rights and freedoms under the broad and flexible defence of fair use, and the First Amendment"*[806].

For present purposes, it is worth noting that, following the Supreme Court's ruling in *Varsity Brands*, it is possible that some of the design features of the Left Shark's costume would qualify as protectable PGS works, either on their own or when fixed in some other tangible medium of expression[807].

It is, however, questionable whether a costume shall be categorized as a "useful article" in the first place. Arguably, a costume serves to portray its own appearance, as distinguished from clothing that also serves the utilitarian functions of clothing the body, keeping the person warm, protect from rain or sun, etc[808].

With this background in mind, we now turn to address other issues that may arise in the 3DP landscape.

10. Are We in the Presence of a Useful Article? The Case of Toys

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[804] Weinberg (2015).

[805] Rimmer (2017), 59.

[806] *Id*.

[807] S.Ct. in *Varsity Brands*, 10.

[808] For example, the sculpted heads on a Halloween costume design were deemed separable from the garment's utilitarian purpose. *See Chosun Int'l, Inc. v Crisha Creations*, Ltd., 413 F. 3d 324, 329 (CA2 2005).

Classification of an article as an uncopyrightable "useful article" or a "PGS work", within the meaning of Section 101 of the Copyright Act, is often not obvious must be determined on a case-by-case basis.

We take the example of toys, which are items that can be easily 3D-printed[809]. Let us imagine that a toy manufacturer wants to sue for copyright infringement a third party that produces and sells 3D-printed copycat toys.

Before initiating litigation, the toy manufacturer should carefully consider whether its own toys are PGS works or articles having an intrinsic utilitarian function. In fact, in the former case, there is no need to carry out a "separability" inquiry.

Numerous courts have recognised that toys can qualify for copyright protection as PGS works, "*even where there is some mechanical or functional element to the toy*"[810]. The Sixth Circuit held that toy airplanes were not uncopyrightable useful articles, because – on par with a painting of an airplane – they do not have an intrinsic function other than to portray real airplanes[811].

By the same token, doll clothes were found protectable because they do not preform a useful function; unlike humans, dolls do not wear clothes because they "*feel cold or worry about modesty*"[812]. In this view, a toy is never a "useful article" and is always subject to copyright[813]. The most obvious counterargument is that toys are useful articles because they enable children to play with them[814]. Yet, "play" is a too vague term: one must distinguish what is (not intellectually) utilitarian about "play".

Arguably, the preferable view is that whenever a toy represents something – whether a doll, a stuffed animal, a toy truck, etc. – should not be categorized as a useful article, since it merely serves the function to portray its own appearance. On the contrary, other kind of "toys", such as sporting equipment, most likely will be treated as useful articles, since they accomplish additional utilitarian purposes.

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[809] To give an example, the company *Mattel* will soon release its own consumer $300 3D printer, which is an updated version of the 1960s manufacturing kit "*ThingMaker*", in order to enable children and parents to print their own plastic toys at home.

[810] *Lanard Toys Ltd. V Novelty, Inc.*, 2010 WL 1452527 (April 13, 2010); *Hasbro Bradley, Inc. v Sparkle Toys, Inc.* 780 F.2d 189, 192 (2d Cir. 1985).

[811] *Gay Toys, Inc., v Buddy L Corp*., 703 F.2d 970, 973 (6th Cir. 1983).

[812] *Mattel, Inc. v MGA Entertainment, Inc*., No. 11-56357 (9th Cir., Jan. 24, 2013).

[813] *Lego A/S v Best-Lock Constr. Toys, Inc.* 874 F.Supp.2d 75, 97 (D. Conn 2012).

[814] Occasionally courts have taken the wrong view that a toy is a useful article because it permits "*a child to dream and to let his or her imagination soar*". *Gays Toys, Inc. v Buddy L Corp.,* 522 F.Supp. 622, 625 (E.D. Mich. 1981).

As discussed, if toys and figurines qualify as PGS works, then the traditional copyright analysis is carried out: do they contain creative elements that are sufficiently original for copyright purposes?

One should thus filter out the unprotected elements, as opposed to the artistic aspects, of a toy[815]. For example, in examining whether the *Lego* figurines were copyrightable, the District Court of Connecticut took the view that the figurines' "*straight legs*" were uncopyrightable, whereas the "*trapezoidal shape of torso*", the "*square, block-like set of shoulders*" and the "*arms extending from upper side of trunk, slightly below where shoulder starts*" were sculptural features eligible for protection[816].

Therefore, while certain toys incorporate little more than an unprotected idea, some others contain unique elements of expression to which copyright may attach[817].

For example, in *Mattel, Inc. v MGA Entertainment,* the Ninth Circuit found that the claimant couldn't claim a monopoly over "*fashion dolls with a bratty look or attitude, or dolls sporting trendy clothing*", because these are all unprotected ideas[818].

Visually depicted characters, such as cartoon characters, may qualify for copyright protection as PGS works under the Copyright Act. Goldstein considers that copyright in visually depicted characters implies a wider range of protection than does copyright in other forms of PGS works. Indeed, "*a character can take on a life on its own and thus be protected against copies that adopt postures, settings and attitudes far removed from anything in the author's original depiction*", i.e "*against any unauthorized exploitation of their personality and appearance*" in two- or three-dimensional form[819].

In this regard, it is worth recalling the Ninth Circuit's decision in *Comics v Towle*[820]. The difficulty with the present case was in determining whether Batman's vehicle – i.e. the Batmobile – should be considered as an automobile (i.e. a useful article), whose design is not protectable, or as a copyrightable character.

The Ninth Circuit, in upholding the District Court's finding[821], took the view that the Batmobile can itself attract copyright protection as a fictional character. The Batmobile is substantially different from an ordinary automobile. It displays "*unique elements of expression and consistent, widely identifiable traits"*, making it "*especially distinctive and*

[815] Section 101 of the Copyright Act provides protection for works of artistic craftsmanship, insofar as their form but not their mechanical or utilitarian aspects are concerned.
[816] *Lego A/S*, [101].
[817] On this, see also Gupta; Tarlock (2013), 5.
[818] *Mattel*.
[819] Goldstein (2017), § 2.11.1.
[820] *D.C. Comics v Towle*, 802 F.3d 1012 (9th Cir. 2015).
[821] *Comics v Towel*, 989 F. Supp. 2d 948 (C.D. Cal 2013).

sufficiently delineated to be recognizable as the same character whenever it appears"[822]. Hence, the defendant's vehicles were found to be derivative works of the original fictional character.

Having made these preliminary remarks, we now turn to explore three different controversies that occurred in recent years, involving digital design files uploaded onto 3DP platforms.

In 2011, Thomas Valenty uploaded onto Thingiverse CAD files embedding figurines inspired by the table top war game "Warhammer", for other users to download for free. Valenty created the 3D-printable models from scratch, using specialised software[823].

The files came to the attention of Games Workshop – the U.K. company that produces and distributes Warhammer – which sent a takedown notice to Thingiverse under the DMCA 1988, claiming copyright infringement.

Thingiverse removed the files, although "*it is unclear whether these files actually infringed copyright, since the figurines seemed to be a kind of fan art inspired by Warhammer, rather than a direct copy of official Warhammer figurines*"[824].

In fact, the figurines "*may well have been better characterized as non-infringing original works inspired by Warhammer pieces than as infringing copies or derivative works of Warhammer pieces*"[825].

Hence, the controversial issue was whether Valenty's digital design models were merely reproducing the style of the game (i.e. uncopyrightable ideas), rather than original expression[826].

Another takedown notice controversy occurred in January 2013, when Moulinsart – a company that owns copyright in the works of Hergé and, in particular, in the famous comic book series of *Tintin* – issued a DMCA notice to Thingiverse, ordering the platform to take down the CAD model of Tintin's cartoon rocket moon[827].

The CAD model at stake was based on the drawings that appear in Hergé's published works "Destination Moon" and "Explorers on the Moon"[828].

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822 *Id.*, [967].
823 Rimmer (2017), 74.
824 Daly (2016), 41.
825 Brean (2013), 812.
826 Thompson (2012).
827 The images of the allegedly infringing CAD model and of the original graphic work can be found in: Kenny (2013), available at: http://animationanomaly.com/2013/02/20/how-3d-printing-will-impact-animation-off-screen/.
828 *See* Daly (2016), note 302, 41. *See* also Yanisky-Ravid; Kwan (2017), 103.

Finally, the third controversy occurred in 2013, when Fernando Sosa created a CAD model for the Iron Throne iPhone5 dock, inspired by images taken from the TV series "Game of Thrones".

The owner of the rights in the Game of Thrones series, i.e. the company HBO, sent a letter to Sosa, expressing concerns that the 3D-printable iPhone dock infringed copyright in the *Iron Throne* design[829].

Hence, when Sosa asked to be granted a licence, HBO replied in the negative, stressing that his 3D-printed products did not have the quality normally required for licensed merchandise[830].

The dispute at hand raises issues about whether the Iron Throne ceremonial chair should be considered as a useful article (i.e. a chair), whose PGS features are eligible for copyright protection, subject to the separability doctrine.

The alternative option would be to consider the Iron Throne chair as a fictional character (i.e. as a PGS work), to the extent that it exhibits distinctive, consistent and widely identifiable traits and attributes that allow justifiably to speak of a "character"[831].

11. CAD Files as Useful Articles

The Copyright Act defines a "useful article" as "*an article having an intrinsic utilitarian function that is not merely to portray the appearance of the article or to convey information*"[832].

A vexing issue is whether a CAD file, as such, shall be regarded as a "useful article". As noted by Osborn, the confusion about whether a CAD file is a "work", as opposed to a "copy" of such work, leads to a wrong analysis on the subject of useful articles[833].

Arguably, the inquiry carried out by some academics on whether a CAD file constitutes a "useful article", within the meaning of the copyright statute, is based on the wrong assumption that the file as such – as opposed to the object it embeds – is the article whose usefulness should be examined.

On closer inspection, it emerges that a CAD file is, indeed, a "file " embedding a string of data that define the design of an object. A CAD file serves as a medium for recording a design, which can be a copyrightable expression, if the conditions for protection are met.

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[829] Rimmer (2017); Hurst (2013).
[830] *Id*.
[831] See *DC Comics v Towle,* [298].
[832] 17 U.S.C. § 101.
[833] Osborn (2017), B, 39.

The CAD file always needs to be processed by software. Then, depending on the computer program that is run, the CAD file may either be rendered into a visual image that appears on a computer screen or be converted into coded instructions for the printer: in both cases the works embedded in the file (i.e. the design drawing and the software code) are not useful articles.

In the first scenario, the CAD file is processed by CAD software that enables visualizing the image of the design on a computer screen. Hence, on par with other PGS works, the information is perceivable by humans, albeit with the aid of software.

The design drawing embedded in the CAD file is not disqualified by the useful article doctrine[834]. It can be assimilated to a blueprint or "technical drawing", which serves the functions to "portray the appearance" of the article and to "convey information" about how to manufacture it [835].

It should, however, be noted that the protection conferred on the design drawing does not extend to the underlying object, if such object is a useful article.

In fact, pursuant to Section 113(b), the Copyright Act "*does not afford to the owner of copyright in a work that portrays a useful article as such, any greater or lesser rights with respect to the making, distribution or display of the useful article so portrayed than those afforded to such works under the law*".

Therefore, as Simon puts it, protection of the document itself does not "*prevent a third party from creating a utilitarian object based upon the drawing, in cases where no unauthorized reproduction of the drawing are subsequently used in creating the copied utilitarian object*"[836].

Hence, while the drawing itself may be copyrighted, control over the blueprint does not result in control over the object. Copyrightability of the useful article portrayed in the drawing will turn on the "separability" doctrine (i.e. whether the utilitarian aspects of the object are separable from its aesthetic features).

In the second scenario, the CAD file is processed by CAM software that generates the coded instructions for the printer to follow (the GCODE file). The newest and best CAM software includes some printing control features (i.e. an application software that serves to connect the

[834] *See* also Reitinger (2015), 136.

[835] Courts have long recognised that technical drawings or architectural plans are not useful articles, as they serve the function to convey information about how to construct an object or a building *Eales v Environmental Lifestyles, Inc.* 958 F.2d 876 (9th Circ. 1992) (architectural plans); *Infodeck, Inc. v Meredith-Webb Printing Co.*, 830 F. Supp. 614, 623 (N.D. Ga. 1993) (technical instructions); *Forest River, Inc. v Heartland Recreational Vehicles*, LLC, 753 F. Supp. 2d 753, 758 (N.D. Ind. 2010) (technical drawings of a recreational vehicle).

[836] See also, Grimmelmann (2014), 695.

computer to the printer and enables the user to control the manufacturing process). The tool path information contained in the GCODE file, once sent to the printer, is read and executed by a firmware loaded into the "brain" of the printer itself[837].

In such a case, the GCODE file that instructs the machine on how to build the object is not a useful article, since it serves the purpose "to convey information" to the printer.

In applying the useful article doctrine to CAD files, Dolinsky argues that "*while architectural plans and other technical drawings convey information to human beings, who then build the object themselves or with the help of machines, CAD files send coded information directly to a 3D printer, which then constructs the object without human intervention*"[838].

Therefore, the question should be answered whether sending coded instructions to a printer could likewise be regarded as "conveying information", within the meaning of Section 101 Copyright Act, even if the recipient of such information is a machine and not a human being. According to Dolinsky and Osborn the answer to this question should be in positive[839].

If this view is correct, then there is no reason to carry out the "separability" inquiry[840]. It follows that Dolinsky's statement that the CAD drawings would be either physically or conceptually separable from the code component is incorrect[841].

As a conclusion, to ask whether the overall function of a CAD file (i.e. to send instructions to the printer) disqualifies the file itself from protection, for being a useful article, is not the right approach to the subject matter[842]. The focus should rest on the works embedded in the CAD file, which, in theory, can be assimilated to a graphic work eligible for copyright protection under Section 102 Copyright Act and/or to computer software.

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[837] Bell (2015), 71.

[838] Dolinsky (2014), 633.

[839] *Id.*, 652, note 348, noting, however, that the question whether computer code conveys information has not yet made it to the courts in the copyright context. *See* also Osborn (2014), 833. On closer inspection it emerges that the Third Circuit gave a positive response as far back as 1982, in the *Apple v Franklin* decision, concerning the copyrightability of operating systems software expressed in object code (i.e. software that conveys information to machines, not human being).

[840] Dolinsky (2014), 653.

[841] *Id.*, 653-654.

[842] Cuzella (2015), 384.

Chapter IV

Three-Dimensional Printing and European Design law

Introduction

This chapter explores whether design protection is available, under the current European regulatory framework, for designs that are computer-created by means of CAD software, and if so under what circumstances. The key point is whether the appearance of a product, embedded in a CAD file, could be regarded as a protectable element under existing legislation.

To this end, it begins with an inquiry into the concepts of "design" and "product", set forth in Article 3 of the Community Design Regulation No. 6/2002 ("CDR"). Then, it considers the EUIPO's practice of accepting 3D digital representations of designs.

The inquiry goes on to illustrate the implications that making a CAD file available online might have. It suggests that the act of uploading a CAD file onto a 3D printing platform may be tantamount to a disclosure for the purposes of triggering unregistered design protection, and for appraising the state of the prior art.

It also argues that, when measuring the individual character requirement, the notion of "informed user" and "the designer's degree of freedom" may need to be reconsidered in the future. The following part touches on the exceptions to design protection, with a special focus on the repairs clause set forth in Article 110 CDR.

The concluding part critically assesses various policy options that have been put forward to address the consequences of 3DP for design law. In particular, it explores different measures that could be implemented to prohibit the unauthorised creation and sharing of CAD files embedding design-protected products.

1. The Legal Framework for Design Protection: National, European and International Registration Systems

The EU framework for design protection is composed of two legal instruments: 1) the Directive 98/71/EC on the legal protection of designs (the "DD"); and 2) the Council Regulation (EC) No 6/2002 on Community Designs (the "CDR").

The substantive provisions of the Directive and the Regulation are identical. Both instruments provide for a system of registered designs. The registration of designs at EU level is administered by the EUIPO, which is based in Alicante, Spain, and which also administers Community trademarks. Moreover, the CDR has put in place a system of unregistered designs.

Therefore, at present, it is possible to gain design protection for the whole of Europe under the Registered Community Design Right (RCD), a right that lasts for 25 years, based on 5 year renewable periods, as well as under the Unregistered Community Design Right (UCD), an anti-copying right that automatically offers protection for three years[843].

Once the request for registration is filed, the EUIPO carries out an *ex officio* examination of the two absolute grounds for non-registrability, set forth in Article 47 CDR. Namely, the Office verifies whether the subject matter of the application corresponds to the definition of a design foreseen in Article 3(a) CDR, and whether it is not contrary to public policy and accepted principles of morality. Accordingly, the registration procedure is kept to a minimum. Compliance with the novelty and individual character requirements will only be examined at a second stage, if a third party submits an application for a declaration of invalidity.

It is also worth noticing that the EUIPO examines whether the appearance of the "product" is disclosed in the light of the design itself. Whether the product is actually made or used, or can be made or used, in an industrial or handicraft fashion, is not taken into consideration[844]. In fact, there is no requirement to submit a specimen of the claimed RCD.

This, in turn, implies that a person can: create a CAD file for a product by means of CAD software; include in the application for a RCD an image taken from such a CAD file; obtain a design registration covering the product design represented therein, irrespective of whether the product is actually manufactured or not.

This leads to the outcome that, although the entire regulatory framework in EU design law is structured on the concept of "product", a design is protectable regardless of whether a product comes into existence or not. Accordingly, legal protection does not depend on whether designs represented as CAD models exist as tangible articles or not. We will return to this later[845].

Even though the transposition of the DD into Member States' legislations has been mostly straightforward, it has sometimes given rise to some interpretation difficulties, in relation to concepts such as "informed user", "individual character" or "visible during normal use", whose meaning is not altogether clear yet[846]. Design protection of spare parts, and the duration of protection thereof, still accounts for a glaring discrepancy between national legislations. All these issues are analysed below[847].

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843 Noteworthy, designers that have first filed an application for a national registered right could rely on the national filing dates, in order to obtain a priority right for a RCD.

844 EUIPO Guidelines for Examination of Registered Community Designs, Examination of Applications for Registered Community Designs (01/10/2017), at 4.1, from now on referred to as "EUIPO Guidelines".

845 *See* infra.

846 *See* the EC Legal Review on Industrial Design Protection in Europe MARKTD2014/083/D, 154.

847 *See* infra.

Noteworthy, the EU legislator has succeeded in achieving a higher level of harmonization through the adoption of the CDR, whose expressed aim is to introduce a Community-wide design right[848].

With the introduction of the RCD, the national registration systems have been nonetheless retained. Hence, it is still possible to file multiple parallel applications to register a design at the national offices of different Member States, as an alternative to file a unitary application to obtain a RCD.

The recent study conducted by the EU Commission in the *Legal Review on Industrial Design Protection in Europe* ("the Legal Review")[849] highlights the overall benefits associated with a pan-EU registration system, as compared to multi-jurisdictional applications, in terms of reduced registration and administration costs, less delay in the application procedure, and overwhelming filing/grant success rate[850]. Multiple national applications, instead, may prove extremely expensive if the designated countries have high registration fees, and quite commonly incur in a delay[851].

It is also worth remembering that the Hague system for the international registration of industrial designs supplements the national and European registration systems[852]. The Hague system provides a practical solution for registering designs in different states and/or intergovernmental organizations (such as the EU) that are members of the Hague Union, through filing a single international application with WIPO.

Unlike the system for registering trademarks at the international level, no prior national or regional application or registration is required. When WIPO receives the application, it checks compliance with formal requirements only, such as the payment of the fees and the quality of the design's representation.

Once formal examination by WIPO has been concluded, and the design has been registered and published on the WIPO's International Designs Bulletin, it is then up to the designated office to check the publication and to ascertain whether the design at stake complies or not with national legislation on *substantive* grounds, given that the formal grounds have already been examined by WIPO. In case of non-compliance, the designated office has six months to issue a notice of refusal to WIPO.

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848 Recital 4 and 5 CDR.

849 Legal Review MARKTD2014/083/D.

850 *Id*., 24.

851 *Id*., 27.

852 The Hague system comprises two international treaties: the Geneva Act of July 2, 1999, and the Hague Act of November 28, 1960, which are totally independent of each other. The EU has adhered to the 1999 Geneva Act as an intergovernmental organization in 2008. Hence, it is frequent to indicate the EU as the designated Contracting Party via the Hague system. In such a case, the registration will cover the territories of all EU Member States.

According to the Legal Review it seems that, for the time being, the best policy option would be to keep the national, EU and international systems of registration in place[853]. This would preserve the possibility for applicants, especially SMEs, to have a choice and opt for the most convenient solution, in relation to geographic scope and costs.

At the same time, the report identifies a number of procedural areas where divergences among national offices are still significant. This is a highly relevant issue, as procedural norms may have a considerable impact on the scope of design protection; the current national rules governing the graphic representation of the design that is included in the application form serve as an example[854].

The discussion on procedural rules that need further harmonization will continue below. It should be noted, in this regard, that the key recommendation put forward by the Legal Review is that national offices should align their practices with the Convergence Programme run by the EUIPO[855].

2. Non-Harmonized Procedural Rules

Existing practices followed by national IP offices reveal glaring divergence on fundamental procedural issues, or even the absence of any written guidance on many important topics.

A matter of concern is the lack of uniform rules concerning the graphic representation of a design, which is submitted at the time an application for registration is filed. This is not surprising, given that the formulation of such rules is a matter left to Member States' competence.

For the purposes of the present analysis, it is worth noticing that a number of national IP offices do not accept computer-aided representations[856]. The EUIPO has implemented a tool for uploading CAD representations; this practice, however, is not yet accepted in all EU Member States[857].

The main concern is that a 3D representation will narrow the scope of protection, by providing a more accurate representation of the design, and detailing features and qualities that are not necessarily visible in a line drawing.

As a result, the Legal Review suggests introducing 3D representations as an optional registration tool, which would leave the door open for applicants who prefer more traditional

853 Legal Review MARKTD2014/083/D, 54.
854 *Id.*,154.
855 *Id.*, 14. The Convergence Programme is available at: https://www.tmdn.org/network/converging-practices.
856 Legal Review MARKTD2014/083/D, 100.
857 *Id.*

methods of registration[858]. Another reason for advocating a non-mandatory solution is that national offices would not be obliged to implement a new, expensive technology[859].

By the same token, there is no harmonized approach across the EU towards the significance of dotted or broken lines in a design application.

In accordance with the EUIPO Guidelines, broken lines can be used for two different purposes: first, to exclude protection for certain features (i.e. if the claim is limited to the shape of the design, broken lines can be used to suggest that ornamentation applied to the design shall not be protected); second, to indicate the parts of the design that are simply not visible in a particular view[860].

However, the Guidelines are permissive and not determinative. There is no mandatory rule on how to interpret features demarcated in broken lines. National authorities must consider each registration on its own merits.

For example, the UK Court of Appeal in *Samsung v Apple*[861] argued that, if dotted lines were used to disclaim a feature, it would be exactly the same not to include such a feature at all in the application. In other terms, if dotted lines serve to demarcate a feature that is out of the scope of protection, it would not make the difference if the same feature were absent altogether.

Arguably, this is not the correct approach towards the role of dotted or broken lines. In fact, if a feature is included in the application, whilst making it clear that it should not form part of the design for which registration is sought, such a feature should be filtered out when assessing infringement by a third party's design. Hence, most likely, the inclusion of a disclaimed feature will weigh against a finding of infringement.

On the contrary, if a feature is absent altogether, another design that has such a feature most likely will be deemed to be different. In other words, the fact that a feature is not present at all in the design application, arguably, gives a narrower scope of protection, pointing towards a finding of non-infringement.

It appears from the above that the lack of clear and uniform procedural rules governing graphic representations might have an impact on the substantive framework, i.e. on the scope of protection in both invalidity and infringement actions.

[858] *Id.*, 102.
[859] *Id.*
[860] EUIPO Guidelines, 5.3.
[861] *Samsung Electronics Co Ltd v Apple Retail UK Ltd & Arnor* [2014] EWCA Civ 376 (01 April 2014), 11.

Another major point of divergence concerns the number of views that can be included in the application form. While the EUIPO practice is to accept the submission of seven pictures maximum, there appear to be different approaches at national and international level[862].

2.1. The EUIPO's Convergence Programme

The national IP Offices and the EUIPO are currently collaborating in the context of the Convergence Programme. The EUIPO launched this program in 2011, with the aim of promoting the convergence of practices and tools[863].

The Convergence Programme encompasses five projects that purport to achieve more effective legal protection, cost savings, and legal security for applications directed to both trademarks and designs[864]. The idea is to eliminate, or at least limit, those situations in which identical or similar design applications are treated differently across the EU.

Of particular relevance, for present purposes, are the following two projects: 1) Convergence on graphic representations of Designs ("CP6")[865]; and 2) Harmonization of Product Indications ("CP7")[866]. On 15 April 2016, a Common Communication on CP6 was published on the website of all EU's implementing offices[867].

In order to remedy the incongruence in practices within the EU, the Common Practice includes both (optional) recommendations and (compulsory) requirements on: how to use appropriate disclaimers; the types of views that are allowed; and how to represent designs in a neutral background[868]. Offices that adhere to and implement such Common Practice will have to adapt their previous practice[869].

A comprehensive review of the Common Practice falls outside the scope of the current analysis. It is worth highlighting, however, the key recommendations contained therein.

First of all, the Common Practice reproduces the definition of a "design" contained in the Design Directive and then offers a definition of "visual disclaimers". Hence, it sets forth the

[862] Legal Review MARKTD2014/083/D, 98.

[863] On this *see* also French (2016), INTA Bulletin, available at: https://www.inta.org/INTABulletin/Pages/Design_Practice_in_EU_7109.aspx.

[864] *Id.*

[865] *See* https://www.tmdn.org/network/graphical-representations.

[866] *See* https://www.tmdn.org/network/harmonisation-of-product-indications.

[867] European Trade Mark and Design Network, *Convergence on Graphic Representation of Designs – Common Communication* (15 May 2018), available at: https://euipo.europa.eu/tunnel-web/secure/webdav/guest/document_library/contentPdfs/about_euipo/who_we_are/common_communication/common_communication_7/common_communication7_en.pdf .

[868] *Id.*

[869] Note that this Common Practice deals only with rules to be followed in the course of the examination procedure, rather than rules that are meant to affect the scope of design protection, which remain within the legislator's competence.

general requirements for accepting visual disclaimers (i.e. the visual disclaimer must be clear, self-explanatory and preferably include only the claimed features), and the guidelines for *specific* types of visual disclaimers (i.e. broken lines).

The Common Practice's recommendation is to include, in the application for registering a design, only the claimed design, and not also the disclaimed features. Where it is necessary to include a disclaimer, broken lines are recommended. Only when broken lines cannot be used due to technical reasons (i.e. they are used to indicate stitching on clothing or patterns or when photographs are used), it is possible to use other visual disclaimers, such as colour shading (i.e. using contrasting tones of colour to obscure features for which protection is not being sought), boundaries (i.e. features for which protection is sought are represented within a boundary) and blurring (i.e. obscuring disclaimed parts)[870].

Noteworthy, the issue of CAD and 3D representations, as well as the number of views that can be filed by the applicant, remain outside the scope of the Common Practice and subject to the practice of each individual Office.

The Common Practice is an important step in the process of achieving further harmonization among national registration systems; arguably, a huge benefit for both users and examiners will accrue if national practices are brought into line with the requirements and recommendation contained therein.

Having made such preliminary remarks on the registration systems established at a national, European and international level, as well as on procedural matters that may significantly affect the scope of design protection, we now turn to the definition of "design" within the EU legislative framework.

3. Designs in the European Union

For the purposes of the Community Design Regulation ("CDR"), "design" means "the appearance of the whole or a part of a product"[871]. While there is no definition of appearance, Article 3(a) CDR provides a non-exhaustive list of elements that one may have to consider for appraising the external aspect of a product. These elements include the lines, contours, colours, shape, texture and/or materials of the product itself and/or its ornamentation.

First, it can be seen that EU design law does not discriminate on the grounds that the specific features of appearance are two-dimensional, surface ornamentations applied to a product or

[870] Common Communication, 2-4.
[871] Article 3(a) CDR.

three-dimensional features of the same product; it includes both under the definition of "design".

Moreover, the examples of features listed in Article 3(1)(a) CDR are all perceivable by the human eye or by the sense of touch, whereas sounds and smells are not contemplated[872]. Yet, as noted in the Legal Review, the definition of a design leaves a degree of uncertainty as to whether: it "*should or not be limited to visual perceptibility, with texture and material being relevant only insofar as they impact on the visual appearance (for example, the use of wood could be relevant insofar as it makes the product look wooden). Or does the inclusion of texture and material as features impacting on the appearance of the product call for a wider definition of the term appearance (i.e. extending it to mean more than mere visual perceptibility, to include tactile perceptibility*)"[873]?

On the one hand, one may contend that the EU legislator has purposely used a clear-cut term such as "viewing", when framing Recital 14 CDR, in the place of a more neutral term such as "observing"[874]. Likewise, the wording of Recital 12 CDR refers to "component parts that are *visible* during normal use". On the other hand, one may suggest that that the current reference to "texture and/or materials", provided for in Article 3 CDR, favours a broad interpretation of the concept of design, which shall be inclusive of both designs perceivable by sight and by touch[875].

Arguably, 3DP technologies pose a new challenge in this respect, conflating features that can be seen and features that can be touched. One may think of a CAD file, such as a 3MF file, which contains all information necessary to define the physical properties of an object, such texture and/or materials.

These features appear on a computer screen, when the CAD file is loaded onto software, thereby stimulating a visual experience, but are not touchable until the product is printed, the ensuing question thus being: to what extent features such as texture and materials need to be touched in order to be fully appreciated?

One can thus be caught in a new dilemma concerning the scope of the term "appearance". If one accepts that such term is not limited to visual elements, but is inclusive of tactile elements, what does "tactile" mean then? Does tactile perceptibility necessarily imply the presence of a physical, tangible product or not?

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872 Suthersanen (2010), 95.
873 Legal Review MARKTD2014/083/D, 57.
874 *Id.,* 60.
875 *Id*.

One may contend that the material properties of an object, which contribute to trigger design protection, are no longer necessarily tied to a physical dimension: they might be incorporated into a digital design file, without the possibility of touching them.

It is here suggested that this is not the same sort of dilemma that "seeing" a product design on a picture, as opposed to "touching" it, poses. In fact, a CAD file is not merely the visual representation of an object; rather, it incorporates all the specifications that contribute to define the outer appearance of an object, as well as the code that enables to rapidly convert a digital design into a finished product.

The Legal Review envisions the impact that broadening the definition of a design beyond "visual elements" might have. In particular, the main argument in favour of a narrow definition is that design law should not protect all economic and marketing value of a design, especially when there is a supplementary and alternative method of protection to IPRs, such as protection against unfair competition[876].

An enhanced protection for industrial designs is only justifiable to the extent that "*it encourages innovation and development of new products and investment in their production",* pursuant to Recital 7 CDR[877].

On the other side of the coin, a narrow definition of "design", that is limited to the visual appearance of a product, might be regarded as not being in line with the letter of the law as well as with the "Green Paper on the Legal Protection of Industrial Design", published by the European Commission in 1991[878].

In this document, the EC stressed that the external aspect of a product is of considerable economic importance. The notion of appearance, therefore, should be broad enough to encompass any economic value attached to the aspect of a product.

Going back to the definition of what constitutes a protectable "design", within the meaning of Article 3 CDR, it is also worth noting that the eye appeal is not a necessary prerequisite for registration. Design protection should be conferred on objective grounds, with no need for aesthetic effect or intention[879].

Article 3(b) CDR goes on to define a product as "*any industrial or handicraft item other than computer programs*". It then offers some guidance as to the type of designs that are eligible for protection.

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[876] *Id.*
[877] EC Green Paper on the Legal Protection of Industrial Design III/F/5131/91-EN, June 1991.
[878] *Id.*
[879] Nordberg; Schovsbo (2017), 283.

The latter include both three-dimensional designs, such as packaging and get-up, and two-dimensional designs, such as graphic symbols and typefaces[880]. Designs of parts of products, for which no assembly is required, and designs of components parts, which are intended to be assembled in a larger complex product, can also be protected[881].

The concept of product, therefore, is central to the whole structure of the CDR. The essence of a design is the appearance of a product. Furthermore, as explained in more detail below, there should be a product, to which the design is applied, in order to commit an infringement.

Yet, it must be absolutely clear that the object of design protection is the design itself, not the product bearing the design. Protection extends to any product in which the design is incorporated[882]. The following enquiry aims at analysing whether the appearance of a product that is represented digitally as a CAD file may attract design protection under existing EU legislation.

4. The Visual Element of a CAD file

The ultimate generation of designs created by means of CAD software embed all information that is needed to define the outer appearance of a product. Embedded data can describe the geometry, as well as the colours, textures and materials of the product.

In this respect, the design-drawing component of a CAD file differs from a more traditional blueprint or technical drawing. In most cases, a blueprint defines only the geometrical aspect of an object: it may be seen as a graphical abstraction of the intended product that needs to be interpreted by a human being. CAD files, instead, may incorporate all the properties and attributes of the product to be printed. They may contain the entire product design that, once printed, will be a finished, tangible product.

Hence, a CAD file can be seen as the medium in which the product design is first recorded. A body of the literature correctly states that a CAD file is "*a mere information conduit, a support or tool to materialize an intellectual creation – the design*"[883]. Hence, one should separate the design as object of right from the support in which it was first created.

It does not matter if the design first came to existence in the form of a computer file, rather than in some physical, tangible form. The object of protection under design law is the

[880] The list of products enumerated in this provision is not intended to be exhaustive.
[881] Article 3(c) CDR.
[882] Article 10 CDR deals with the scope of protection conferred by a Community design, clarifying that such protection extends to any design that does not produce a different overall impression on the informed user.
[883] Nordberg; Schovsbo (2017).

appearance of the product as first recorded in digital form – with all its properties being stored in the CAD file – and then manufactured by a 3D printer.
On the other hand, in parallel with a photograph of a real-life object, the visual element of a CAD file – i.e. the image of the product stored therein – may be regarded as a view of the appearance of the finished product, for which protection is sought. Hence, as noted in more detail below, the appearance of a product embodied in a CAD file may enjoy Community design protection from the moment the CAD-based image is made available to the public, irrespective of whether the product is later manufactured or not.
It is doubtful, instead, whether making available online a CAD file (such as a STL file) that does not clearly reveal the outer appearance of a product, but merely details a blueprint with technical information on how to build the object, may nonetheless trigger design protection.
One may contend that, in the event that the design-drawing component of the CAD file does not enable to see with clarity the whole product design, being a mere set of instructions for its construction, protection under design law is not activated before the item is printed, by the mere diffusion of the file trough the Internet.

5. Design Protection of the Digital Item Embedded in a CAD file

Another compelling issue that needs to be touched upon is whether a digital item, which is computer-created by means of CAD software, may attract design protection in its own right, as a graphic symbol.
At first reading, the notion of “design” seems to be confined to the appearance of products having some physical form, in so far as the CDR makes express reference to “industrial or handicraft items”, and expressly excludes computer programs.
Hence, the definition of “product”, set forth in the CDR, gives rise to a certain degree of uncertainty as to whether a design, that is not applied to a product in the sense of a physical, tangible object, should likewise be considered as a protectable element under existing regulation.
The inclusion of graphic symbols in such definition of products indicates that protectable designs need not be tied to a physical dimension. The European Union Intellectual Property Office (“EUIPO”) guidelines provide some assistance in this respect.

The Office's practice allows registration of screen displays, icons, and other visible elements of a computer program, such as graphical user interfaces ("GUIs"), in Locarno class 14, Subclass 04 ("screen displays and icons")[884].

Therefore, design protection appears to cover all digital items – with the sole exclusion of sounds and animated images – that appear on electronic devices, such as computer screens or mobile phones.

By contrast, computer programs as such are excluded from design protection. The reason for inserting this exclusion is explained in the Explanatory Memorandum of the first proposal of the CDR. The rationale was mainly to avoid any potential interference with the Software Directive, which might arise whenever copyright protection provided under the aforementioned Directive is supplemented or reinforced by a protection of the "look and feel" of a computer program by way of design protection[885].

In theory, an item represented digitally in a CAD file[886] could enjoy Community design protection. One may argue that, in parallel with other computer icons, the item embodied in a CAD file is a graphic symbol that appears on a computer screen when the file is loaded. Since the CDR enumerates graphic symbols as a category of product of their own, their appearance can be protected under the title of Community designs.

This analogy appears, however, questionable if the CAD file is a 3D printable file. One should always keep in mind that the categories of existing CAD files vary depending on their purpose. In general terms, a CAD file can embed an item to be used for rendering purposes, a digital icon to be included in a videogame, a schematic blueprint for a product, as well as all the build information to be used in 3DP.

There is a substantial difference between a computer icon and a product embedded in a CAD file for 3DP purposes. The former fulfils its function exclusively once it is displayed on a computer screen. As noted by Margoni, it does not even possess the characteristics to be manufactured or printed into an industrial or handicraft item[887]: it is "intangible" by its very nature.

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[884] *Id.,* 4.1.3. *See* also the EU Commission, Explanatory Memorandum on the Proposal for a European Parliament and Council Regulation on the Community Design, 3 December 1993, 11. The Explanatory Memorandum clarifies that the exclusion provided in the CDR for computer programs does not extend to "specific graphic designs as applied, for example, to icons or menus".

[885] *Id.,* Explanatory Memorandum, 11.

[886] Not printable files, but files that are used for other purposes, such as in videogames or in rendering.

[887] Margoni (2013), 232, 4(3).

On the contrary, not only an item embedded in a printable file becomes tangible once it is shown on a computer screen; it could also be turned into a physical product at the click of a button.

In other terms, the reason why a person creates a 3D printable file is to enable manufacturing the object embodied therein. Design rights protect the appearance of the product to be made from that file.

To be entirely clear on that point, if one takes the example of a 3MF file, which contains all information for printing the item, design protection can only attach to the product corresponding to the 3D-printed output. It seems rather unrealistic to assume, in the absence of a specific provision, that the CAD files themselves could be seen as "products", whose appearance deserves protection in their own right. The definition of "design" would need to be broadened in future legislation, in order to cover a wider range of "immaterial" protectable elements.

Having noted that, an applicant may wish to protect the virtual product *per se*, in order to avoid the risk that no protection will be available, under the scope of European design law, if a third party makes a digital copy of its design, i.e. creates a CAD file depicting the product design and uploads such file on the Internet. In fact, as discussed below in more detail, Article 19 CDR seems to confine infringing use of a design to use in relation to physical goods or corporeal movables[888].

6. CAD Files as Computer Programs

An emerging body of literature has addressed the copyright status of CAD files[889]. Some scholars suggest that the definition of "computer programs" is perfectly compatible with CAD files[890]. The present writer, instead, rejects former existing assumptions on the application of this analogy.

This issue is of particular relevance for the following discussion, given that computer programs are expressly excluded from the definition of protectable designs[891].

As discussed in chapter II, a CAD file simultaneously encompasses both a "design drawing component" and a "code component". The latter serves to give a series of instructions to the

[888] *See* below.
[889] The question of whether CAD files warrant copyright protection is examined at length in chapter II of the present thesis
[890] *See*, among others, Bradshaw et al. (2010), 24, 7(1).
[891] Article 3(b) CDR.

printer (i.e. where to move the print head and how fast to deposit the material). Even if a CAD file embeds a code, it is not the equivalent of a computer program.

It is important to remind the reader that the CAD file itself is just the medium for recording a work. To the extent that the content of the CAD file is the expression of the author's creativity, and is not dictated by purely functional considerations, it may qualify as a copyright protected work. The fact that the work exists in digital file format does not change its nature.

In this respect a CAD file bears certain similarity to other files, such as JPG or PDF files, which respectively embed a photograph or a literary work. Thus, the distinction between what is the work of authorship, as opposed to the medium of its expression, takes on a particular significance when claiming copyright protection of CAD files.

As far as the code component of the CAD file is concerned, in most cases it will not be eligible for copyright protection as a literary work. Amongst the reasons for this is the fact that the code is computer-generated and not human-authored[892].

Moreover, in most cases, the code embedded in the CAD file is exclusively dictated by functional considerations, thus falling outside the scope of copyright protection. It is therefore only the CAD software that finds protection under the Software Directive, not the CAD file itself.

Having made such preliminary remarks, this chapter aims to untangle the different question of whether design protection may be triggered if a product design is represented solely in digital form, i.e. whether or not it comes into physical existence.

7. CAD Drawings as Graphic Representations

Under current practice, the drawing component of a CAD file may serve as a "graphic representation" of the design for which protection is sought. The following analysis attempts to clarify this point.

As discussed, a person seeking protection for his or her design at the EU level has the option to either apply for a RCD through the EUIPO, before disclosing it, or, alternatively, opt for an anti-copying right, relying on UCD protection.

In the former case, in order to have a valid application for a RCD, Article 36 CDR requires to include "a representation of the design that is suitable for reproduction". There are several ways in which a design can be represented. As noted above, the EUIPO accepts drawings,

[892] Dolinsky (2013), 641.

photographs and computer-made representations (i.e. CAD representations), either in black or in colour, provided that they are of quality, permitting all details of the design to be clearly distinguished[893].

Hence, it may well be that, in parallel with a photograph, a CAD representation is used to disclose the features of the design for which protection is sought. By way of explanation, if the applicant wishes to register the design of a table knife, rather than affixing a photograph of such a knife, she can affix the 3D representation, created by CAD software, of the same household good. The applicant will then have to indicate “knives” as the relevant product category (class 7-03 of the Locarno classification)[894].

However, in order to be of quality, a CAD representation should enable to determine, with clarity, the subject matter of the protection afforded by the RCD to its holder. Hence, it should contain clear and intelligible information about the sizes, dimensions, and colours of the item in which the design is incorporated or to which the design is applied.

Interestingly, a recent decision from the UK Supreme Court, *PMS International Group Plc.*[895], is notable for stressing the importance of the images affixed in the application form, for determining the scope of Community design protection. It also shows that CAD representations might depict some unnecessary tonal contrast. This, in turn, could generate confusion and be understood as limiting the scope of design protection to certain colours only.

7.1. *PMS International Group Plc.*

The case concerned an alleged infringement of a RCD, which consisted of six images prepared by CAD software, of an item (a ride-on animal suitcase) whose main body appeared as a uniform grey, but which had black strips in the front, a black strap on the top, and black wheels.

The suitcase for which RCD protection was obtained (i.e. the “Trunki” suitcase) originated with a UK company, Magmatic Ltd., and was allegedly infringed by a competing product (i.e. the “Kiddee Case”) that has been marketed by PMS International Group plc.

At first instance, the UK High Court found that the claimant’s RCD was valid and infringed. The Court of Appeal overturned the lower’s court decision, identifying a number of errors in

[893] EUIPO Guidelines, 3.3.1.

[894] The EUIPO has recently released an e-filing tool, called “ 3D image uploader”, that allows the applicant to upload and store its CAD files. The applicant can move the 3D image, zoom in and out, take some pictures from different views, and select between a maximum of 7 static views.

[895] *PMS International Group Plc v Magmatic Ltd* [2016] UKSC 12.

which the court of first instance had incurred. Kitchin LJ expressed the following main criticisms towards the High Court's decision[896].

First, the Court did not "*give proper weight to the overall impression of the RCD as an animal with horns, which was really different from the impression made by the (accused designs) Kiddee Case"*, which were "*either an insect with antennas or an animal with ears"*[897].

The second criticism is that Arnold J did not take into due account the lack of ornamentation on the surface of the RCD. In fact, the reason why the claimed design looks like a horned animal is "*because of its shape and because its flanks and front are not adorned with any other imagery which counteracts or interferes with the impression the shape creates*"[898].

Third, the High Court has erroneously ignored that, since the RCD is showed in monochrome, it is not limited to particular colours. Hence, "*the defendant cannot point to the colour of its design as being a point of distinction*"[899].

The final criticism centred on the lower court's failure to adequately consider the colour contrast between the wheels and the body of the RCD. In fact, by analysing the graphic representation of the RCD, it was not clear whether the two tone colouring on the CAD images – i.e. the contrast in colour between grey and black – was simply an artefact of the computer-generated process or a visual cue to indicate that the wheels and the strap should be considered as separate components.

The problem, therefore, was whether the RCD was aimed at protecting the shape only or the shape in two contrasting colours. Only in the latter case, the overall impression created by this contrast in colour could be considered. In Kitchin LJ's opinion the colour contrast was a striking feature of the RCD, which was "*simply not present in the accused design and which the judge ought to have taken into account in carrying out the global comparison*"[900].

For all such reasons, the Court of Appeal overturned the lower's court decision finding no infringement. The Supreme Court upheld the Court of Appeal's finding against an infringement, noting that the Kiddee Case animals "*were not horned, but had ears or*

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[896] *Id.*, [21], referring to *Magmatic Ltd v PMS International Ltd* [2014] EWCA Civ. 181, per Kitchin LJ, [41]-[48].

[897] *Magmatic Ltd* EWCA per Kitchin J, [41].

[898] *Id.*

[899] *Id.*, [42].

[900] *Id.*, [48].

antennae"[901]. Interestingly, the Supreme Court agreed with Kitchin LJ's findings that the absence of surface ornamentation "*reinforced the horned animal impression*"[902].

The Court further clarified, obiter, that "*the absence of decoration can, as a matter of principle, be a feature of a registered design. Simplicity or minimalism can notoriously be an aspect of a design"*[903].

With respect to the issue of the two-tone colouring of the RCD, the Supreme Court considered that Kitchin LJ was right in concluding that the RCD was not a claim merely for a *"specific shape, but a shape in two contrasting colours"* (grey and black)[904]. Hence, in comparing the allegedly infringing article with the design, the colouring of the article must be taken into account among other factors[905].

This case is remarkable for stressing that, when it comes to deciding the extent of protection afforded by a RCD, the question "*must ultimately depend on the proper interpretation of the registration in issue, and in particular of the images included in the registration*"[906]. Therefore, it will almost always be the images that "*exclusively identify the nature and extent of the monopoly*" which the applicant is claiming[907]. Verbal descriptions are not allowed[908].

Hence, this decision confirms that protection for a shape is better achieved by using line drawings or single colour renderings. In fact, CAD images usually show shadings, colour contrast, materials and as well as ornamentations and decorations, narrowing the scope of protection to the effect created by such features.

Images consisting of line drawings most likely will be interpreted as broadest claims, concerned with the external shape only and not including ornamentation. Accordingly, in infringement proceedings, the proper comparison will be with the shape of the alleged infringing item, whereas surface decoration or graphics applied to it will be irrelevant.

Likewise, filtering out functional parts by use of colour contrast increases the risk that such features will be considered an essential part of the claimed design, rather than separated, unprotected features.

[901] *PMS International* UKSC, [37].
[902] *Id.*, [41].
[903] *Id.*, [44]
[904] *Id.*, [53].
[905] *Id.*, [52]-[54].
[906] *Id.*, [30].
[907] *Id.*, [31].
[908] Article 36(3) CDR, and Article 4(1) of the Implementing Regulation No 2245/2002 ("no explanatory text, wording or symbols, other than the indication "top" may be displayed)..

Whether absence of ornamentation is a feature of a particular design must be inferred from the images attached to the design application, lacking any verbal description. The natural implication of this principle is that, if an important feature of a RCD is “no ornamentation”, the informed user will give weight to the presence of such ornamentation in the allegedly infringing design.

8. Unregistered Design Protection of CAD files

An Unregistered Community Design (“UCD”) is based on the same substantive provisions postulating the validity requirements for a RCD. The meaning of “design”, “appearance” and “product” are the same for both RCD and UCD. As a general matter, any design capable of being registered at the EU level could also benefit from the protection granted to UCD.

There are, however, substantial differences between RCD and UCD. A RCD confers a true monopoly, whereas an UCD grants the right to prevent any commercial use of a design that is an intentional copy of the protected one, although it is not required to demonstrate that the alleged infringer acted in bad faith. Furthermore, a RCD confers protection for up to 25 years, subject to renewal each five years, whereas an UCD affords protection for only three years.

Protection of the UCD commences from the date in which the design has been “made available to the public” within the EU. As Recital 16 CDR puts forth, there is no need to register products having a short market life. A designer can introduce a new design testing the market, and file an application for registration at a second stage.

In fact, the designer is entitled to register its design within a 12 months period (“grace period”) from the date of the first disclosure. In other words, in the event that the designer files an application for a RCD, disclosure during the year preceding the date of filing shall not be taken into consideration in appraising novelty and individual character of the design in question, pursuant to Article 7(2) CDR.

Let us now assume that a CAD file for a product, to which a design is applied, is uploaded onto a website, which is a 3DP marketplace or repository. This, in turn, raises a number of questions. Should the act of uploading a CAD file onto an online 3DP platform be tantamount to a disclosure of the design to the public, which triggers UCD protection? Has the design been “made available to the public”, and become known in the normal course of trade? Has the 12 months grace period commenced?

The following part of this chapter detects the circumstances under which a design shall be deemed to have been made available to the public. The phrase “made available to the public”, for the purposes of identifying the date on which UCD protection commences, is defined under Article 11(2) CDR. This provision mirrors Article 7(1) CDR, which clarifies when a design has been disclosed for considering questions of novelty and individual character, for both registered and unregistered designs. In fact, all designs made available to the public, prior to the relevant date (indicated at Article 5(1)(a)&(b) and 6(1)(a)&(b)), are to be taken into account to determine whether a design is new and it has individual character. This, in turn, raises an additional question: should we consider all the CAD models that have been previously uploaded onto 3DP online platforms as antecedent designs in the prior art?

It should also be noted that a disclosure should take place within the territory of the European Union, in order to create an UCD. Hence, UCD protection is not accorded to designs that have first been made available outside the EU. On the contrary, this requirement is not imposed under Article 7 CDR, which defines the notion of disclosure that is relevant for determining the state of the prior art.

9. The Concept of "Made Available to the Public"

Articles 7(1) and 11(2) CDR provide some guidance to assess whether a design has been 'made available to the public'. This is the case if "it has been published following registration or otherwise, or exhibited, used in trade or otherwise disclosed". The following part of these provisions set forth the so-called "safe-guard" clause, stipulating that a disclosure shall not be taken into consideration if these events (publication, exhibition, and use in trade) could not have become known "in the normal course of business to the circles specialised in the sector concerned", operating within the Community.

The EUIPO[909]'s case law from 2004 onwards allows enough clearance on which acts constitute a disclosure of a design to the public, which could also become known in the normal course of business to specialised circles.

A remarkable ruling that helps us to understand better whether the publication of a CAD file on an online platform would amount to a disclosure to the public is the Board's decision in *Crocs, Inc. v Holey Soles Holdings Ltd*[910]. The holder of a RCD for *Crocs* clogs, which was published in the Bulletin of 8 February 2005, conceded that the design had already been published on www.crocs.com before 28 May 2003.

Nonetheless, the right owner argued that such disclosure on the website did not destroy novelty of the design in question, since it could not have reasonably become known in the Community.

[909] Formerly called Office for Harmonization in the Internal Market ("OHIM").
[910] OHIM Third Board of Appeal, decision of 26 March 2010 – R 9/2008-3.

At that time the website was unsophisticated and virtually impossible to access. The website merely functioned as an information tool for persons "who might have learnt about the clogs from people who had already bought them" and was not used as a large mail order service. Websites that will be regarded as a source of inspiration for developing new designs are those of the established footwear companies, such as Nike or Adidas, whereas *Crocs Inc.* was not an established manufacturer at the relevant date[911].

The Third Board of Appeal dismissed the appellant's findings. In the first place, the Board found that the Internet is a formidable information tool and is used by designers in footwear as well as in other fields as a resource in the development of their designs. Moreover, *Crocs* website was an active website already at that date and was configured to function as a sales channel. Henceforth, the audience targeted by the website was not only composed by those who knew *Crocs* from before[912].

Accordingly, when a design is published on a website it will *per se* be publicly disclosed and reasonably become known in the normal course of business, even if the circles specialised in the sector were not aware of the website owner at that date[913]. This is further confirmed in recent case law from the EUIPO. As a matter of principle, information disclosed on the Internet or in online databases forms part of the prior art and is considered to be publicly available as of the date the information was posted[914].

Moreover, neither restricting access to a limited circle of people (for example, by using password protection) nor requiring payment for access (in the same way as requiring a payment for subscribing to a journal or purchasing a book) prevent a webpage from being part of the prior art. The European circles specialised in the sector concerned could reasonably meet the accessibility requirement[915].

A disclosure shall be deemed to be obscure and irretrievable only in situations in which a design disappears from mankind's memory over time and is available only in a local museum or traded on a remote local market. This is not the case for prior designs made available online. Users – either the broad public or experts in a particular field of industry – use the service of web browsers, such as *Google* or *Yahoo*, to search on the Internet. By using keywords, they can easily find websites dealing with a particular subject matter. Therefore,

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[911] *Id.*, [10](d).

[912] *Id.*, [85]-[92].

[913] Suthersanen (2010), 126

[914] OHIM Invalidity Division, *Mariusz Adamski Adams Group v Abakus Direct Ltd*, decision of 10 July 2014, [13]. In the present case the holder had disclosed its design on *eBay* prior to the RCD's filing.

[915] OHIM Invalidity Division, *Napco Beds B.V. v Leopold Meijnen Oosterbaan*, decision of 24 February 2015, [13].

once a design is published on the Internet it becomes automatically accessible and retrievable[916].

For the purposes of applying Articles 5 and 6 CDR, a disclosure could also take place outside the EU, in so far as the design has become known in the trade circles in the European Union. The question of whether events taking place outside the EU could reasonably have become known to persons forming part of specialized circles in the EU is a question of fact, dependent on the particular circumstances of each individual case[917]. In theory, even where the design has been disclosed to a single undertaking within the EU, a disclosure of that kind may indeed be sufficient for that purpose[918].

Making a design available overseas, therefore, may destroy novelty, on the basis that Article 7(1) CDR is not geographically restricted to the EU. On the contrary, the same disclosure, taking place outside the EU, may not be sufficient to commence UCD protection, given the territorial qualification contained in Article 11(1) CDR[919].

It is therefore maintained that, in principle, the act of uploading a CAD file onto an online platform should be a sufficient ground for "disclosing" the design represented therein, for the purposes of applying Articles 5 and 6 CDR. A CAD file is retrievable and easily accessible by Internet users, including experts in the field. This might be the case for both CAD files that have been made available to the public, subject to a Creative Commons licence, and those offered for sale in 3DP marketplaces.

It follows that whether the design is new and has individual character would need to be considered taking into account the already available body of designs, including all antecedent CAD files that have been previously disclosed. In other words, product designs embedded in CAD files that have already been distributed online will form part of the state of the prior art[920].

The publication of the CAD file on a EU website can also trigger UCD protection from the date of the online first publication, if the criteria for protection (i.e. novelty and individual

[916] OHIM, Invalidity Division, *Samsung Electronics CO. Limited et al. v Apple Inc*., decision of 05 July 2013, [70]-[71].

[917] See the CJEU's ruling in *H. Gautzsch GroBhanden GmbH & Co. KG v Munchener Boulevard Mobel Joseph Duna Gmbh*, C- 479/12, [34]. See also OHIM Board of Appeal, *Kirschenhofer GmbH v WS Teleshop International Handles-GmbH*, decision of 11 July 2007.

[918] *Id. H. Gautzsch GroBhanden GmbH*, [15].

[919] See the decision of the German Federal Supreme Court of October 9, 2008, *Gebackpresse* I ZR 126/06, [2009] GRUR 79.

[920] More precisely, in order to pass the novelty and individual character test, the design embedded in the CAD file shall differ from all the designs made available before: the date on which the file itself was published on the 3DP website, with respect to UCD; the date of filing or validly claimed priority, with respect to RCD.

character) are met. The designer would then have the option to register the design within one year.

An unsettled issue is whether UCD protection is activated if the CAD file is first uploaded onto a website that is hosted outside the EU (such as *Thingiverse*). If the website is easily accessible by European users, a positive answer may appear as more appropriate in light of the above-mentioned case law, which focuses on the retrievability of Internet publications, whereas a literal interpretation of Article 110a (5) CDR may suggest the opposite.

It should also be noted that the CAD file made available online should clearly reveal the outer appearance of the product for which protection is sought. Lacking a clear representation of the product design, the act of publishing the CAD file on a website will not constitute a relevant disclosure for the purposes of Articles 7 and 11 CDR.

The option of making CAD files available online, therefore, constitutes an interesting possibility for those designers that want to prevent third-parties from using their 3D models to obtain design protection[921]. When the CAD file is disclosed, all later designs will have to produce a different overall impression on the informed user.

10. Requirements that a Design Has to Meet Towards Design Protection

Articles 5 and 6 CDR state that a design has to be new, has to have individual character, and must not fall foul of any of the stipulated exceptions, in order to enjoy design protection. These requirements will be analysed in turn, focusing on the implications that 3DP carries.

10.1. Novelty and Individual Character

A design is new only when it differs materially from everything that has been produced before. In fact, Article 5(2) CDR states that differences between two designs are irrelevant whenever they relate to mere “immaterial details”. In this regard, the novelty requirement is much closer to that for utility patents, rather than the originality requirement for copyright protection. It follows that users who download already existing CAD models from a 3DP platform will have to modify them substantially, in order for their designs to be new.

In this respect, a critical issue that 3DP poses is whether customized designs differ materially from other designs that have been made available before. Today, many companies, such as *eMachineShop.com* or *Shapeways*, manufacture customized products based on consumers’ CAD files.

[921] Margoni (2013).

From an IP perspective, a key issue is whether customized products provide "added value" because they imprint true novelty, or because they just enhance the value inherent in the design of the core product. It may well be that customized designs lack in novelty, since they differ from the core product design in details that are immaterial, banal or commonplace.

Novelty and individual character overlap to a certain extent. The main difference between these criteria lies in the kind of examination carried out by the EUIPO. When assessing novelty, the EUIPO makes a comparison between the overall appearances of the two designs. In contrast, when measuring individual character, the EUIPO considers the overall impression that the design produces on the "informed user".

Therefore, any reference to the informed user is not justified when assessing novelty. It is the Board's task to measure the differences between the designs under examination, on the basis of their overall appearance[922].

The test for individual character is less straightforward and is likely to give rise to slightly more subjective appraisals[923]. In assessing individual character, what counts is the *overall* impression, which must be analysed through the informed user's perception of *individual* designs, i.e. the designs should be taken as a whole. It follows, in the first place, that the *overall* impression is not dependant on "counting" the similarities and dissimilarities between the designs under comparison.

In *Karen Millen Fashions*[924], the CJEU held that, in order for a design to be considered to have individual character, the overall impression which that design produces on the informed user must be different from that produced on such a user "*not by a combination of features taken in isolation and drawn from a number of earlier designs, but by one or more earlier designs, taken individually*".

Therefore the assessment as to whether the product design embedded in a CAD file has individual character must be conduced in relation to individualised, defined and identified designs that have been made available to the public previously, not an amalgam of different design features taken from multiple different designs[925].

922 OHIM Third Board of Appeal, *Imperial International Limited v Handl Cookware Limited*, decision of 2 September 2008, [11]-[12].
923 OHIM Third Board of Appeal, *Daka Research Inc. v Ampel 24 Vertiebs-GmbH & Co. KG,* decision of 22 November 2006, [20].
924 *Karen Millen Fashions Ltd v Dunnes stores et al*. C-345/13 ECDR 17, [35].
925 Waelde et al. (2016), 292.

Yet, as a practical matter, it is inevitable to break down the design into its constituent features, "*in order to give appropriate significance or weight to each of them*"[926]. For example, features that are solely dictated by function should be disregarded.

Hence, the designs are generally compared side-by-side, not only by taking into account all similarities and differences, but also by assessing their significance in the eyes of the informed user. Clearly, assessing the impact that a feature has on the informed user may also involve comparison of the designs against the existing design corpus, in the sense that certain aspects of the designs at stake may be similar because all prior designs belonging to the same "family" look that way.

This point is illustrated by the UK High Court in *Samsung v Apple*[927], a case concerning an allegation of infringement of a RCD, whose validity, however, what not a stake. The UK Court has clarified that even if two products look very similar when resting on a table, many similarities will need to be filtered out in the individual character assessment, insofar as they do not bear particular significance from the perspective of the informed user.

In other terms, if some features are common to a body of prior designs, they do not stand out to the informed user to anything special or unusual, the most straightforward example being the front screens of tablets that are strikingly similar between all family members[928].

In its recent decision in *H&M Hennes & Mauritz BV*[929], the General Court held that the individual character test is a four-stage examination, which consists in deciding upon: first, the sector to which the products belong; second, the identity of the informed user of those products; third, the designer's degree of freedom in developing his design; fourth, the outcome of the comparison of the designs at issue. The designer's degree of freedom cannot, on its own, give rise to an outcome as regards the assessment of individual character, but can only "reinforce" this evaluation. The starting point should always be the perception of the informed user[930].

The problem is how to carry out the four-stage examination of the individual character requirement with respect to CAD files. In order to be protectable, a product design in the form of a CAD file should produce an overall impression on the informed user that differs from the impression produced by all previous designs. Therefore, such a design will only pass the

926 *Samsung Electronics (UK) Ltd v Apple Inc* [2012] EWHC 1882 (Pat), [54].
927 *Id.*
928 *Id.* at [189].
929 *H&M Hennes & Mauritz BV & Co. KG v OHIM – Yves Saint Laurent* (handbags) T-526/13, at [32]-[34].
930 See also recital 14 CDR.

individual character test if it differs from: a) any CAD file for a product that has been previously uploaded onto a 3DP platform; b) any product that has already been marketed.

The situation is further complicated by the contention that the informed user of an item represented as a CAD file might need to be distinguished from the informed user of the corresponding physical product. Arguably, the former should be the user of a 3DP platform, who wants to 3D print the item, rather than the person who purchases the product in a retail store.

Let us assume that a CAD file represents a bottle opener, and that a later CAD file depicts a similar bottle opener. In potential litigation, the informed user for assessing the individual character requirement of the disputed design could be: a private individual who drinks wine; a professional (e.g. waiter or sommelier); the user of a 3DP platform, who wants to manufacture the bottle opener at home.

Therefore, a number of issues need to be addressed. Who is the informed user of CAD files? How should we evaluate the degree of freedom of the CAD file's designer? Will the individual character threshold become less strict in the future, if the market sectors become overcrowded? The next paragraph suggests some possible answers to these questions.

11. The "Informed User" in the 3D Printing Landscape

As noted in the previous paragraph, the assessment as to whether a design is valid, because it has individual character, should be based on the overall impression produced on the *informed user*, taking into account a number of factors, such as: the nature of the product, the industrial sector to which it belongs and the designer's degree of freedom (Recital 14 CDR; Article 6 CDR).

The informed user is also mentioned in Article 10 CDR, clarifying that the scope of protection conferred by a Community Design includes any design that does not produce on the informed user a different overall impression.

For the purposes of this analysis, it is worth asking, in the first place, who would be the notional informed user, if an increasing number of individuals engage in the creation of CAD models and in digital-design-file-sharing. Everyone can now design a product from scratch, by using CAD software.

Users can also download third parties' CAD files and use online tools to transform, adapt or recast the pre-existing designs. Individual makers are both users and designers. Hence, the following analysis suggests that, if it becomes common practice that people not only print, but also design their own product at home, the notion of informed user might need to be revisited in the future. It argues that informed users would tend to belong to the circles specialised in the sector concerned, and resemble the "person skilled in the art" in patent law.

The legal concept of "informed user" differs from that of "average consumer" in EU trade mark law. The possibility of imperfect recollection on the part of the average consumer plays a vital role in trademark law, which is aimed at preventing consumer confusion or deception. By contrast, design law protects the appearance of a product. This implies that the informed user should not merely half-remembering the articles, but have a certain degree of familiarity with the item goods in which the design is incorporated[931].

According to established case law, therefore, the informed user shall be particularly observant, aware of the state of the art in the sector concerned, and use the product related to the RCD in accordance with the purpose for which the product is intended[932].

The background knowledge of the items is certainly higher than average, but not even too specific. She is more than a mere consumer, but is less than a design expert. Moreover, Lord Justice Jacob, in *Procter & Gamble Company v Reckitt Benckiser* (UK) *Limited*[933], highlighted that the informed user is not the same sort of person as the 'person skilled in the art' of patent law. The equivalent to that person in the field of design would be some sort of average "designer", not a "user".

Originally, the EUIPO's Invalidity Division adopted a rather different approach. The informed user was found to be a person aware of the prior art known in the normal course of business to "the circles specialised in the sector concerned". She does not ignore the specific methods and techniques of production[934].

For example, in a case concerning an application for a declaration of invalidity of a RCD for "wheels for bicycles", the Invalidity Division found that the informed user is aware of the requirements that bicycle wheels must fulfil in order to perform their function. Therefore the informed user also "takes into account whether the degree of freedom of the designer is limited by the requirement that a wheel has to be laced with the spokes between the hub and the rim and to transfer the weight of the rider to the rim"[935].

It thus seems that the notion of informed user was once much closer to that of a design expert. The Invalidity Division used to consider the informed user as belonging the "circles

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[931] *Procter & Gamble Co v. Reckitt Benckiser* (UK), Ltd [2007] EWCA Civ 936, per LJ Jacob, [27].
[932] Judgement of the General Court (First Chamber), 9 September 2011, in Case T-10/08, *Kwang Yang Motor Co. Ltd. v OHIM*, [23].
[933] [2007] EWCA Civ 936, per LJ Jacob, [27].
[934] OHIM Invalidity Division, *Eredu S. Coop v Arrmet S.r.l.*, decision of 27 April 2004, at 18: *"in particolare, l'utilizzatore informato non ignora lo stato della tecnica quale è conosciuta nel corso della normale attività commerciale negli ambienti specializzati del settore considerate".*
[935] OHIM Invalidity Division, *Rodi Commercial S.A. v ISCA S.p.A.*, decision of 30 August 2005, [27].

specialised in the sector concerned". Nonetheless, as noted above, this criterion should only apply when establishing what is a relevant disclosure to the public, and potential conflicts with an already existing design corpus, under Article 7 CDR. The person of the informed user, who is the reference for evaluating individual character, shall not be part of any specialised circle, lacking this sort or requirement in Article 6 CDR.

A correct interpretation of these two provisions should be that a design is considered to have individual character if the overall impression it produces on the informed user differs from that of an earlier design, which has already been disclosed to the public. However, a design shall *not* be deemed part of the prior art if not even the circles specialised in sector concerned, operating in the territory of the EU, are aware of its existence[936].

Therefore, in a recent ruling, the Board of Appeal found that the informed user of clogs is "*neither the manufacturer nor a seller of clogs, but the person who wears clogs. Without being a designer or a technical expert, the informed user knows the various designs for clogs as a result of the relevant product range offered in retail shops or over the Internet*"[937]

In the present context, footwear designers and footwear industry, operating in the EU, represent the circles specialised in the sector concerned.

At national level, the UK Court of Appeal has aptly summarised the characteristics of the informed user is *Samsung Electronics (UK) Ltd v Apple Inc.*[938]. The Court of Appeal, taking into account the design of Apple's iPad, reached the following conclusion: the informed user is "*a user of the product, in which the design is intended to be incorporated, not a designer, technical expert, manufacturer or seller*"; "*unlike the average consumer of trademark law, he is particular observant*"; "*he has knowledge of the design corpus and of the design features normally included in the designs existing in the sector concerned*"; "*he is interested in the products concerned and shows a relatively high degree of attention when he uses them*"; "*he conducts a direct comparison of the designs in issue"; "he neither merely perceives the designs as a whole and does not analyse details, nor observes in detail minimal differences which may exist*".

This decision draws on the CJEU's rulings in *PepsiCo v Grupo Promer*[939], *Grupo Promer v OHIM*[940] and *Shenzhen Taiden v OHIM*[941], which altogether define the attributes of the informed user within the meaning of Community design law.

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936 See, *inter alia*, Opinion of Advocate General Wathelet, 5 September 2013, in Case C-479/12, *H. Gautzsch GroBhanden GmbH & Co. KG v Münchener Boulevard Möbel Joseph Duna Gmbh*, ECLI:EU:C:2014:75, [44].
937 OHIM third Board of Appeal, *Hessy s.r.o. v Crocs, Inc*., decision of 14 September 2015, [16].
938 *Samsung Electronics (UK) Ltd v Apple Inc* [2012] EWCA Civ 1339.
939 *PepsiCo v Grupo Promer* (C-281/10 P) [2011] E.C.R. I-10153; [2012] F.S.R. 5.

This chapter argues that 3DP may blur the distinction between the notions of informed user and that of design expert. Users may become more and more aware of the specific methods and techniques of production. If this is the case, one will have look at early case law from the EUIPO in order to detect who should be considered the informed user, in a new ecosystem where the person of the designer and that of the user conflate to a greater extent.

12. Product Sector

Another contentious issue is whether the notion of informed user and that of individual character are linked to a specific "product sector". In fact, it makes a substantial difference if a design has to produce a different overall impression on the informed user with respect to all designs within the same product sector or across all product sectors.

Hence, the question should be answered whether "product sector" is or not a relevant factor when assessing the individual character requirement. Following the wording of Recital 14 CDR, the answer should be answered in the positive, given the express reference to the "product nature" and the "industrial sector to which the product belongs" (Recital 14).

The CJEU's case law seems to be in line with this approach, when it qualifies the informed user not as a user of average attention, "*but a particularly observant one, either because of his personal experience or his extensive knowledge of the sector in question*"[942].

Moreover, the informed user uses the product in which the design is embodied in accordance with the purpose for which it was intended[943] and has some awareness of the different designs available in the sector concerned[944].

Accordingly, the notion of "informed user" seems to be tied to a given product sector. Common sense leads us to the same conclusion. It is rather impractical and unrealistic to assume that the informed user will be so "informed" to be aware of existing designs across a multitude of different sectors; rather, the notional person to consider should be cognizant only of those designs in the product sector for which the design is registered.

Having noted that, an area of uncertainty remains. In fact, in accordance with Article 36(2) CDR, the application for a RCD should "*indicate the products in which the design is intended*

[940] *Grupo Promer v OHIM* (T-9/07) [2010] E.C.R. II-981; [2010] E.C.D.R. 7.
[941] *Shenzhen Taiden v OHIM* (T-153/08) [2010] E.C.R. II-2517.
[942] *Grupo Promer v OHIM,* [62].
[943] *Shenzhen Taiden Industrial,* [47].
[944] *PepsiCo v Grupo Promer,* [62].

to be incorporated or to which it is intended to be applied"; yet, product classification mainly serves administrative purposes and does not affect the scope of design protection[945].

Once a design is registered, it is protected against any use, in relation to any product that does not produce a different overall impression on the informed user. This, in turn, has resulted in considerable confusion over the relationship between "individual character" and the product nature and/or industrial sector.

The CJEU's decision in *Easy Sanitary Solutions* [946] helps to shed some light on this controversial issue. This decision was issued following the appeal from *Easy Sanitary Solutions* and the *EUIPO* against the judgement of the General Court [947] in the same proceedings, concerning a declaration of invalidity of a RCD related to a shower drain.

The General Court held that "*the nature of the product in which the earlier design is incorporated or to which it is applied has no bearing on the assessment of novelty of the contested design, within the meaning of Article 5 CDR"*[948]. Moreover, the General Court pointed out that the "sector concerned", within the meaning of Article 7(1) CDR, "*is not limited to that of the product in which the contested design is intended to be incorporated or applied"*[949].

Hence, in essence, the General Court held all prior designs, even if incorporated into a different type of product from that covered by the protected design, are part of the prior art, for the purposes of assessing novelty.

In its appeal before the CJEU, *Easy Sanitary Solution* argued that the General Court has erred in stating that the prior art for challenging novelty is not linked to a specific product sector[950].

The CJEU, however, dismissed this ground of appeal, upholding the General Court's finding that a design cannot be regarded as being new "*if an identical design was made available to the public earlier, whatever the product in which that earlier design is intended to be incorporated or applied"*[951].

In its decision, the CJEU referred to Article 10(1) CDR, which ensures protection by a RCD for "any design" that does not produce a different overall impression on the informed user. Hence, a RCD confers to its holder the exclusive right to use this design for all types of products, not only for the types of products indicated in the application for registration.

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945 Article 36(6) CDR; EUIPO Guidelines, 6.1.4.1.

946 Case C-361/15P *Easy Sanitary Solutions BV and EUIPO v Group Nivelles NV.*

947 Judgement of the General Court (Eight Chamber) in Case T-15/13 *Group Nivelles v OHIM – Easy Sanitary Solutions B.V* (13 May 2015).

948 *Id.*, [88].

949 *Id.*

950 On this *see*: Dinwoodie et al. (2014-2015), 200.

951 *Easy Sanitary Solutions,* CJEU [104].

Since the protection conferred by a design is not limited by product classification, likewise the assessment of novelty must not be limited to certain products only. This conclusion is not affected by Article 7 CDR, which merely sets out the rule that certain events cannot constitute a relevant disclosure, i.e. those events that could not, in the normal course of business, reasonably have been known to the "circles specialised in the sector concerned". The reference to "the sector concerned" must not be interpreted as limiting the scope of the prior art[952].

Furthermore, in its ruling, the General Court differentiated the prior art for assessing the "novelty" and the "individual character" of a design[953]. Individual character must be evaluated against a more limited prior art, which is composed of all products that belong to the same sector or products of the same nature that are intended for the same use.

Thus, the General Court has made clear that the "informed user" to be taken into consideration is "*the user of the product in which the design is incorporated or to which it is applied*"[954]. Plus it held that, although it cannot be excluded that the informed user will also have knowledge of the design corpus of products from other sectors, this *knowledge* cannot be presumed automatically, but must be appositely proved[955].

The CJUE held that the General Court erred in law when it considered "the sector concerned" to be relevant for the determination of the scope of the prior art in the context of the "individual character" assessment. An earlier design that was intended to be used in a different sector or for a different product is also part of the relevant design corpus. Likewise, the General Court went wrong when it imposed the requirement of knowledge: this requirement is simply not set by the law[956].

To conclude, the CJEU's ruling suggests that product classification will not have an impact on what is the prior art, neither when examining novelty nor when assessing individual character of the design-in-suit. Hence, the invalidity applicant is only required to prove that an act of disclosure has occurred, not that the informed user was actually aware of the earlier design.

13. How to Evaluate the Designer's Degree of Freedom

[952] *Id*., General Court [122].
[953] *Id*., General Court [133], CJEU [121].
[954] *Id*., General Court [129].
[955] *Id*., General Court [131], CJEU [119].
[956] *Id*., CJEU [134].

In order to assess whether a design has individual character, the designer's degree of freedom is one of the factors to take into consideration. Following established case law from the EUIPO, the designer's degree of freedom is likely to be lower if he or she has to comply with technical constraints. Similarly, if a field of application is already very crowded, minor advances from the prior art might produce a different overall impression on the informed user[957].

On the one hand, applying this reasoning to 3DP, one could maintain that the designer's degree of freedom will be gradually reduced. Assuming that an increasing number of users and companies will start producing and distributing their own versions of CAD files, and that such files form prior art, many market sectors will be thoroughly soaked.

If a specific sector is saturated, it inevitably entails compromises, since minor differences in the appearance of products might be enough to lead to a different overall impression on the part of the informed user. The appearance of a contested design, therefore, might be very similar to that of an earlier design and, nonetheless, lead to a different overall impression.

Besides, it is worth considering that the designer has to work within certain constraints, in order to make a 3D model suitable for printing. In the first place, there are some dimensional constraints. The designer has to comply with height and size requirements, in order for the 3D printer to be used.

In other words, when designing the 3D model using modelling software, the designer should take into account that printed objects are limited by the printers' size[958]. Furthermore, a 3D model should have a minimum thickness at any given point ("minimum wall thickness"), which depends on the material used. Arguably, all these technical constraints limit the designer's freedom.

On the other hand, one may argue that 3DP enhances the designer's freedom, since it enables the creation of much more complex geometries, as opposed to traditional manufacturing processes. Furthermore, individuals have gained the capacity to design all sorts of products with a relatively low experience. It is also possible to find tutorials on the Internet on how to use modelling software, such as CAD software. 3D scanners enable the designer to digitize

[957] By way of example, the OHIM third Board of Appeal, in *Mafin S.p.A. v Leng-D'Or S.A.,* decision of 4 November 2010, [20]-[21], found that the presence of so many shapes for "snacks items" is evidence of the broad possibilities open to the designer and, at the same time, the limits thereof. The designer freedom is not limitless, since the overcrowding of the market sector and industrial feasibility of the goods item determine much more constraint on a competing company operating in the same market sector. Accordingly, the designer's degree of freedom was found to be average, rather than broad or limitless, and implying a gradual decline in the shapes that are still available.

[958] It is however likely that in the future it will be possible to produce 3D printed products in larger sizes.

without difficulty any physical object. The 3D model so created can then be modified, adapted and optimized.

Thus, it is questionable whether the designer's degree of freedom should be considered lower in 3DP than in other design processes. This issue, however, is dependant on whether the technology will or not become widespread. As noted throughout this thesis, for the time being individual users engaging in the creation and sharing of CAD files include mainly 3DP enthusiasts.

14. Brief Overview of the Exceptions to Community Design Protection

The scope of design protection is narrowed by a series of exceptions, set forth in the CDR. The first functionality exclusion, provided in Article 8(1) CDR, states that a Community design shall not subsist in features of appearance of a product, which are solely dictated by its technical function. Such features shall not only be necessary, but *essential* to obtain a technical result. Thus, the level of functionality required is higher than that provided under trademark law.

In a way, such exclusion emulates the idea and expression dichotomy in copyright law. In fact, in the 1991 Green Paper on the Legal Protection of Industrial Design[959], the European Commission made clear that if the designer has a choice among various forms, in order to arrive at the technical effect, the features in question could be protected. This, in turn, means that features of appearance of a product, represented as a CAD file, will not be granted protection only if they are indispensable for achieving a specific technical result. It does not follow, however, that the whole design will automatically be denied protection.

Over and above the general exclusion of "technical function", Article 8(2) CDR provides the so-called "must-fit" exception or "interface" exclusion. This exclusion is aimed at enabling technical replacement products and ensuring mechanical interoperability.

Hence, no protection is given to those features that must necessarily be reproduced in their exact form and dimension in order to permit the product, in which the design is incorporated, to be mechanically connected to another product (for example, exhaust pipes or coupling sleeves are examples of "must fit" designs in the automotive industry).

This provision turned out to be rather redundant, in so far as spare parts, which are not visible in normal use[960], and those that are solely dictated by their technical function, are anyway excluded from design protection[961].

[959] At 5.4.6.2.
[960] *See* Article 4(2)(a) CDR.

One of the most problematic issues the EU legislators had to face concerns the so-called "must-match" exclusion[962]. This exclusion deals with the visual synchronisation and aesthetic appearance of a complex product, rather than with functionality. In other terms, the must-match provision concerns the design of a component part, which should be used for the purpose of the repair of a complex product so as to restore its original appearance (e.g. the design of a car body panel that is used to restore the original appearance of the vehicle).

The protection of must-match spare parts has occasioned the greatest controversy among a wide range of stakeholders, especially in the automotive industry. The next paragraph provides a brief overview of the legislative history on this issue. This will help explain why the dispute is not resolved yet.

15. The Non-Harmonization of the Repairs Clause at the EU level

The original idea in the 1993 proposals for a Regulation on the Community design[963], and for a Directive on the legal protection of designs[964], was to introduce a must-match exception in Europe, specifying that only after a period of three years, from the first placing on the market of a complex product, the rights conferred by a RCD could not be exercised to prevent third parties from using the design of a component part, in order to restore the original appearance, or to permit the repair of, the complex product. The Council of Ministers rejected this option.

The European Parliament advanced a different solution in the Amended Proposal for the Design Directive, opting for a compulsory licensing regime that allowed the use of component parts, for repair purposes, immediately after the placing on the market of the complex product, in exchange for a fair and reasonable remuneration of the right holder[965]. Manufacturers of component parts were required to inform the public as to the origin of their products used for the repair, by means of a trademark or trade name. They also had to notify the right holders of the intended use of the design, and regularly inform them as to the scale of

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[961] Both the functionality and the must-fit exclusions do not apply to design features which allow the multiple assembly or connection of mutually interchangeable products within a modular system (Recital 11, Article 8(3) CDR). Hence, design subsists in interconnection features of construction toys or modular furniture. Cornish et al. (2007), 613, maintain that the special treatment offered to toy manufacturers has no reasonable explanation, except that it shows how determined lobbying can squeeze special concessions into legislation.

[962] The "must-match" terminology comes from the UK legislation on UK Unregistered Design Rights. Such exception was first introduced within the UK Community Designs and Patents Act 1988.

[963] Proposal for a European Parliament and Council Regulation on the Community Design, COM (93) 342 final-COD 463, 3 December 1993, Article 23 of the Draft Regulation.

[964] Proposal for a European Parliament and Council Directive on the Legal Protection of Designs, COM (93) 344 final-COD 464, 3 December 1993, Article 14.

[965] Amended Proposal Design Directive [1996] OJ C1 42/7, Article 14.

such use. Nonetheless, no agreement on the compulsory licensing clause was reached by the European Council.

Ultimately the disagreement between EU institutions was the subject of a Conciliation Committee meeting, where the Council insisted on its position against a remuneration scheme. It recommended, instead, an extension of the period of exclusivity over component parts, for a period ranging from three to seven years.

In such a tense context, the European Union opted for the so-called "*freeze plu*s" solution, stating that until amendments to the Directive are adopted on a proposal from the Commission on this subject, Member States shall maintain in force their existing legal provisions. Member States should only change their laws if they wished to liberalise their market for spare parts, pursuant to Article 14 Directive 98/71/EC.

Therefore Member States had alternative options: they could introduce a clause allowing any use of the design for repair purposes; adopt a remuneration system; provide a term-limited design protection; or craft their own exception, which is a combination of the second and third options.

Article 110 CDR codified another "freeze plus" or transitional provision, mirroring the one set forth in the Directive. Thus, in 2004 the Commission made its third attempt to achieve harmonization in this convoluted area, issuing a proposal designed to liberalise the aftermarket for spare parts[966]. This proposal, known as the "repairs clause", purported to increase legal certainty and allow market operators and consumers to take full advantage of a uniform internal market for spare parts[967].

In fact, the situation at that time was characterised by opposed regimes, where nine Member States, including Italy and the UK, have liberalised, whereas sixteen Member States had *de jure* design protection to spare parts (among them, Austria, Denmark, Finland, Germany, Portugal, Sweden). The European Commission found that the *status quo* – with mixed protection regimes of design protection for spare parts – was altogether unsatisfactory and created trade distortion in the internal market[968]. The non-harmonization of the must-match exclusion means that independent manufacturers are only able to sell their products and offer their services in some Member States, but not in others.

Following a lack of progress at Council level, in May 2014 the proposal was withdrawn. Successively, the Commission launched a comprehensive legal and economic evaluation of

[966] European Commission (2004), Proposal for a Directive of the European Parliament and of the Council amending Directive 98/71/EC on the Legal Protection of Designs: Extended Impact Assessment.

[967] *Id.*, 2.

[968] *Id.*, 1.1.1.

the overall functioning of EU design systems[969]. In the framework of this evaluation, an external contractor, Europe Economics, presented "The Economic Review of Industrial Design in Europe"[970].

The latter suggests that, among various policy options, full liberalisation, meaning a complete elimination of design protection for spare parts within the EU, would be the best outcome. In an age of widespread availability of 3D printers, consumers and independent manufacturers think that they are entitled to produce their own 3D-printed spare parts for the purpose of repair. Hence, a *de facto* repairs clause might become inevitable anyway. In so far as it is impossible to enforce design law against all infringers in the 3DP landscape, a full liberalisation has to take place.

In response to this argument, one could maintain that 3DP makes the introduction of a repairs clause a more delicate issue than it was in the relatively recent past, because 3D printed products might not meet quality and safety standards. Any proposal fur full liberalisation should foresee a method to ensure that component parts are safe and useable, when it becomes possible for different industries to manufacture spare parts using 3DP.

In a study commissioned by the UK Intellectual Property Office ("IPO"), Reeves and Mendis stressed, in this regard, that it is rather unrealistic to assume that 3DP will be heavily used, in the near future, to make component parts in certain industrial sectors, such as the automotive aftermarket[971].

The component parts that, according to the UK IPO's study, are not yet suited to additive manufacture include: tyres, batteries, oil filters, air conditioning, etc. There are also aftermarket parts whose manufacture is technically possible by means of 3DP, but not economically viable yet, since the production costs would be higher than the current aftermarket value. The latter include: exhaust pipes, distributor caps, water pumps, and radiators[972].

As noted by the authors, one of the biggest limitations to the production of 3D printed spare parts lies in the lack of credible design data, from which to print. In the Office's opinion, it is erroneously "*assumed that parts can be simply scanned and reverse engineered, with the resulting data then being stored on the cloud*" for downstream 3DP. It is of fundamental

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[969] *See* http://ec.europa.eu/growth/industry/intellectual-property/industrial-design/protection/index_en.htm.
[970] Europe Economics (January 2015).
[971] Mendis; Reeves (March 2015), 19.
[972] *Id.*, 17.

importance to have access to the original CAD files, to understand "issues such as tolerances, loading conditions and material requirements"[973].

Hence, whether the impact of 3DP on the liberalisation of the aftermarket sector will be significant in the next future is not altogether clear yet[974]. For the sake of completeness, it is also worth recalling a recent Order from the CJEU in *Ford Motor Company v Wheeltrims s.r.l.*[975], dealing with trademark law.

At first instance, in the Italian proceedings, the claimant *Ford Motor Company* claimed that the defendant, a company operating in the automotive aftermarket, had infringed its registered trademark "Ford". *Wheeltrims* was marketing wheel caps bearing the registered trademarks of the original manufacturers – including Ford's trademark – without the owners' authorisation.

The defendant raised the repairs clause defence, arguing that Article 241 of the Italian Industrial Property Code, implementing Article 14 of the Design Directive, should apply as a defence to trademark infringement. The use of the trademark "Ford" was justified for the purpose of restoring the original appearance of the complex product, in derogation of the Trade Mark Regulation (EC) 207/2009 and Trade Mark Directive 84/104/EC. The Tribunale Ordinario di Torino made a reference for a preliminary ruling to the CJEU on the interpretation of the repairs clause set forth in the DD and CDR.

The CJEU answered the referred questions by Order, stating that Article 14 of DD and Article 110 CDR must be interpreted as not allowing – by way of derogation from the provisions of the Trade Mark Directive 2008/95/EC and Trade Mark Regulation 2009/207/EC– a manufacturer of replacement parts and accessories for motor vehicles to affix to its products a sign, which is identical to a trademark registered for such products by the original manufacturer, without the latter's authorisation, on the ground that the use thus made of the trade mark is the only way to restore the original appearance of the complex product.

Hence, the CJEU has made clear that, in its current form, the repairs clause that is anchored in European design law does provide a defence to an alleged trademark infringement. As a result, a third party who replicates by means of 3DP a component part, to which the manufacturer's own trademark is affixed, may be found liable for trademark infringement, provided that the private use exception does not apply[976].

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[973] *Id.*, 19.

[974] *Id.*, 20. According to Reeves and Mendis it will not be significant for the next 10 years.

[975] Order of the CJEU (Third Chamber) of 6 October 2015, Case C-500/14.

[976] According to Article 10 of Directive 2015/2436/EC, in order to commit an infringement the use of a third party's trademark should be "in the course of trade", i.e. in the context of a commercial activity with a view to economic advantage and not as a private matter. *See* the CJEU's ruling in *Arsenal Football Club plc. v Reed*, C-206/01 [2002] ECR I-10273, [40].

16. The CJEU's Decision in *Acacia*

The CJEU has recently released its decision in *Acacia*[977], deciding upon three different, but related references for a preliminary ruling issued by the Italian and German courts.

Acacia manufactures and markets via its website replica rims for car wheels that fit Audi, BMW and Porshe cars. The rims produced by the Original Equipment Manufacturers (OEMs) are registered as Community designs[978].

The main issue at stake in the main proceedings was whether Acacia's activities could or not fall under the "repair clause" provided for in Article 101(1) CDR.

More precisely, the first question that both courts referred to the CJEU, although framing it in slightly different terms, concerned the possibility to limit the application of Article 101 to "fixed shape parts", meaning "*those parts whose shape is in principle determined by the appearance of the product as a whole and cannot therefore be freely selected by the customer, such as rims for motor vehicles*"[979].

Guidance was therefore sought as to whether the bar to design protection, set forth in Article 101(1) CDR, covers component parts that do not come in a particular form only, but are interchangeable in accordance with consumers' wishes (i.e. customizable accessories, such as wheel rims).

In his Opinion, the AG highlighted that the wording of Article 110(1), as reinforced by its legislative history, leads to the conclusion that this provision shall apply even if the appearance of the component parts "*is not determined by the appearance of the complex product"*[980].

Moreover, the referring courts sought clarification as to whether the scope of the repair clause is limited to spare parts that are *identical* to the original parts. The CJEU answered this question in the positive: in order for Article 101 CDR to apply, the component parts must be identical to the originals.

It follows that, "*if a replacement part does not correspond, in terms of its design, colour or its dimension, to the original part, or if the appearance of the complex product was changed since it was first placed on the market",* the defence will not be available[981].

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[977] Joined Cases C-397/16 and C-435/16 *Acacia Srl, Pneusgarda Srl and Audi AG v Acacia Srl, Rolando D'Amato and Dr. Ing. H.c. F. Porshe* AG ELCI:EU:C:2017:992.

[978] The rims do not fall under Article 4(2) CDR, insofar as they are visible in normal use.

[979] Such as headlamps. Case C-435/16: Request for a Preliminary Ruling from Germany lodged on 4 August 2016 – *Acacia Srl and Rolando D'Amato v Dr.Ing. h.c. F. Porshe* AG, OJ C 419, 14.11.2016.

[980] *Acacia,* [AG69] et ss.

[981] *Id.,* CJEU [77].

This issue is particularly important in view of consumers' practice to upgrade their cars' aesthetics by purchasing a new set of component parts such as wheel rims. It is now clear from the CJEU's ruling that Article 110 CDR will not cover the *upgraded* versions of the original component parts.

Moreover, the CJEU further clarified that "*the manufacturer or seller of a component part cannot be expected to guarantee, objectively and in all circumstances, that the parts they make or sell for use … are, ultimately, actually used by the end users in compliance with (Article 110 CDR)*", i.e. for repair purposes, so as to restore the product's appearance"[982].

Having noted that, manufacturers or sellers are under a duty of diligence as regard compliance by downstream users, meaning that they should: 1) "*inform consumers, through a clear and visible indication on the product, on its packaging, in the catalogues or in the sales documents … that the component part concerned incorporates a design of which they are not the holder"*, and that "*the part is intended exclusively to be used for the purpose of the repair of the complex product so as to restore its original appearance"*[983]; 2) ensure, through appropriate (contractual) means, "*that downstream users do not intend to use the component parts at issue in a way that does not comply with the conditions set forth in Article 101(1)"* CDR[984]; 3) "*refrain from selling a component part where they know or … ought reasonably to know that the part in question will not be used in accordance with the conditions laid down in Article 110(1)"*[985].

Hence, not only has the CJEU ruled out the possibility for a manufacturer or seller to place on the market the upgraded versions of the official wheel rims without the right owner consent; it has also imposed on undertakings an obligation to take some precautionary measures, in order to ensure that purchasers of component parts acquire them for repair purposes only, and not for other purposes such as customization of the complex product.

Clearly, this last point bears particular importance within the 3DP context. In practice it might be extremely difficult for an intermediary to ensure that users have the intention to print and use component parts in a way that complies with Article 110(1) CDR.

[982] *Id.*, [85].
[983] *Id.*, [86].
[984] *Id.*, [87].
[985] *Id.*, [88].

If a consumer purchases four physical rims for its car, there is a reasonable ground to believe that he or she is not doing so for repair purposes; on the contrary, it is more difficult to ascertain how many copies will be printed out of a CAD file and what for[986].

Hence, it remains to be seen whether, and under what circumstances, the offer of downloadable files that enable printing component parts will be prohibited. The duty of diligence envisioned by the CJEU might be difficult to implement, if 3D-printing spare parts becomes practicable for end users.

17. Exclusive Rights Conferred by a Design

Once a design is registered, the holder of a RCD is granted an exclusive right to use it and to prevent any third party not having his or her consent from using it. Pursuant to Article 19 CDR, the right to "use" the design covers different sorts of activities, such as the making, offering, putting on the market or using the product in which the design is incorporated.

In contrast, an UCD confers the right to prevent the same aforementioned activities, but only in so far the contested use results from copying the protected design, and is not the result of an independent work of creation.

The owner's exclusive rights extend towards any third party, without any differentiation between primary and secondary infringers. This, in turn, implies that the holder of a RCD can pursue claims for direct infringement against intermediaries (e.g. online 3D platforms).

Furthermore, as already mentioned, infringement is not confined to the use of the design on the same product, in which the design was incorporated in the first place. Protection extends toward any use of the design, in relation to any products. It is also worth remembering that infringement cannot occur with respect to acts done privately and for non-commercial purposes[987], and acts done for experimental purposes (Article 20 CDR).

In light of the above considerations, the question of whether 3D printing a design-protected product from a CAD file constitutes or not an infringing activity is straightforward. There is no doubt that the acts prohibited under Article 19 CDR will encompass the manufacture of objects via 3DP, that is done in the context of a commercial activity and outside the scope of the private use exception (i.e. "making" the design)[988].

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[986] *See* Knight (2018) suggesting that: "*if wheel rims are sold in sets of four, no matter how robust the contractual arrangements with downstream users, this would suggest that they are being sold for the purposes of upgrade, and therefore infringing*".

[987] These criteria are cumulative. Use should be both private and for purposes that are not commercial.

[988] Malaquias (2014).

The holder of an unregistered design can only prevent the manufacture of products by means of 3DP if it results form copying the protected design. Thus the use by third parties in good faith does not constitute infringement of the UDR, if it results in a product independent creation.
As noted by some commentators, "*this may well be the case for most users of online CAD sharing platforms. Because they are mostly non-professional designers, mere enthusiasts or 3D printing hobbyist, it may be easier to establish the requirements for independent creation – i.e. that the user was unfamiliar with a prior unregistered EU design made available to the public when she created the CAD file*"[989].
Infringement will not be actionable, instead, against an individual, who 3D prints a design product at home, for private and personal use. Moreover, the fabrication of products, by means of 3DP, done for scientific research will be exempted irrespective of whether it is for a private or commercial purpose[990].
As noted by Suthersanen, this exception should be interpreted narrowly and be only allowed if the experimental usage of the design is in the general interest. A demarcation should always be made between acts of experimental nature, and those that seek to exploit the design[991].
Whether the scope of design protection should also include the act of making a scanned representation and/or a CAD file from a design already existing as a tangible article is less clear-cut. Also, does the unauthorized act of copying and marketing a third party's CAD file, in which a design is incorporated, amount to infringement of the design right?
The unsolved issue, therefore, is whether activities carried out in relation to CAD files alone fall foul of Article 19 CDR, and constitute an illegitimate "use" of the design. Moreover, who is the party responsible for the infringement: the one who uploads, downloads or markets the CAD file? Should the host of the file-sharing site be held liable too?
To answer these questions, two conflicting lines of thought can be followed. A strict interpretation of the law would suggest that the answer to these questions should be no. Just as a design requires there to be a product, infringement should only occur where a person uses a physical product[992]. The latter should not necessarily be the same product to which the design was incorporated in the first place, but it should however be an industrial or handicraft item.
On the other hand, one may point to the fact that EU Design Law provides for an "abstract"

[989] Nordberg; Schovsbo (2017), 295.
[990] Article 20(1)(b) CDR.
[991] Suthersanen (2010), 140.
[992] Bently; Sherman (2008), 666.

protection of a design as such[993]. Hence, at a par with copyright law – where the work is protected against all reproductions, in a similar or different medium of expression, as well as against transformative uses in the form of adaptations – design law protects the "design" in abstract terms, even if the product whose appearance is protected has not been made.

Accordingly, using a picture of a 3D product on a brochure, on a flyer or on the Internet may constitute infringement, if such product is protected as a design, even tough the 3D product as such has not been duplicated.

If a design is protected against all uses, it should not make the difference if such use amounts to a reproduction in 2D or 3D form. Protection conferred to the holder of a design in not restricted to a product category (i.e. the products indicated in the application for registration), but also covers uses in digital form of the design, such as the sharing of CAD files for products.

If products are then actually produced, that in itself amounts to an infringement, "*both in the country of manufacture and – if shipped – in the EU country in which the importer (even a private consumer) is located*"[994].

It should also be noted that the CDR does not offer protection against indirect use of a design, differently from patent law. There is no specific provision that confers on the holder of a RCD the right to prevent third parties, not having is or her consent, from supplying the "means" for using the design (e.g. marketing a complete kit that, when made up, constitutes the design)[995].

A CAD file could be seen as a "means" enabling the fabrication of the product in which the design is incorporated. As a consequence, making and distributing a CAD file would constitute an authorized (indirect) use of the design[996].

Therefore, a crucial issue to address is the extent to which a design right can be used against a new form of exploitation that does not imply the making of physical objects, but the creation and sharing of digital files.

Confining the scope of design protection to use on material products only may prove overly restrictive, in the light of the current technological change brought about by 3DP. One may argue that this technology is blurring the line between the physical and the immaterial worlds. An increasing number of undertakings might decide to make their CAD files available online, in the course of their business. Digital networks might emerge as an ordinary means of

[993] Nordberg; Schovsbo (2017), 284.
[994] *Id.*, 285.
[995] *See* Article 30 of the Convention for the European Patent for the Common Market (Community Patent Convention) 76/76/EEC.
[996] Bently; Sherman (2008), 666.

distributing 3DP templates of protected designs. In this way, undertakings would not need to mass-produce or distribute their products any longer.

Once a design is made available in the form of a CAD file, it then becomes extremely easy for anyone to replicate it, either by entrusting a third party with the task of printing the product, or by using personal hardware.

Future advancements in personal 3D printers will further expand this capability. Hence, design-based industries have to be equipped for the digitalization of things. In order for alternative business practices to come to light, it is of outmost importance to ensure that material protected by an IP is respected.

This, in turn, may call for a reinterpretation of the legal basis on which right holders shall receive protection. One may argue that right holders should be exclusively entitled to use – and prevent third parties from using and dealing with – the CAD files of their protected designs.

There are several ways to address this issue. A first option would be to consider the digital representation of a design as a "product" within the meaning of Article 19 CDR. Accordingly, this provision would cover different activities, such as the unauthorized making of CAD files, sharing of CAD files with other Internet users, and the sale of CAD files on 3DP marketplaces.

Furthermore, a possible interpretation of Article 20 CDR would be that the private use exception exempts from liability a third party, who simply downloads a CAD file and saves it on her computer.

One way to support this conclusion is to argue that requiring products to have some physical form is unduly limiting[997]. From a systemic perspective, it seems rather contradictory to allow registration of graphic symbols – including computer icons – and, at the same time, postulate that the notion of "product" is tied to a physical dimension for infringing purposes.

Furthermore, the scope of design protection is not limited to a certain category of products; rather, it covers any use of the design, in relation to "any" product that does not produce on the informed user a different overall impression. As noted by Malaquias, it seems very difficult to ascertain that a CAD file "will produce on the informed user a different overall impression from the protected design, considering that its purpose is to replicate the existing design in three-dimensions"[998].

[997] This expression is used by Bently and Sherman (2008), 667, footnote 66.
[998] Malaquias (2014), 27.

Alternatively, the law on indirect infringement allows some room for manoeuvre. Whilst the law of patents is equipped with a form of protection against indirect infringement, EU design law is not. A possible avenue to pursue, therefore, is the introduction of "indirect design infringement" as a separate head of liability under EU design law.

A provision against indirect infringement could be modelled on Article 30 CPC 1975, expressly setting out the prohibition on indirect use of a patented invention. This provision can potentially be deployed to prevent the sharing of CAD files for patented products, thus bringing real gains in terms of enforcement efficiency[999].

18. Limitations and Exceptions: Private and Non-commercial Use

In analysing the implications that 3DP might have on EU design law, the exception for "private and non-commercial use" deserves special attention.

Under EU design law, the private and non commercial use exception is set out in Article 20(1)(a) CDR and Article 13(1)(a) DD, which both have their template provision in Article 27(a) of the Community Patent Convention 1989.

In the context of design law, "private" refers to a type of use that is carried out solely for personal use. In this respect, the notion of "private" does not necessarily imply "secrecy" and does not necessarily contrast with "public".

One may think of certain activities undertaken by hobbyists or DIYers in an open space such as a FabLab, but for personal use. The same holds true if a product is printed in the presence of a group of friends or family members. What matters for an act to fall foul of the exception is the fact that it is not destined to benefit the public at large, but to satisfy personal needs.

As for the "non-commercial" part of the exception, it means devoid of economic benefit for the user. Hence, the publication or offer for sale of an infringing design most likely will not be exempted.

At present, it is not entirely clear whether lawfulness of a CAD file is a precondition for the private use exception to apply, as it is the case under copyright law. Applying the CJEU's reasoning in copyright infringement cases, one may conclude that the source from which a reproduction for private use is made should be lawful[1000].

This, in turn, would restrict substantially the scope of the private use exception in the context of 3DP. In fact, CAD files used for manufacturing purposes would need to originate with the

999 Most intermediaries might be exempted under the safe-harbour rules set out in the E-Commerce Directive.

1000 C-435/12 *ACI Adam BV v Stichting de Thuiskopie et al.* ECLI:EU:C:2014:254.

right holder or be authorized by the latter. Likewise, scanning activities would only be permitted insofar as they are directed towards the original design.

The section of the Legal Review dedicated to 3DP[1001] concentrates the analysis on the legal implications of 3DP vis-à-vis the private and non-commercial clause within Article 20(1)(a) CDR.

As noted in the Review, the current exception for private and non-commercial use was not conceived with 3DP technologies in mind. In fact, the origins of the private use exception to design infringement can be traced back to the law regulating patent rights, and more precisely to Article 27(a) of the Community Patent Convention 1989[1002].

Therefore, the historical roots of the private and non-commercial use exception in design law impose a brief overview of the rationale underpinning the same exception in patent law.

19. Private and Non-commercial Use Exception in Patent Law

As Ballardini and Lee point out, one rationale for the private and non-commercial use exception is rather pragmatic: it relates to the consideration that it is nearly impossible to trace and monitor all users' activities, and find out when such users exploit a patented invention for their own enjoyment, in their private households[1003].

Even when such monitoring activities become (technically and legally) feasible, it is usually posited that use by private persons and/or for non-commercial purposes of a patented product does not substantially affect the holder's commercial interest.

The market impact of such use would be minimal, as long as the invention is not shared amongst other users[1004]. Accordingly, it is believed that activities undertaken in private, for non-commercial purposes, should be excluded from the effects of patents.

Hence, the public policy objectives for providing the private and non-commercial use exception in patent law usually reflect the rationale underlying the patent system, on the one hand, and the need for a balance of interests, on the other. These two types of rationale are strictly intermingled[1005].

[1001] The Legal Review MARKTD2014/083/D, 128, [6.1], defines 3DP as a technology that provides "*a low cost means of reproducing objects that could potentially be protected by intellectual property rights, including design rights"*, raising the issue whether "*the current legal framework offers a balance between innovation and misappropriation*".

[1002] The Legal Review MARKTD2014/083/D, 129.

[1003] Nordberg; Schovsbo (2017), 174.

[1004] *Id.*, 174.

[1005] *Id*.

Patent rights are state-granted monopolies intended to protect new “inventions”. An invention can be defined as a new solution to a technical problem[1006]. The social purpose of a patent is to provide an incentive: (1) for further investment into R&D, in order to make new inventions; and (2) for the patentee to disclose the invention, thereby contributing “*to the to promotion of technological innovation and to the transfer and dissemination of technology .. in a manner conducive to social and economic welfare*” (Artcicle 7 TRIPs).

Therefore, on the one hand, the patent system rewards inventors for their novel and inventive contributions, by providing them with a temporary monopoly right. The inventor can exclude others from having access to the invention without his or her consent, but cannot exclude as completely as in the case of physical property. Otherwise, the patent coverage would be excessively broad, in a manner that does not conduce to social and economic welfare.

In fact, while weak rights may lead to under-production of innovative products, too strong rights may impede access to knowledge embedded in previous inventions and slow down the pace of technological development and progress (i.e. create a deadweight loss). Hence, the need of reconciling incentives to produce inventions with concerns about restricting access to such inventions by granting a too broad monopoly.

To this end, the patent system requires, as a condition for obtaining protection, that the patent applicant discloses certain details of the claimed invention. If information in patents is published, others can study the invention and thus build on it.

Moreover, in certain jurisdictions, if there are several ways to put the invention into practice, the applicant must indicate which one is preferable[1007].

Likewise, another limitation operates in relation to the term of protection available for patents: pursuant to Article 33 TRIPs, at a minimum, the monopoly expires after a period of 20 years from the filing date (i.e. the date of the application).

Finally, patent rights may be subject to certain exceptions and limitations, in order strike a fair balance between various interests (i.e. those of patent holders, third parties and the public at large), thus reaching the ultimate goal of the patent system, that is social welfare[1008].

This principal objective is also acknowledged in the responses given by most Member States to the survey conducted by the WIPO Standing Committee on the Law of Patents[1009]. All

[1006] The term “patent” is not defined in international treaties.

[1007] For example, in the U.S., *see* 35 U.S.C. 112(a).

[1008] WIPO, Standing Committee on the Law of Patents (January 27 to 31, 2014), *Exceptions and Limitations to Patent Rights: Private and/or Non Commercial Use*, available at: http://www.wipo.int/edocs/mdocs/patent_policy/en/scp_20/scp_20_3.pdf.

[1009] *Id.*

Member States seem to identify the major policy objective pursued by the private and non-commercial use exception in the balancing of legitimate interests.

Some Member States note that the economic interests of the patent holder are not affected by this exception[1010]. In fact, private use does not prejudice the normal exploitation of the invention, nor does it harm the right owner. The enforcement of patents against use of patented inventions at home, which goes beyond business use, is considered to be excessive and unnecessary. This exception can also eliminate barriers to trade, foster creativity, stimulate intellectual activity and promote the dissemination of knowledge[1011].

In fact, there is no need to extend the scope of the patent exclusive rights to cover minor activities carried out in the private sphere, without hindrance by the threat of patent infringement. Arguably, such an extension might result in an "abuse of rights" and, in any case, does not contribute to advance the state of the art[1012].

It must also be noted that the private use exception would need to meet the requirements set forth in Article 30 TRIPs: it should be limited; it should not unreasonably conflict with the normal exploitation of the patent; and it should not unreasonably prejudice the legitimate interests of the patent owner, taking into account the legitimate interests of third parties.

Arguably, 3DP is expected to change this scenario. An increasing number of consumers might invoke the private use defence against a claim of infringement[1013]. If 3D printers are used on a massive scale, activities undertaken by users that have traditionally been regarded as minor activities might become a great hindrance to right owners.

The commercial interest of right holders might be adversely affected by conducts taking place in the private realm. Users' access to digital designs might suddenly become the gateway to extensive misappropriation of protected inventions and creations.

Hence, the concern is that defining the boundaries between what is private and what professional, as well as what is commercial or non-commercial, might become increasingly difficult in the context of 3DP[1014].

Hence, the fundamental question that 3DP poses is whether it is advisable to amend the current legal framework or not. Does 3DP really upset the balance of interests that patent law aims to strike by setting forth the private use exception?

[1010] *Id.*

[1011] *Id.*

[1012] *Id.*

[1013] Legal Review MARKTD2014/083/D, 129.

[1014] *Id.*, 131.

The current legal framework might need to be subject to revision in the future, but it seems still adequate at present. Having noted that, legal scholars have put forward a set of proposals to address potential hindrance by threat of patent infringement in the 3DP landscape. This issue will be dealt with in the chapter V, when dealing with patent law.

20. Three-Step Test Language

Going back to EU design law, it is worth noticing that the current exception for private and non-commercial uses, provided for in Article 20(1)(a) CDR, might become incompatible with the three-step test enshrined in Article 26(2) TRIPS Agreement, in particular with the requirements that an exception must not "*unreasonably conflict with the normal exploitation of the protected industrial designs*" and must not "*unreasonably prejudice the legitimate interests of the owner of the protected design, taking account of the legitimate interests of third parties*"[1015].

In fact, where private parties are capable of reproducing product designs at little cost, rather than purchasing the respective objects, the normal exploitation of the design is affected, and the right owner's legitimate interests are prejudiced, as opposed to the legitimate interests of third parties[1016].

It is true that many uses of 3DP are extremely beneficial for users and the public at large (i.e. customization), but 3DP facilitates also harmful activities, such as the diffusion of counterfeits. A balance needs to be struck between protecting right owners' legitimate interests and fostering technological innovation[1017].

Hence, the Legal Review recommends, as a valuable policy option, a restriction of the private and non-commercial use limitation, by incorporating the three-step language in the CDR. According to the Legal Review, this might provide greater flexibility and achieve a balance between the legitimate interests involved[1018].

At national level, some Italian legal scholars have likewise suggested that the adoption of the three-step language, as already employed in the InfoSoc Directive, in both design and patent laws would better achieve the Constitutional principle of equality, pursuant to Article 3 of the Italian Constitution, which imposes to treat equally situations that are analogous[1019].

[1015] *Id.*, 129 stressing that: "*provided that such exceptions do not unreasonably conflict with the normal exploitation of protected industrial designs, and do not unreasonably prejudice the legitimate interests of the owner of the protected design, taking account of the legitimate interests of third parties".*

[1016] *Id.*

[1017] *Id.*, 130.

[1018] *Id.*, 132.

[1019] Galli; Zama (2014).

In fact, the most likely scenario is that users will increasingly use CAD files supplied by third parties, with the specific intent to violate a patented invention or a product design. That being the case, the private use exception must not be available, since the supply of CAD files may seriously affect the economic interest of the right holder and conflict with the normal exploitation of the work.

These legal scholars draw an analogy with the restrictive interpretation that, in the filed of patent law, has been given to the-called “Galenic exception”, which excludes from the scope of a patent the extemporaneous preparation of medicines, in pharmacies, based on medical prescriptions, provided that such preparation does not include the use of active principles manufactured industrially[1020].

Clearly, the rationale for the Galenic exception is to strike a balance between the patentee’s legitimate interests and the patient’s right to health. The exception does not apply if the pharmacist uses commercially available ingredients, and the final preparation is identical to the commercially available product in terms of dosage and excipients.

Hence, scholarship proposes to restrict the scope of the private use exception, taking inspiration from the narrow scope that the legislator and the judiciary have given to the Galenic exception[1021]. *Mutatis mutandis,* individual users should not be allowed to use CAD files that are serially created for the specific purpose of enabling the reproduction of a patent.

As the Galenic exception does not apply in cases in which the ingredients are produced on an industrial scale, likewise the private use exception must be ruled out when CAD files are produced on a large scale to enable a “domestic” reproduction of patented products.

One way of limiting the private use exception is to include in the CDR the three-step language, as provided under the TRIPS Agreement[1022]. This way of narrowing down the scope of the exception, however, does not seem advisable for the following main reasons. The three-step test appears in four international treaties currently in force: the Berne Convention; the WIPO Copyright Treaty; the WIPO Performances and Phonograms Treaty (WPPT); the TRIPS Agreement. The TRIPS Agreement contains four provisions that refer to the three-step test.

[1020] *Id*., 52 et ss.
[1021] *Id.*
[1022] *Id.* at 132.

When looking at the TRIPs Agreement, it also emerges that the formulation of the three-step test slightly varies in relation to the intellectual property regime at stake[1023]. Hence, the test is not the same in each TRIPs provision in which it appears[1024].

So, for example, Article 26(2) TRIPS, dealing with industrial designs, refers to "limited" exceptions. The same wording is used in Article 30 (i.e. for patents) and Article 17 (i.e. for trademarks). On the contrary, Article 13 (copyright works) confines limitations to "certain special cases".

Another difference in the formulation of the test relates to the expression "conflict with a normal exploitation of the work" (Article 13), which is accompanied by the adverb "unreasonably" for both patents and industrial designs, and which does not appear in Article 17 with respect to trademarks. Hence, it is important to understand whether these differences in wording do actually mean difference in substance[1025].

Likewise, in the case of industrial designs, the three-step test applies to "exceptions" and not also to "limitations". However, there is no consensus among scholars on the meaning to be attributed to the terms "exceptions" and "limitations".

For example, some scholars consider that whilst an exception is an unremunerated permitted use, a limitation is a remunerated permitted use[1026]; some others suggest that an exception gives immunity from infringement proceedings (or removes liability) for certain kinds of "permitted uses" (such as news reporting or education, private copying, quotation and use for teaching purposes), whereas a limitation excludes from protection a certain subject matter or material (i.e. official texts of a legislative, administrative and legal nature or news of the days) or limits the duration of an exclusive right[1027].

Clearly, it is important to ensure that the various versions of the test are interpreted in a manner that avoids "*mutually contradictory results*"[1028]. It is therefore argued that the proposal to employ the three-step language in EU design law may lead to ambiguity and to non-uniform interpretation. Rather than representing a useful tool, it may create additional confusion.

1023 Note that most scholars have focussed on the application of the three-step test in copyright law. A long-standing discussion concerns the structural function of the three-step test, as provided for by Article 5(5) of the InfoSoc Directive. Whether the test is addressed only to legislators in the EU Member States or it is also addressed to national courts remains unanswered. *See* Griffiths (2009).

1024 *See* Christie and Wright (2014).

1025 *Id.*

1026 *Id.*, 14.

1027 Ricketson (1999), 59.

1028 *Id*. at 8.

It also appears that the private use exception in EU design law has some peculiar traits when compared to the same exception in copyright law. Pursuant to the InfoSoc Directive, Member States may implement certain exceptions and limitations to the exclusive right of reproduction. One such optional exception to the reproduction right is "private copying" (Article 5(2)(b) InfoSoc Directive)[1029].

As Dimita points out, the justifications underpinning the private copying exception can be found in the necessity to "*restore the copyright "balance" when licensing and enforcement are impractical, and to promote the creativity of prospective authors facilitating the access to existing works"*[1030].

As noted by the EC, "*an act of private copying cannot be licensed for practical purposes, and thus causes economic harm to the relevant right holder*"[1031]. Hence, under copyright law, private copying exceptions are provided generally "on condition that right holders receive fair compensation which takes into account the application or not of technological measures"[1032].

Fair compensation "*is linked to the possible harm that derives from acts of private copying"*, hence, it is *compensatory* in nature[1033].

When compared to the InfoSoc Directive, it emerges that EU design law sets forth a broad exclusive right, i.e. the right to *use* the design, which is inclusive of the act of reproduction. Directly correlated to the wider scope of exclusivity conferred to right owners is the mandatory exception for all acts done for private and non-commercial purposes. Such an exception is not subject to fair compensation being paid to the right-holder.

Hence, a policy option is to introduce a compensation mechanism for holders of design rights. In such a case, it would be necessary to determine "*the equipment on which a levy is applied and the amount that should be levied*"[1034]. In theory not only 3D printers, but also 3D scanners and 3DP materials may be subject to a levy, for being tools suitable for replicating the product design.

Yet, "*levy systems are national in scope; Member States have responded in different ways in setting the levies, even for identical digital equipment or blank media"*[1035]. Hence, the divergent national ways of imposing levies in the 3DP context may cause additional fragmentation in the internal market.

[1029] *See* chapter II.
[1030] Dimita (2010), 188.
[1031] *Id*. quoting the EC, Background Document, *Fair Compensation for Acts of Private Copying*, Brussels (14/02/2008), http://ec.europa.eu/internal_market/copyright/docs/levy_reform/background_en.pdf .
[1032] Article 5(2)(b) InfoSoc.
[1033] EC, *Fair Compensation for Acts of Private Copying*, p. 4, [2].
[1034] *Id*., p. 5, [3.1.1.]
[1035] *Id*., p. 3, [1].

Member States may refuse to adopt a uniform approach towards the devices that should levied. Likewise, there might be differences in how Member States charge identical equipment. Rates, in fact, may be dependent on the 3DP devices' capacity or speed in replicating products, the quality of reproductions or simply constitute a percentage of the purchase price. Arguably, this risk of inhomogeneity weighs against the introduction of a levy system.

Moreover, levy schemes seem at odds with innovation, because they turn attention away from the development of 3DP services to physical devices or hardware. Many stakeholders have put forward the idea "*to replace the current hardware-based levy systems with other forms of fair compensation*"[1036].

In considering the possibility to introduce a levy system, it is important to take into account that business models and consumption patterns change over time and could likewise change in the 3DP context. Hence, as 3DP is moving fast, it may be too early to predict what will be the model preferred by the majority of consumers (scanning products, printing products at home, delegate the actual print to an intermediary, share CAD files via Creative Common licenses, etc.).

For example, in the copyright realm, consumers seem to prefer new consumption models that are based on access, rather than ownership. These access models have the potential to significantly reduce "*the overall amount of copying undertaken by end users and, as a consequence, the amount of levies required to compensate for acts of private copying*"[1037].

As noted in the Legal Review, in response to the question whether a "fair compensation" mechanism similar to that under EU copyright law is desirable also under design law, in light of the challenges posed by 3D printing, the French automotive manufacturers replied yes, whereas in the non-automotive sector, only the 45 % of respondents considered it an appropriate option[1038].

Arguably, introducing a levy system for compensating owners of design rights is not the best policy option for the time being. Levies may be a relevant source of income for right holders only if the number of 3DP devices that can make copies of protected designs will steadily increase.

It is also worth noticing that the diffusion of the technology amongst users largely depends on the interpretation that is given to the private and non-commercial use exception. 3D printers

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1036 Vitorino (2013), *Recommendations Resulting from the Mediation on Private Copying and Reprography Levies*, 2.

1037 *Id*., 7.

1038 Legal Review MARKTD2014/083/D, 131.

will be commonly available in private households only to the extent that the exception is not interpreted too narrowly, for fear of the owner's exclusive rights being eroded.

Final Remarks

To date, the EUIPO accepts 3D digital representations of designs as "representations of the design that are suitable for reproduction", within the meaning of Article 36 CDR. Such a representation is enclosed in the application form for a RCD to show, in the same way as a photograph, the design for which protection is sought.

It has also been noted that, although the CDR is structured on the concept of "product", the EUIPO does not take into consideration whether a product is actually made or used, or can be made or used, in an industrial or handicraft fashion. This, means that, in theory, the CAD representations included in the application for a RCD will determine the scope of design protection, regardless of whether the product is actually manufactured or not.

It has also been contented that, in case a CAD file clearly unveils the outer appearance of a product, its publication online will be tantamount to a "disclosure" for the purposes of Article 7 CDR. As a consequence, all later products – and CAD files for products – will have to produce a different overall impression on the informed user. By contrast, it is not entirely clear whether publishing a CAD file on a website that is hosted outside the EU will trigger UCD protection from the date of the first online publication, given the geographical limitation contained in Articles 11 and 110(a) 5 CDR.

Hence, there are many issues that have to be clarified. First, who is the informed user of a product represented digitally as a CAD file, as opposed to the informed user of the finished product? Second, is the designer's degree of freedom enhanced or limited by the fact that she creates a product design using CAD software? Third, if many individuals begin to create their own CAD files for products and upload them online, thereby disclosing the design for which protection is sought, will many market sectors suddenly become overcrowded? Will all subsequent designs have to depart from the considerable amount of CAD models already made available online?

Besides, the ease of converting a CAD file into a physical item has led some commentators to suggest that design owners should be entitled to claim protection for the CAD representations of their designs. In a hypothetical world of widespread 3D printers, it could be that CAD files become almost interchangeable with end products. The owner of a CAD file might be as satisfied as if she possesses the end product itself. A CAD file would then serve as a substitute for a good, offered to the same or actual potential customers.

Following this line of reasoning, many are the fields in which clear-cut rules are needed, since new technologies empower individuals in their creativity and yet should make them responsible for potential infringement of third party exclusive rights.

In order to address the challenges that an extensive use of 3D printers might pose to design rights, the EU Commission, in its Legal Review, has put forward a number of proposals to be evaluated before any legal reform takes place. The first proposal concerns the end user directly (i.e. the scope of the private use exception), whereas the other three proposals affect the user only indirectly, since they concern "intermediary party infringement".

More precisely, the European Commission has made the following recommendations: (1) limiting the private use defence, by employing the three-step language as provided under the TRIPs Agreement; (2) introducing a provision against indirect design infringement that would be in line with the availability of such liability under patent law; (3) introduce a form of direct liability for authorisation of design infringement; (4) clarify what constitutes design infringement by including the creation of a design document as an infringing use[1039].

As discussed in detail above, the first recommendation (i.e. to reformulate the private use exception) is grounded on the belief that, if consumer 3DP becomes a mass phenomenon, many private uses in the 3DP context may actually affect the commercial interest of the right holder. If this were the case, the private use defence would not be compliant with the three-step test. It must be noted, though, that use of 3D printers by individuals in their private sphere is still a very limited phenomenon.

The proposal is based on the presumed impact of widespread copying of products, bearing protected designs. However, at least in the short term, right holders will not encounter the risk of millions of people 3D printing products in their homes. Hence, right holders will not have a strong claim that the line between what is private and what is commercial is suddenly blurred. For this reason, the first policy option outlined in the Legal Review is not advisable.

Noticeably, the Legal Review recommends, as alternative option, the introduction of a compensatory scheme for the prejudice suffered by right holders, in the form of a private copying levy to be applied to 3DP hardware and/or software[1040]. We have discussed the drawbacks of such proposal.

The second recommendation is to introduce in EU design law a "patent style" provision on indirect design liability. Such a provision is aimed at targeting intermediaries involved in facilitating infringement by introducing "indirect design infringement" as a separate head of

[1039] Legal Review MARKTD2014/083/D, 132 et ss.
[1040] *Id*. 130.

liability. On the one hand, a policy option that concentrates enforcement efforts on intermediaries, rather than individual users, appears preferable.

On the other hand, as it will be discussed when dealing with indirect patent infringement in chapter V, interpretative quandaries concern the significance of “means” related to an “essential element of the invention”, and whether such concept includes CAD files or not. This uncertainty, in turn, may significantly impact the operation of a provision on indirect design infringement, which may or nor cover online repositories of CAD files, besides 3DP platforms offering additional services.

One may argue that 3DP online sharing platforms enable the participation of users in co-creation activities with their peers and with firms. Co-creation and innovation promoted by communities of users should not be stifled.

Moreover, protection against intermediaries may discourage new business models that are beneficial for consumers. For instance, 3DP shows the potential to increase mass-customization of product, which is said to create considerable “added value”. The threats of potential harmful activity (i.e. the supposed spread of counterfeit goods) should not in itself be conducive to a legal response to 3DP.

Finally, a provision against indirect design infringement requires knowledge on the part of the infringer. As noted by scholarship, contractual arrangements will tend to transfer liability[1041].

The third recommendation outlined in the Legal Review is aimed at filling this gap: intermediaries should be held directly liable, for an act of primary infringement by authorisation, regardless of whether they have actual or constructive knowledge of infringement.

EU design law could fashion a provision similar to Section 226(3) CDPA 1988, specifying that it is a “primary” infringement of a design right to do or “authorise” another to do, without the design right owner’s permission, anything which is the exclusive right of the design right owner.

In the UK, this provision should be read in conjunction with Section 226(1) of the UK CDPA 1988, which states that “the owner of a design has the exclusive right to reproduce the design for commercial purposes […] by making a design document recording the design for the purposes of enabling such articles to be made”.

“Design document” is defined in Section 51(3) CDPA as: “any record of a design, whether in the form of a drawing, a written description, a photograph, data stored in a computer or

[1041] Nordberg and Schovsbo (2017), 300.

otherwise". The scope of this provision is wide enough to include CAD files as design documents[1042].

Hence, the Legal Review recommends that EU design law could fashion an additional provision similar to Section 226(1) stating that the creation of a design document amounts to an infringing use[1043].

In the first place, the proposed legal framework would clarify that making a CAD file from an existing design-protected product, for the purposes of 3D printing such product, amounts to an infringement of the design right. It would also specify that intermediary parties, such as 3DP online platforms, might also be directly liable for "authorising" design infringement. Neither actual nor constructing knowledge would be required for a positive finding of infringement. Yet, such form of liability carries the risk of being too broad, as it potentially encompasses the manufacturers of 3D printers, as well as 3DP online platforms.

It follows from the above that, when considering how to regulate 3DP, the guiding principle should be the need to achieve the optimal scope of design protection, which incentivizes right holders and protects them against mass-scale copying, whilst encouraging innovation by communities of users, the adoption of new business models leading to increased customization, artistic creation and cultural fruition by users. All such legitimate interests must be duly taken into account.

A clear message emerges from the Legal Review: a more concrete recommendation should only be put forward after a comprehensive review of the impact of 3DP is made. Arguably, a legislative intervention should not predate the full development of this technology.

[1042] It should however be borne in mind that, in the UK, pursuant to Section 51(1) CDPA 1988, copyright in a design document (i.e. in the CAD file) will not infringed by making a 3D article from it, where the design is for anything other than an artistic work or a typeface. Hence, if a CAD file embodies a utilitarian design (for example, the design of automotive spare parts), printing the object will not result in copyright liability.

[1043] Legal Review MARKTD2014/083/D, 133.

Chapter V

Three-Dimensional Printing: Threats to the Patent System

Introduction

The following discussion is aimed at answering two main questions: (1) what conducts in the 3DP landscape amount to *prima facie* patent infringement?; (2) What are the conditions under which exceptions to patent infringement apply?

Whether activities undertaken in relation to CAD files incorporating patented objects constitute acts of (direct or indirect) infringement is far from clear.

The question should be answered whether "making" a CAD file for a patented product shall be equated to "making" the physical object itself, which amounts to direct patent infringement. Likewise whether conducts such as "selling" or "offering" to sell CAD files are unlawful under current law on direct patent infringement remains unanswered at present.

In order to establish direct patent infringement, the CAD file shall be treated as the equivalent of the physical product embedded therein. Alternatively, a CAD file can be regarded as an essential means for putting the invention into effect, whose distribution online amounts to indirect patent infringement.

Particular attention is also given to the diverging interpretations that the concept of "repairing" a patented product attracts throughout the EU. This issue appears particularly relevant, as 3DP enables making digital changes to a CAD file embedding a patented product, and then printing out such product.

Whether these activities amount to "making" a new product, which results in direct patent infringement, or constitute a legitimate maintenance measure that is undertaken for the purpose of repairing the patented product, may vary depending on the jurisdiction[1044].

We will also consider the position of those who supply third parties with 3D printers, filaments or scanners. Are they liable for indirect patent infringement, if the person supplied is the final user, who can rely on the private use exception? Following the structure of the CPC 1975 (Articles 29 and 30) and of the UPCA (Articles 26 and 27) the answer seems to be yes. Moreover, under certain circumstances, the "staple article of commerce" doctrine may exempt them from liability[1045].

To recapitulate, as scholarship notes, in the 3DP context right holders may find it useful to: (1) expand the scope of the patent rights to cover the "making" of a CAD file, on the ground that the latter must be equated to a physical object; (2) further clarify the concept of "repairing" v "making" the invention; (3) give a narrow interpretation to the existing exceptions to patent infringement (i.e. the "private and non-commercial use" and the

[1044] On this *see* also Ballardini (2015).
[1045] *See* infra.

"research and experimental use" exceptions); (4) quaify CAD files as "means" relating to an essential element of the invention"[1046].

Before analysing each of these options, patent reforms that have recently been put in place in Europe are illustrated. The analysis goes on to outline the EU regulatory framework of both direct and indirect patent infringement.

In the second part, the discussion will move to U.S. patent law, considering the additional question, from the side of *protection*, of how shall patent claims be construed in the 3DP context, i.e. whether the claim shall be limited to the physical, printable object or extend to the digital design embedded in a CAD file[1047].

1. Recent Patent Reforms in the EU Landscape

A number of patent reforms have recently been adopted at the EU level, introducing a system whereby a single unitary patent, with uniform protection throughout all member states, can be obtained[1048]. Additionally, the establishment of the Unitary Patent Court ("UPCt") might serve to overcome inconsistency and uncertainty in patent litigation[1049].

Before entering into the core of the reform, a brief overview of the process of patent law harmonization must be given. The first attempt at EU level to create a fully harmonized patent system goes back to the 1950s.

The EU harmonizing efforts led to the adoption of the European Patent Convention ("EPC"), an international agreement that came into force in 1977. The EPC has established the classical European patent ("CEP"). Moreover, through the EPC, the contracting member states formed the European Patent Office ("EPO").

It must be noticed that the EPC left the determination of substantive patent provisions to contracting states, which were not required to conform their national patent laws to the Convention[1050]. Nonetheless, the EPC fixed few substantive rules that most contracting states have implemented[1051].

[1046] Ballardini (2015), 856.

[1047] Hence, the first part of this chapter, dealing with EU law, is limited to patent infringement. The second part, instead, focuses also on protection of CAD files under U.S. patent law.

[1048] Regulation (EU) No. 1257/2012 and Regulation (EU) No. 1260/2012. Note that Italy joined the cooperation scheme on 2 October 2015. The Regulations are in force for 26 EU member states, with the exception of Spain and Croatia.

[1049] Agreement on a Unified Patent Court (UPCA), published in OJ EPO 2013, 287. The UPCA is the third component of the Unitary Patent package. Yarksy (2017), 171.

[1050] Bayliss (2014).

[1051] Di Cataldo (2017).

Even if the EPC did not provide for a unitary patent title, it created a centralized system for processing the applications filed with the EPO[1052].

In fact, a CEP does not automatically confer protection throughout Europe, but must first be validated within each country in which protection is sought[1053].

Hence, pursuant to Article 64(1) EPC, in each contracting state for which it is granted, the CEP has the same effect and is subject to the same conditions as a national patent granted by that state[1054].

Therefore, under the EPC system, infringement and invalidity proceedings have to be pursued before national authorities, rather than before the EPO. Litigation in multiple countries, in turn, may result in higher costs, inconsistent case law, legal uncertainty over the scope of protection available and forum shopping[1055].

As an alternative to file a single application with the EPO, it remains possible for inventors to file different national applications in each country in which they seek protection. In general, this option is recommended if the applicant intends to file in fewer than four European countries[1056]. Finally, an applicant could file an international application under the PCT[1057].

An important step towards harmonization, this time in relation to post-grant matters, has been achieved through the Community Patent Convention ("CPC") 1975. Although such treaty never came into force, it has nevertheless contributed to the approximation of national laws, serving as a template for the implementation of substantive provisions regulating, inter alia, infringement and exceptions and limitations. This is why such rules very much resemble each other among different EU member states.

The Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPs Agreement) likewise played a critical role in terms of harmonizing some substantive provisions on, inter alia, patentable subject matter, the exclusive rights conferred by a patent, and the exceptions to such rights.

It is worth noticing that, after Lisbon, Article 207 TFEU vests the EU with the exclusive competence, in its external relations with non-member countries, to adopt and amend international agreements that are "*intended to promote, facilitate or govern international*

1052 *See*: https://www.epo.org/applying/basics.html.

1053 In case a CEP is issued and then validated in various contracting states, the patent becomes a bundle of national rights enforceable according to national legislation in each given jurisdiction. See Article 2(2) and Article 64(3) EPC.

1054 Note that validation requirements vary between countries.

1055 https://www.epo.org/law-practice/unitary/upc.html#tab1.

1056 Bayliss (2014).

1057 For an in-depth analysis of international applications see: http://www.wipo.int/pct/en/.

trade" ("common commercial policy"), including "the commercial aspects of IP". The latter covers the TRIPs Agreement, as well as any future agreement regulating IPRs[1058].

The EU has not gained, instead, an exclusive competence to regulate the filed of IP law in the internal market. The Lisbon Treaty, however, set out the legal basis for the introduction of European IPRs: Article 118 TFEU[1059].

Article 118 TFEU has granted the EU competence to establish the Unitary patent system ("UPS"), according to which it will be possible to obtain protection across all signatory member states, through a patent with unitary effect.

1.1. The Unitary Patent System

Up until recently, the EU did not provide for a unitary patent, with EU-wide effect. Inventors who wished to obtain patent protection at EU level had to face numerous hurdles, including multiple translations requirements, inhomogeneous administrative costs and inconsistent court decisions.

To overcome the current fragmentation of the EU patent system, the EU legislator has introduced a unitary patent ("UP"), "*providing uniform protection in all participating member states*"[1060].

Before a UP can be registered by the EPO, the applicant must first obtain a CEP. A European patent application must therefore be filed and processed under the EPC in the same way as today. Once the application has been filed with the EPO and the CEP has been granted, it is possible to obtain a UP at the request of the patentee[1061].

The UP automatically gives protection in twenty-six member states of the EU. As a general rule, a UP can "*only be limited, licensed, transferred, revoked or lapse in respect of all the participating member states"*[1062].

Therefore, while the application and examination procedures will remain unchanged, and will be exclusively governed by the EPC, a separate post-grant procedure for the administration of UPs has been established (i.e. for obtaining, maintaining and managing UPs), with the aim of reducing both complexity and costs associated with the current validation system.

[1058] C-413/11 *Daiichi Sankyo Co. Ltd Sanofi-Aventis Deutschland GmbH v Demo Anonimos Viomikhaniki kai Emporiki Etairia Farmakon,* (18 July 2013)(ECJ). On this *see* Dimopoulos; Vantsiouri (2012), 12.

[1059] Council of the EU, 15 April 2011, *Proposal for a Regulation of the European Parliament and of the Council implementing Enhanced Cooperation in the Area of the Creation of Unitary Patent Protection*, COM(2011) 215 final, 1.

[1060] https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52011PC0215&from=EN.

[1061] *See* Recital 18 of the Preamble to the Regulation No 1257/2012.

[1062] Article 3 Regulation No 1257/2012.

Despite the broad recognition of the shortcomings stemming from the present European patent system, some EU member states, such as Italy and Spain, did not want to participate in the UP project, due to a contrasting view over the translation requirements. Therefore, in March 2011 the Council of Ministers, having heard the European Parliament, authorised a group of member states to implement "enhanced cooperation" in the area of UP protection, under Article 20 of the Treaty on the European Union.

Under the enhanced cooperation regime, two regulations were adopted, one creating the UP and the other laying down the translation arrangements for UPs[1063]. These two regulations entered into force on 20 January 2013, but will be applicable only when the Agreement on a Unified Patent Court (UPCA) likewise enters into force[1064].

On 19 February 2013, twenty-five EU member states signed the UPCA. The Unified Patent Court (UPCt) is entrusted with handling the majority of cases, thus helping achieving more consistency and predictability with respect to invalidity or infringement matters[1065].

As Pinckney notes, the decision to give the UPCt jurisdiction over both CEPs and UPs seems entirely understandable: it is "*logical to provide a central forum to litigate European patents, granted centrally*"[1066]. Indeed, this helps avoiding high costs, risks and complexities associated with multi-forum litigation[1067].

Nonetheless, the issue of whether litigation before the UPCt should or not be compulsory, in case of CEPs, has been highly controversial. In fact, applicants for the CEPs have signed to a system under which litigation was conduced nationally, not supra-nationally[1068].

In this respect, it is worth noting that the CJEU found the previous European and Community Patents Court (ECPC) agreement inconsistent with EU Treaties[1069]. Thereafter, the drafters of the UPCA established a court that does not have an international character, but it is "*common to the member states of the EU*"[1070].

[1063] Regulation (EU) No. 1257/2012 and Regulation (EU) No. 1260/2012.
[1064] Published in OJ EPO 2013, 287.
[1065] Yarksy (2017), 168.
[1066] Pinckney (2015), 268.
[1067] EPO patent's guide, 35, available at: http://documents.epo.org/projects/babylon/eponet.nsf/0/C3ED1E790D5E75E0C125818000325A9B/$File/Unitary_Patent_guide_en.pdf.
[1068] Article 64(3) EPC.
[1069] Opinion 1/09 of the CJEU delivered pursuant to Article 218(11) TFEU, available at: http://curia.europa.eu/juris/document/document.jsf?text=&docid=80233&pageIndex=0&doclang=en&mode=lst&dir=&occ=first&part=1&cid=425262.
[1070] Article 1(2) UPCA.

Moreover, the UPCA explicitly sets forth the UPCt's duty, as a national court, to comply with the primacy of EU law, rely on the CJEU's case law and request preliminary rulings[1071].

As far as jurisdiction over CEPs is concerned, a compromise solution was reached through the transitional regime provided for in Article 83 UPCA. According to this provision, while the UPCt will have exclusive jurisdiction over disputes concerning UPs, as for matters related to CEPs, an action may still "*be brought before national courts or other competent national authorities"* for a transitional period of seven years after the entry into force of the Agreement[1072].

Moreover, "*a proprietor of or an applicant for a EP granted or applied for prior to the end of the transitional period"* can "*opt out of the exclusive competence of the Court"*, and can also withdraw the opt-out at any moment[1073]. The possibility to bring an action before national courts or to opt out of the UPCt's jurisdiction is not available for UPs.

It follows from the above that the UP package, in its current form, does not reduce the alternative avenues to gain patent protection. In essence, under the UPS, an applicant can decide to file either with national offices or with the EPO. In the latter case, the applicant will have the choice to request for the unitary effect. This procedure is less burdensome and expensive as compared to the current system of national validation.

Arguably, the current non-harmonized landscape in EU patent law constitutes a major hurdle for the development of 3DP technology. It remains to be seen how the creation of a UPS in Europe will affect businesses, and whether it will pave the way for technological change and progress.

In fact, some argue that the UP system will penalize those member states in the EU with less technological innovative power[1074]. The reason is that foreign patentees (mostly from advanced non-EU countries) can now obtain a UP covering the territories of those countries in which the number of validated CEPs has always been rather low (for example, Hungary). Hence, the enforcement of patent rights in such countries will reach unknown and unforeseeable levels; this could, in turn, affect local innovators and developers.

2. Substantive Patent Law in the EU

1071 Article 20 UPCA.
1072 Pickney (2015).
1073 *See* Article 83(3) UPCA. It is unclear if, during the transitional period, the UPCt shall apply national law, in case the patentee opts out of the court's jurisdiction, and whether national courts shall apply national law or the UPCA, if an action involving a CEP is brought before them.
1074 Pintz & Partners (2018).

The substantive provisions regulating the patent system can be divided into two groups: pre-grant provisions and post-grant provisions.

As noted, pre-grant provisions were left outside the scope of the UP package, since the pre-grant phase remains entirely regulated by the EPC. As literature suggests, this is a missed opportunity for the EU legislator to regulate important aspects of patent law, such as the grace period, the doctrine of equivalence and employees' inventions[1075].

As far as post-grant provisions are concerned, during drafting lawmakers have decided to place a number of substantive provisions in the UPCA, some of which are particularly relevant for present purposes. In fact, the previous draft proposal on the Unitary Patent Regulation contained Articles 6-8, which set forth the exclusive rights conferred by the patent and the limitations thereof, mirroring Articles 25-27 CPC 1989.

After a heated debate on the opportunity to include these provisions in the Regulation, the Council proposed Articles 6-8 be deleted and moved to the UPCA. At the same time, Article 5 was included within the Regulation No 1257/2012 under the title "uniform protection".

As advocated by most legal scholars and practitioners, the choice to include provisions on substantive patent law in the UPCA, rather than in the Regulation, was meant to avoid giving the CJEU jurisdiction to hear preliminary references from national courts[1076].

In fact, at the time the Regulation was adopted, the CJEU was incurring into severe delays in judgements. Moreover, the main concern was that the CJEU is not enough specialised in patent law to issue preliminary rulings[1077].

Hence, national laws will keep on being important sources of law within the framework of the UPS[1078].

In fact, Article 5(1) of Regulation No 1257/2012 is an extremely vague provision that establishes the so-called "unitary effect" of the unitary patent. Accordingly, this kind of patent confers the right to prevent any third party from "*committing acts against which that patent provides protection throughout the territories of the participating member states in which it has unitary effect, subject to applicable limitations*".

Article 5(2) of the same Regulation clarifies that the scope of the right and its limitations, including the private and non-commercial use exception, shall be *uniform* in all participating EU countries, where the patent has unitary effect. Article 5(3) further specifies that the

[1075] *See* Kaisi (2014), 173.
[1076] Yarksy (2017), 184.
[1077] In any case, the provisions of the UPCA on substantive patent law reflect those of the EPC and the CPC, which have served as a template for harmonisation of national laws.
[1078] Ballardini; Lee (2017), 176, §8.02[B]. Kaisi (2014).

applicable (national) law to determine which are the relevant acts and limitations to which paragraph (1) refers must be identified pursuant to Article 7 of the Regulation (i.e. by the residence, principal place of business or a place of business of the applicant(s); failing any of these in a participating state, then German law will apply)[1079].

Hence, on the one hand, if the EU patent package goes into effect[1080], it will require patent norms on the scope of rights and limitations to be interpreted uniformly across the EU, in order to achieve consistency and standardization. On the other hand, in substance, the applicable law remains national law, determined pursuant to Article 7.

The fact that the law of a single country applies throughout the whole territory of the EU (i.e. the territories of the enhanced cooperation), in case a UP is granted, is an important achievement. Yet, the UP package failed to introduce European substantive norms directly applicable in the EU legal system contrary to Article 118 TFEU – a provision that is aimed at the creation of a European IPR[1081].

National laws of the EPC contracting states converge on the core aspects of substantive patent law, but still differ on important details. Hence, in applying national law, the UPCt may reach contradictory decisions on the very same issue, thus leading to further fragmentation of the internal market.

This, in turn, may result in forum shopping – the business is based in the country that has a more favourable law – and the spread of patent trolls – the creation of non-innovative companies that obtain patents from undertakings close to bankruptcy, so that innovative companies will need to ask the patent troll for a license[1082].

It is also important to stress that, in order for the unitary patent regime to be operational, it suffices that thirteen member states ratify the UPCA. Poland has already manifested its intention not to ratify the agreement.

A contentious issue is whether the UPS will lead or not to an increased standardization and harmonization of national patent laws. There is still an on-going debate regarding member

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[1079] If a company that is based in a third country (i.e. the U.S.) files an application with EPO, German law should apply because the EPO has its headquarter in Munich. Arguably, the decision to render German law applicable, lacking the other conditions set out in Article 7, is discriminatory and unjustifiable.

[1080] The UPCt Agreement must be ratified by at least thirteen EU member states, including France, Germany and the UK, which are the most "patent intensive" states. The UK has not yet ratified the UPCA, but the Government has announced it intention to do so, despite Brexit. It remains to be seen whether the UK will go ahead in the ratification process. If not, it will become necessary to move the central division of the UPCt that is based in London (Article 7.2. UPCA). *See* Sellens (2018).

[1081] Kaisi (2014), 178.

[1082] *Id.*, 179.

states' obligation to implement some changes to their national patent laws, in order to comply with the UPCA's substantive provisions[1083], as far as national patents are concerned.

On the one hand, the UPCA covers only UPs and CEPs, whereas it does not regulate national patents. Hence, one may argue, there is no reason why national laws should be aligned to the UPCA, as far as national patents are concerned.

On the other hand, as Article 2(2) EPC requires CEPs to have the same effect as national patents, member states should not keep in force different laws for national patents as compared to (Unitary or Classical) European patents granted by EPO. Following this line of reasoning, member states will need to amend their laws in order to comply with the UPCA.

2.1. Substantive Provisions Regulating Direct Patent Infringement

Direct liability for patent infringement covers the unauthorized acts of "making, using, selling, offering to sell, or importing" the entirety of the patented invention, including equivalents[1084].

Direct liability is a form of "strict" liability that may arise irrespective of whether the infringer had (actual or constructive) knowledge of the patent, and regardless of how the patented invention has been replicated, thus including 3DP processes[1085].

The quality of the replicated invention is of little significance to establish infringement. Hence, a third party may still be found liable if he or she makes a low quality version of a patented item, by means of 3DP.

Direct infringement clearly covers the act of 3D printing a patented product from a CAD file[1086]. In practice, however, pursuing direct infringement claims might not be an attractive option for patentees. There might be several problems with enforcing patent rights against individual infringers, who put the invention into effect by printing objects at home or in 3DP hubs.

First, it might be extremely difficult to detect and track infringers in those situations. Moreover, even when a patentee becomes aware of infringing activities, the private and non-commercial use exception might apply.

[1083] The UPCA contains several provisions on substantive patent issues, such as the basic criteria for establishing direct and indirect patent infringement and exceptions to patent rights.

[1084] The wording of the law in various countries much resembles Article 29 CPC 1975 and Article 25 UPCA.

[1085] Ballardini et al. (2015), 853.

[1086] An example can be cited to illustrate how easy it might be in the future for everyday consumers to print patented objects: the case of a college student who scanned his own teeth and then used the 3D printer at his school to print models of his teeth and a set of braces. *See* https://www.sciencealert.com/a-college-student-has-3d-printed-his-own-braces-for-less-than-60.

Second, enforcing patent rights against customers, rather than competitors, might turn out to be a counterproductive strategy. Third, the line between unlawful activities, such as re-manufacturing a patented product, and legitimate acts, such repairing a patented product, is thin.

For all such reasons, patent owners will rather try to control the sharing of CAD files, and this is where, in the words of Osborn, doctrinal quandaries begin to emerge[1087]. As discussed, the question of whether a CAD file shall be treated like the corresponding physical product for the purposes of patent law – so that the making and sharing (upload, download or sending by email) of such file constitute an act of direct infringement – remains unanswered at present.

Arguably, patent law in most jurisdictions will encounter difficulty with CAD files embedding instructions to print patented products. Historically, making a blueprint of an invention has not been equated to making the invention itself, because of the intermediate steps that must be taken to have the object in finished form (from the design phase to the actual manufacture).

In other terms, for an act of direct infringement to be established, the allegedly infringing product should be in a physically complete form[1088]. Nonetheless, 3DP changes traditional manufacturing processes by making the passage from a blueprint to the end product very swift.

Because patent owners may receive too weak protection in light of technological development – some commentators argue – the law against direct infringement should expand to cover activities such as "making", "selling" and "offering to sell" CAD files, even when the patent's claim covers a physical object[1089]. Not only is a patent infringed when the invention is embodied in a tangible item, but also when the CAD file for the same invention is made, sold or offered.

The unclear relationship between the CAD file and the final 3D printed output gives rise to such a conundrum. As argued by Osborn, the question should be answered whether CAD files are or not interchangeable with physical goods[1090]. If a CAD file can displace the corresponding physical item or otherwise harm the economic interest of the patent owner, then "*offers to sell, sales and perhaps even making digital files should constitute direct infringement*", irrespective of whether the patent claim is to a tangible object[1091]. This point

[1087] Osborn (2016), 18.
[1088] Hoblrook; Osborn (2015), note 9, citing Holbrook (2003).
[1089] *Id.*, 1319.
[1090] Osborn (2016), 20.
[1091] *Id.*

will be developed in further detail below when discussing the issue from the perspective of U.S. law.

For present purposes, it is also important to distinguish between the unlawful act of "making" the patented invention and the legitimate act of "repairing" the patented product. As some commentators point out, this distinction is still unclear in most EU jurisdictions[1092].

In fact, while the infringing conduct of "making" a patented product covers the manufacture, without authorization, of a whole new article using raw materials, a more challenging issue arises when the alleged infringer purchases a patented product and then replaces some of its parts or components: is he or she "making" the patented product or merely "repairing" it?[1093]

In most jurisdictions, a distinction is drawn between changes and alterations to a patented product that amount to a "repair" of such product and those that amount to a "reconstruction" or "remanufacture".

As noted by literature, this question needs to be addressed in accordance with the principle of exhaustion, which covers only activities aimed at repairing the product, rather than at remaking it[1094]. According to the principle of exhaustion, once a patent owner sells one of its products, it can no longer exercise control over that specific product. The purchaser acquires general property rights over the physical embodiment of the patented invention, and can do whatever he or she wishes to do with regard to the patented product, without fear of infringing the patent.

Hence, all patent rights in that specific product are said to "exhaust", regardless of any contractual restrictions on resale or post-sale use that is required by the patentee (restrictions that may be of relevance as a matter of contractual law, rather than for the purposes of enforcing patent rights).

Having noted that, whilst the purchaser is authorized to "repair" the product, he or she cannot undertake further activities that amount to "reconstruction", "remanufacture" or "remake" of the patented product[1095].

"Remanufacturing" constitutes an additional commercial exploitation of the patent, which falls within the exclusive rights to which the patentee is entitled, whereas "mere repair" falls within the "intended use" of the patented invention, i.e. the sort of use "*that can be expected*

[1092] Ballardini et al. (2015).
[1093] *Id*., 853.
[1094] *Id*.
[1095] In patent law, any right to repair shall be regarded as a residual right, which consists in doing whatever does not amount to "making" the product. *United Wire Ltd v Screen Repair Services (Scotland)* Ltd [2000] 4 All ER 353.

during the working life of the device"[1096]. Accordingly, in cases where the repair is remaking or remanufacturing in nature, the purchaser will infringe the patent.

Where to draw the line between the admissible "repair" and the infringing "remanufacturing" is a matter of fact and degree[1097]. In principle, it is possible to rip off a part from the whole patented product and substitute it without infringing the patent, if the replaced component does not fall within the scope of the patent's claim.

Hence, in any action for infringement brought by the patent owner, the key question is whether, after the removal and replacement of the component part, the function of the patented invention remains unaltered, because "*what is left still embodies the whole of the inventive concept of the claim"* [1098]. In other terms, to be allowed, a usual maintenance measure shall not affect the identity and integrity of the product as a whole[1099].

Having noted that, understanding whether a printed product incorporates elements of the patent claim may not be easy in light of current digital manufacturing practices, which permit easily modifying the CAD file of a product and then printing it. As scholarship argues, the possibility to modify digitally the CAD file blurs the line between "making" and "repairing"[1100].

2.2. The Private and Non-commercial Use Exception

Most national legislations allow third-party uses of a patented invention for private and non-commercial purposes, although harmonization has not been achieved in this area.

As Ballardini and Lee point out, discussion over the private and non-commercial use exception in patent law has been relatively scarce, both in the literature and jurisprudence, as compared to the other exception for research and experimental uses[1101].

In fact, private and non-commercial uses of patents have always been rare, for both technological and economic reasons[1102]. The diffusion of DIYers' communities is likewise a relatively recent phenomenon that has not traditionally caused potential threat to the economic

[1096] Ballardini et al. (2015), 854.

[1097] See the UK Supreme Court's decision in *Schultz (UK) v Werit (UK) Ltd (Rev 1)* [2013] UKSC 16 (13 March 2013).

[1098] On this *see*: Ballardini et al. (2015).

[1099] *Id*.

[1100] *Id.*, 856. Arguably, the user who alters the CAD file (not for personal use only) may be liable as a direct infringer, whereas the person distributing the CAD file, who enables the user to alter the product, may be regarded as an indirect infringer.

[1101] Ballardini; Lee (2017), 173, § 8.02 [A].

[1102] *Id.*

interest of right owners. On the contrary, the majority of patent litigation has involved research institutions, universities or other undertakings.

As little case law is available, the scope of the exception cannot be easily defined. The survey conducted by the WIPO Standing Committee on the Law of Patents reveals the degree of heterogeneity at EU level as far as the private and non-commercial use exception is concerned[1103].

First, the replies overview shows that, whilst some Member Sates provide for an explicit, statutory exception for private and/or non-commercial use, some others simply set forth "*the right to prevent others from using the patented invention for commercial/business purposes"*[1104]. It follows that activities undertaken for private and non-commercial purposes are, by definition, excluded from the scope of protection, without the need for a statutory exception.

Some other member states further delineate the ambit of the exception, by confining it to activities undertaken for experimentation, academic, technological or scientific research, and/or teaching purposes[1105].

It must also be noted that, as case law dealing with this exception is limited, many interpretative quandaries remain unsettled, such as the exact meaning of the terms "private" and "non-commercial". Generally speaking, a private use may denote an act that takes place in the private sphere, as opposed to a public space, as well as an act carried out for personal use, regardless of the place where it occurs[1106].

In fact, activities undertaken in the private realm can pursue commercial and non-commercial purposes alike; is an infringement to be found if the purpose of the activity is both commercial and non-commercial? How do we evaluate the purpose of the activity in the context of 3DP?

The UPCA provides for the "private and non-commercial use" exception under Article 27(1)(a). The requirements of "private" and "non-commercial" appear to be cumulative. Moreover, the structure of the provision reflects that of Article 31 CPC 1975, pointing towards the qualification of the exception as a personal "privilege", which cannot be licensed.

[1103] Standing Committee on the Law of Patents, Twentieth Session, Geneva, January 27 to 31, 2014, *Exceptions and Limitations to Patent Rights: Private and/or Non-Commercial Use,* Available at: http://www.wipo.int/meetings/en/doc_details.jsp?doc_id=256317.

[1104] *Id.*, [13].

[1105] *Id.*

[1106] For U.K. case law on the meaning of "private" and "non-commercial", see, inter alia, *Smith, Kline and French Laboratories Ltd v Evans Medical Ltd* [1989] FSR 513.

In fact, under the CPC, a person who knowingly supplies a third party with the means for putting the invention into effect can still be found liable for indirect infringement, if the third party's conduct is exempted under the private and non-commercial use exception.

This can also be inferred from Article 26 and 27 UPCA read in conjunction. Article 26(1) stipulates that it is an act of indirect infringement to supply any person "*other than a party entitled to exploit the patented invention*" with means relating to an essential element of that invention for putting it into effect.

Article 26(3) clarifies that persons performing acts for private and non-commercial purposes (pursuant to Article 27(1)(a)) "*shall not be considered to be parties entitled to exploit the invention within the meaning of Article 26(1)"* UPCA.

Hence, an intermediary that supplies the final user with a CAD file for a patented invention may still be found liable, if such user prints the invention at home for personal use. It likewise follows that the occurrence of an act of direct infringement is not a condition for indirect infringement to take place.

As suggested above, UPs will continue to co-exist with both CEPs and national patents. When dealing with the exceptions and limitations to infringement, the UPCt will have to apply the national law of the member state determined in accordance with the criteria set forth in Article 7 UPCA[1107]. In light of the considerable divergences between national laws, the UPCt' case law might result in an even more fragmented legal framework, notwithstanding the established aim of "uniform protection" set out in Article 5 UPCA.

Academic scholarship has accomplished the difficult task of delineating what conducts carried out in the 3DP landscape might be covered by the private and non-commercial use exception. More precisely, Ballardini and Lee have delineated the following three scenarios where such exception could apply in practice.

Under the first scenario – that is "home 3D printing" – a physical product comes to light. It is possible to imagine that the more the technology evolves, the more affordable it becomes for end users, who will progressively undertake activities that are covered by the exception, such as scanning and printing the patented invention at home, for personal and non-commercial purposes.

In principle, the activity of 3D printing an object is "private" if undertaken by the user for the enjoyment of her private person or, at the maximum, his/her family or a group of friends. However, questions may be raised if the final user 3D prints the object at home and then

[1107] Ballardini; Lee (2017), 176, § 8.02[B] noting that "national laws and interpretations will continue to be important sources of authority".

shares it with a group of friends without compensation. How large should the group of friends be for the exception to apply? Do we have to accept the reality of highly populated communities of DYIers?

The term "non-commercial" necessitates further clarification. First, does the term "commercial" require the distribution of the object on a commercial scale or not? Does it overlap with the term "professional" or not? Does the exception apply when both commercial and non-commercial purposes are present? Does a *de minimis* rule apply if a home-printed object is offered for sale to a few persons and/or at a very low price?[1108]

The fact that an object can be printed from a digital file makes it possible for users to engage in infringing activities again in the future. Arguably, it is more difficult to establish with certainty that what the user did amounts to infringement on a *de minimis* scale, as the act of printing can be repeated in the future.

Does the threat that the final user could 3D print the object again justify the commencement of proceedings by the patentee, whether in order to seek an injunction or a financial remedy? Moreover, does the mere act of scanning an object amount to patent infringement, if a physical object does not come into existence?

Under the second scenario, Ballardini and Lee consider whether printing an object at a 3DP café, Fab Lab, service bureau or other "public" place rules out the private use exception. Arguably, the term "private" shall not relate to the physical space where the actual print takes place, but to the purpose of the activity, which should be carried out for personal use and enjoyment. Hence, the fact that the patented invention is printed in a public space or commercial establishment, such as a 3DP bureau, shall not as such preclude the application of the exception[1109].

Yet, the fact that an intermediary, such as a 3DP platform, prints the object on behalf of the final user bears significance. The final user is the only person entitled to benefit from the private use exception, which, at least under the current understanding of Articles 31 CPC 1975 and 27 UPCA, is a personal "privilege" or "defence", as opposed to a "right" that can be licensed.

In other words, the exception does not apply if the person who, in practice, manufactures the object ("makes" or "uses" the invention) is not the same person who receives enjoyment and personal gain from it[1110].

[1108] *Id.*, 182, § 8.03[B].

[1109] *Id.*, 183.

[1110] The same holds true under copyright law.

From a policy perspective, 3DP raises the question of whether it is desirable or not to extend the private use exception to cover activities undertaken by intermediaries on behalf of users, such as printing the patented item, whenever the final print out is destined to satisfy the users' personal needs.

One may argue that, as long as the ultimate purpose of the intermediary's activity is to enable the user's personal enjoyment of the printed-out invention, such activity should be permitted. The fact that the final beneficiary of the claimed invention has not printed the object should carry no weight. On the other hand, as Ballardini and Lee argue, this approach would transform the private use "privilege" or "defence" into a right that may be licensed or sub-contracted to a third party[1111]. Moreover, one may argue that the criteria to be followed in identifying which intermediaries can be excused are necessarily arbitrary. It is questionable whether 3DP service bureaux should be "privileged" as compared to other manufacturers. Does the goal of fostering the development and spreading of 3DP technologies justify such different treatment?

Another likely scenario is that of 3DP service bureaux not directly printing objects on behalf of users, but merely providing the machinery, materials, equipment and facilities that enable users to print the items.

In such a case, the user's activity may be exempted, if undertaken for personal and non-commercial purposes. By contrast, under the current legal framework, infringement liability can in principle be found, when a service provider facilitates the activity of printing the item. The final user would not be considered a party entitled to exploit the patented invention, within the meaning of Articles 30(1) CPC 1975 and 26(1) UPCA. Furthermore, no finding of direct patent infringement is necessary to establish indirect infringement, as the latter is an independent cause of action.

Questionably, however, it would be discriminatory to exempt from liability, under a revisited "private use" exception, only those intermediaries that directly engage in the actual print of the patented item, as opposed to those offering the equipment necessary for printing the item.

The final scenario that is taken into consideration by literature is that of digital-design-file-sharing, i.e. users sharing with their peers a CAD file embedding an object claimed in the

[1111] *Id.*, 184.

patent[1112]. The act of sharing CAD files over the Internet can be performed in various ways, through P2P platforms or simply by an email attachment[1113].

In order to answer the question of whether sharing the CAD file of a patented object gives rise to patent infringement liability, we go back to the not yet defined relationship between the physical object and the CAD file itself: shall we consider the CAD file as the equivalent of the invention represented therein, so that the sharing of the file, by uploading, downloading or emailing it, would constitute an act of direct infringement, if an exception to infringement does not apply?

The next section examines the different question of whether 3DP platforms could be held liable for indirect patent infringement.

2.3. Substantive Provisions Regulating Indirect Patent Infringement

The EU Commission, in its *Legal Review on Industrial Design Protection in Europe*, has proposed the introduction in EU design law of a provision mirroring Article 30 CPC 1975, which sets out some substantive principles regarding the prohibition on indirect use of a patented invention. The uncertainty surrounding the scope of this provision, however, calls into question the opportunity to pass the proposed reform[1114].

Before sketching out the elements of the infringement test under Article 30 CPC 1975, it is worth noticing that various jurisdictions across the EU – such as the UK[1115], Germany[1116] and France[1117] – have modelled their statutory rules governing indirect patent infringement on this template provision[1118].

In Italy, the Industrial Property Code does not contain an express provision on indirect patent infringement. However, protection against secondary liability can be inferred from the statutory rules on corrective measures against counterfeiting.

In fact, pursuant to Article 124(4) IPC, "by the judgement that determines the infringement of industrial property right, it may be ordered that the items produced, imported or sold infringing the right *and the specific means that unequivocally serve to produce them or to*

[1112] *Id.*, 181.

[1113] The business models of 3DP intermediaries vary to a considerable degree. For example, some platforms function as hosting providers, where users share their CAD files, whereas some others are marketplaces where users can sell their CAD files, similarly to what happens on online marketplaces such as eBay. Some services offer printing and delivery services.

[1114] *Inter alia* what is meant by "means" relating to an "essential element" of the invention, and what is the required "knowledge".

[1115] See the UK Patents Act 1977, Sections 60(2), (3) and (6).

[1116] See § 10 of the German Patent Act.

[1117] See Article L. 613-4 CPI.

[1118] Mimler (2013), 3.4.

carry out the protected method or process, be assigned to the ownership of the owner of the right, without prejudice to the right to compensation for damages". Hence, the term "means" could be relied on to extend protection against acts of indirect infringement.

Moreover, such protection can be further derived from the broad scope of Article 66 IPC, which confers to the right holder the exclusive right not only to implement the invention, but also to *profit* from the same invention in the territory of the country[1119]. From this provision one can infer that exclusivity conferred by a patent right covers the supply of the means necessary to implement the invention.

Therefore, the above-mentioned countries provide either for an explicit/statutory or for an implicit/non-statutory indirect patent infringement tort, covering the offer or supply of the means for working an invention.

Significantly, the wording of Article 30 CPC very closely resembles Article 26 UPCA, which will need to be given a uniform interpretation throughout the whole of Europe. According to Article 26 UPCA and Article 30 CPC, an act of indirect infringement is committed when means, relating to an essential element of the invention, are supplied or offered within the relevant territory, without the patent owner's consent, to any person other than the person entitled to exploit the invention, who has knowledge that such means are suitable and intended for putting that invention into effect.

The distinctive features of indirect infringement can be summarised as follows. First, the tort is actionable at the moment of supply, irrespective of whether the person supplied uses the means in an infringing way or not.

Second, an act of indirect infringement may be established even where no direct infringement has been committed[1120]. Transposing this clear-cut assertion in a potential scenario involving 3DP technology: it does not matter if the product has actually been printed or not[1121]. Hence, an act of indirect infringement can be pursued even if what is supplied is capable of non-infringing use and without any damage being suffered by the patentee[1122].

Third, the alleged indirect infringer must have the required "knowledge". Suffice here to note that this subjective requirement might constitute a noticeable difference between the UPCA and existing national laws. In fact, pursuant to Article 26(1) UPCA, to commit an act of

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[1119] Galli (2014), 55.

[1120] BGH GRUR 2001, 228 – *Luftheizgerat, see* Mimler (2013), note 45. See *Grimme Maschinenfabrik GmbH & Co KG v Derek Scott* [2010] EWCA Civ 1100, [90].

[1121] Leistner (2014), 81.

[1122] *Grimme,* [88].

indirect infringement, the alleged infringer must know or "should have known" that the means are suitable and intended for putting that invention into effect.

This wording differs from that used under German law (it was "obvious from the circumstances")[1123] or under UK law (it was "obvious to a reasonable person in the circumstances")[1124]. The extent to which, in practice, the different wording of the UPCA requires an adjustment of the subjective requirement under national laws remains to be seen.

National courts have also followed different lines of interpretation when dealing with the double territorial requirement, according to which both the supply and the end use of the essential means must occur in the same member state.

Pursuant to this territorial requirement, the supply of the essential means in one jurisdiction for use in another does not constitute infringement. Hence, in such a case, the patent owner will have to pursue litigation against the direct infringer in the country where the invention is put into effect. This option might not be desirable if the direct infringer is a customer rather than a competitor, and if the foreign jurisdiction in which to enforce the patent has not a favourable litigation environment[1125].

The UPCA likewise provides a double territorial requirement, but the relevant territory extends to all the contracting states. Hence, indirect patent infringement occurs when the supply or offer to supply the means takes place within the territory of a contracting state, for putting the invention into another contracting state. This appears to be a major achievement, insofar as cross-border activities that were not condemned under national law are now expressly forbidden.

Beyond the specific provisions on indirect patent infringement, additional remedies based on general tort law are present in most EU jurisdictions. For example, in Germany, a tort of "contributory" patent infringement has been established through case law[1126]. Contrary to the statutory tort of indirect infringement, to be accountable for an act of contributory infringement, an act of *direct* infringement should have been committed.

In fact, the indirect patent infringer should wilfully contribute to such direct infringement; it should be legally and factually possible for the indirect infringer to prevent the act of direct

[1123] Section 10 of the Germany Patent Act. Regarding the language "obvious from the circumstances", the German Supreme Court considered it a synonym for "self-evident for the unbiased observer" or beyond "reasonable doubt" See Quan (2016), note 53, citing Weigeleben (2003), at 226.
[1124] Section 60(2) of the UK Patents Act. On this *see*: Hoffmann and Wiktorson (2017)
[1125] *Id.*
[1126] See Leistner (2014), 81.

infringement; and the breach of a reasonable duty of care to prevent the infringement must be established (i.e. negligence)[1127].

In the UK – beyond the specific statutory provision on indirect patent infringement set forth in the Patents Act, section 60(2) – the basic principles of contributory infringement were laid down in the two *Amstrad* cases[1128], where it was held, in essence, that merely supplying a machine that is capable of both lawful and unlawful uses does not suffice to establish (joint) liability[1129]. A close analogy can be drawn with manufacturers of 3D printers and 3DP devices.

Moving back to Article 30 UPC, it is worth considering that the Convention is intended to have the same effect in all signatory countries. Hence, a national court must follow the reasoning of a decision taken in another jurisdiction, unless there are reasonable grounds to depart from it.

In other words, "*an important decision in one member state may well be of strong persuasive value in all the others, particularly where the judgement contains clear reasoning on the point*"[1130]. As a consequence, some degree of uniformity over indirect patent infringement has been achieved across the EU.

In order to untangle the question of whether, who and under what conditions might be liable for indirect infringement, in the event that a CAD file for a patented item is distributed over the Internet, the next section attempts to unravel the meaning of the expression "means relating to an essential element of the invention" that appears in the CPC, the UPCA, as well as in national laws. In principle, a CAD file can be regarded as a "means" that, once transferred (i.e. "supplied") to a third party, enables the actual infringement of the patent right.

The discussion goes on to suggest that the rationale underlying a statutory provision against indirect infringement can be found in the required "knowledge" on the part of the indirect infringer about the unlawful destination of the means he has supplied or has offered to supply. Hence, the importance of identifying the conditions under which the requirement of knowledge is satisfied.

1127 *Id.*

1128 *Amstrad Consumer Electronics Plc v British Phonographic Industry Limited* [1986] FSR 159. *Id.* at note 31.

1129 The UK Court of Appeal in *Grimme* [88] has delineated the main differences between the statutory tort under Section 60(2) and the common law tort claims. The former is actionable even if what is supplied can be used for lawful, non-infringing purposes and will never be used in an infringing way, without any damaged being suffered by the patentee. Reference should be made to the moment of the supply, irrespective of what may come afterwards.

1130 *Grimme*, [79].

2.3.1. Means Relating to an Essential Element of the Invention

A claim of indirect infringement can be pursued when a person supplies or offers to supply within the relevant territory the "means" relating to "an essential element" of the invention, with the exception of staple products.

The "essential element" as such needs not be supplied or offered. Hence, it may well be that the relevant means do not fall within the patent claim, but can be regarded as the instruments necessary for working out the invention and the supplier is aware of their intended use.

Looking at national case law on indirect patent infringement, the lack of uniform approach towards what constitutes the requisite "means" stands out. Whether such "means" include only products of physical or tangible nature is not altogether clear.

As noted by Mimler, in jurisdictions such as the UK and Germany, "*abstract instructions on how to produce a patented product"* would normally not be considered to be the object of indirect infringement[1131]. However, the author refers to some judicial decisions, in both jurisdictions, that seem to go in the opposite direction.

In fact, the UK Court of Appeal in *Menashe Business Mercantile Ltd*[1132] found that software recorded on a CD or on a downloadable file that enables users to play a casino game should be regarded as a "means" within the meaning of Section 60(2) UK Patents Act 1977. Likewise, in Germany, software and digitally processed data may be tantamount to a "means" that is essential to produce the patented product[1133].

A similar conclusion might be reached in the Italian jurisdiction. Legal scholarship recalls a number of decisions that support the view that the supplier of a CAD file, which can be later used for manufacturing a protected invention, in principle, may be liable for contributory infringement in Italy[1134].

Having examined national case law, Ballardini et al. reach the conclusion that while the concept of means "*thus far has been interpreted in physical terms, there is no apparent objection to include software*" or data within it[1135].

Nonetheless, it is also apparent that mere abstract instructions, drawings, sketches or plans that do not have a strong enough connection with the patented invention do not count as "means" in the sense required. As further clarified below, CAD files appear to have an

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[1131] Mimler (2013), 3.4.2.

[1132] *Menashe Business Mercantile Ltd v William Hill Organization Ltd* [2003] RPC 31, [6].

[1133] Mimler (2013), 3.4.2. See also *Ballardini et al.* (2015), 858.

[1134] Galli (2014), 56. Cassazione Sezioni Unite, 1 novembre 1994, n. 9410.

[1135] Ballardini et al. (2015), 858.

intimate connection with the ultimate printed product, because they contain the coded instructions that are needed for its manufacture.

Another controversial issue is whether the concept of "means" under Article 30 CPC encompasses a standing alone, complete, and non-infringing machine or apparatus, or is limited to the component elements that will be assembled with other elements to implement the invention[1136].

In the UK, this issue was addressed by Jacob J in *Chapman v McAnulty*[1137], a case concerning "dollies", i.e. mobile carts used by the cameraman in filming situations, which a third party could easily modify for making them infringing.

As further confirmed in *Grimme*, there is no rational basis for the "whole machine" point, as the relevant "means" can be a device to which a part must be added for making it infringing, but can also be a whole device, machine or apparatus to which a part must be removed or replaced for making it infringing.

The means shall be related to an "essential element of the invention". "Invention" means what is indicated in the patent's claim. The German Supreme Court, in its decision of 4 May 2004, has provided a definition of what is an "essential element" of the invention[1138].

First, the Court made clear that every feature or "integer" that is part of the claim, unless of absolute minor importance, is an essential element. In order to meet the "essentiality" standard, it is irrelevant that such feature enables distinguishing the invention from prior art.

However, in more recent case law, German courts seem to suggest that features or integers of the claim are not "essential" just because they are described in the patent claim. In fact, it may well be that elements that are in the claim are, nonetheless, unessential[1139].

In the UK, in order to ascertain whether an element is "essential", courts ask if such element is indispensable for putting the invention into effect, in the sense that the invention cannot be worked out lacking it[1140]. Overall, it seems that an element is not "essential" if it is secondary, trivial, absolutely insignificant and unimportant for practical implementation of the invention.

Therefore, whether an element that is an integer of the claim is automatically seen as "essential" or not varies depending on the jurisdiction. On the other side of the coin, it remains unclear whether an element can be viewed as "essential" if it is not part of the

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[1136] *Grimme*, [99].
[1137] See *Grimme*, [100] citing *Chapman v McAnulty*, 19th February 1996, British Library ref SRIS C/20/96.
[1138] Holder (2006).
[1139] Ballardini et al. (2015), 859.
[1140] *Hazel Grove Limited v Euro-League Leisure* [1995] RPC 529 (Judge Ford).

claim[1141]. Eventually, whether an element is essential or not is closely related to the facts of the case and, to some extent, is dealt with in different ways in each EU member state.

The requirement that the means must "relate" to such an essential element has been construed very broadly at national level, i.e. the means must *co-operate* with the integer in realising the protected inventive concept. Only those means that contribute nothing to the inventive concept and are absolutely unimportant for its realisation are ruled out[1142].

In fact, the rationale underlying indirect infringement doctrines is to prevent infringement before it takes place. This is why, for indirect infringement to occur, it suffices that direct infringement is threatened. Hence, in most cases courts tend to give a broad reading to the provisions on indirect infringement, finding that the alleged infringing means do actually relate to an essential element of the invention.

We now turn to the requirement that the means must enable to "put the invention into effect", i.e. to put the invention into an infringing state. The relevant means shall enable the recipient to directly infringe the patent, regardless of whether he or she does actually so[1143].

The "test" to assess whether the means enable direct infringement combines objective and subjective considerations. In the first place, the means must be *objectively* suitable for putting the invention into effect, meaning that "*the subjective ability (or inability) of the receiver to put such means to a use that would infringe*" must not be taken into account[1144].

As a consequence, means that are suitable only for unlawful uses, by implication, enable putting the invention into effect[1145]. Secondly, the means must be *intended* to put the invention into effect. Hence, we now turn to the subjective requirement of "*knowledge*".

2.3.2. The Requirement of Knowledge

The critical requirement under Article 30 CPC is that the supplier must *know* that the means are suitable and *intended* to be used in an infringing way, i.e. to put the invention into

[1141] Ballardini et al. (2015), 859. In other words, what remains unsettled is whether an "essential element" refers to an element that is described in the patent claim and, therefore, infringes the patent when put into effect, or it could also include whatever element contributes to solve the problem of the invention, regardless of whether it is part of the claim or not

[1142] *Id.*

[1143] *Id.*

[1144] *Id.*, 860.

[1145] In case the supplier provides its users with means that are capable of both lawful and unlawful use, some practical solutions to prevent or sidestep indirect infringement are usually relied upon. One option is to use appropriate disclaimers, expressly stating that the product or digital file so supplied should be used in a certain way and for certain purposes only. Otherwise, the contract for the supply of goods or services may include a clause imposing an obligation on the party supplied not to use the goods or services for purposes other than that specifically indicated in the agreement and/or for putting the invention into effect.

effect[1146]. Hence, not only we need to consider the "knowledge" requirement, but also "intent".

The UK Court of Appeal in *Grimme* has addressed the difficulties to which the knowledge requirement gives rise. The UK Court favoured a very extensive operation of Section 60(2) and, by implication, of Article 30 CPC 1975.

The relevant knowledge must be that of the supplier, whereas the person supplied is not required to have knowledge of the patent claim or of the infringing nature of the acts undertaken[1147]. Knowledge on the part of the supplier can either be actual or constructive (when it is obvious in the circumstances)[1148].

For the knowledge requirement to be satisfied, it is not sufficient that the means are objectively suitable for infringement; such means must also be intended for putting the invention into effect[1149]. Courts have clarified that the relevant intention is that of the user supplied, not the supplier, since only the former, as distinguished from the latter, has the intention to put the invention into effect[1150].

Moreover, such intention is not limited to the person(s) directly supplied with the means, but it regards all potential, ultimate users of the invention. To hold the opposite would mean that the supplier who supplied the essential means to a middlemen would not be held liable for secondary infringement, even if he or she knew that the final users would use the means so as to infringe[1151].

Moreover, relevant intention does not need to be an already formed, *actual* intention of a presently *identifiable* user supplied with the means. It is sufficient to show what will *probably* be intended by *some* ultimate users[1152].

In fact, as the law protects also against the "offer" to supply means, the UK Court's view is that "*a future intention of a future buyer is enough if that is what one would expect in all the circumstances*"[1153]. As German courts have also pointed out, this test is based on a balance of

[1146] As discussed above, the text of the UPCA differs from that of the CPC 1975, since it provides that, for an act of indirect infringement to take place, the third party must "know or should have known" that the means are suitable and intended for putting the invention into effect, whereas under the CPC 1975 the third party must know or it should be "obvious in the circumstances" that the means are suitable and intended for that purpose. The extent to which these requirements differ remains unclear. This section refers to the knowledge requirement under the CPC 1975 and national laws.
[1147] *Grimme*.
[1148] *Id.*, [106].
[1149] *Id.*, [109].
[1150] *Id.*, [108]. *Cranway v Playtech* [2009] EWHC 188 (Pat) [2010] FSR 3.
[1151] *Grimme*, [110].
[1152] *Id.*, [112] et ss.
[1153] *Id.*, [125].

probabilities, i.e. what *probably* will be the use of the means[1154]. It follows that it is not necessary to show that the ultimate user's intention has been put into practice, by working out the invention.

In short, the knowledge and intention requirements under Article 30 CPC are satisfied if, "*at the time of supply or offer to supply, the supplier knows or it is obvious in the circumstances that some ultimate users will intend to put the invention into effect"* [1155]; this is to be proven on a balance of probabilities.

Such requirements most likely will be satisfied if the means can be used in an infringing way only by the third party, as well as in case the supplier recommends or advertises the possibility of infringing uses in its promotional material[1156]. If the means are capable of non-infringing use, it is more difficult to give evidence of the required degree of knowledge (i.e. that the means are both "suitable" and "intended").

In the 3DP context, any attempt to target, as indirect infringers, the manufacturers of 3D printers or scanners, as well as the suppliers of 3DP materials, would fail for lack of the requisite knowledge and intention.

3D printers are "generic", meaning that they are not associated with a specified invention, but they enable printing whatever material object from a CAD file[1157]. Hence, it is almost impossible to prove that the secondary infringer knows, or it is obvious in the circumstances, that the final user will use the 3DP device or materials for infringing a patented product.

Moreover, an act of indirect infringement does not take place when the means supplied or offered are "staple" goods, i.e. products for every day needs that are available to the ordinary consumer. Arguably, 3D printers and printing materials are regarded as staple goods, since they are widely obtainable products for every days use.

The next section purports to show whether a claim for indirect infringement can be pursued against the suppliers of CAD files.

2.4. CAD Files and Indirect Patent Infringement

The question of whether a CAD file could in principle be regarded as a means relating to an essential element of the invention remains unclear at present.

[1154] *Id.*, [116]-[117].

[1155] *Id.*, [131]. Hence, the scope of protection against indirect patent infringement is broadly construed. All it is required is evidence of (actual or constructive) knowledge that some users will probably intend to use the means that are suitable for putting that invention into effect.

[1156] *Id*.

[1157] Ballaridni et al. (2015); Holbrook; Osborn (2015).

As the case law discussed above seems to suggest, the relevant "means" do not need to be of tangible nature, but may also include software. It is at least questionable whether CAD files can be equated to computer programs. Hence, the question should be rather answered whether other digital works that do not qualify as software, including CAD files, amount to relevant "means" under patent law.

As discussed, relevant means do not include pure abstract information and instructions. One could rule out the possibility to qualify CAD files as "means" on that ground, arguing that a CAD file is the equivalent of a digital blueprint (i.e. a set of abstract building instructions), which is not part of the claimed product.

This conclusion can be inferred from the nature of the CAD file as a separate entity from the finished product. When the product is printed, the CAD file conserves its autonomous existence and can be used again to print other products. Hence, the CAD file is distinct from, and not part of, the patented product as mentioned in the claim.

In this regard, an important counterargument as to whether CAD files shall be regarded as pure, abstract instructions can be raised. A CAD file enables printing a product without the intermediate steps that characterize other manufacturing processes, i.e. from the blueprint directly to the finished item.

Where a more traditional blueprint is "*miles away from the realization of the final object*", arguably a CAD file is strictly linked to a physical product, since it contains all the product specifications that are needed for manufacturing the item[1158]. Accordingly, in principle nothing prevents a CAD file from being equated to a relevant "means"[1159].

The ensuing question is whether the CAD file relates to an "essential element". As discussed, there is wide disagreement on that issue. Some scholars suggest that whether the CAD file relates to an essential element of the invention is largely dependant on how the patentee intended to manufacture the patented object[1160].

In fact, if the patented object was originally produced by means of 3DP, then the unauthorized CAD file is essential for creating the object and, thus, for putting the invention into effect. That being the case, the CAD file will normally be mentioned in the patent claim, thus falling within the scope of the patent.

On the contrary, there is quite some disagreement on whether an element can be regarded as "essential" if it is not included in the patent claim. Accordingly, in the 3DP context, it is by no

[1158] Van Overwalle (2016), 519.

[1159] See chapter VI, addressing the question whether CAD files are "goods" for the purposes of EU trademark law.

[1160] Mimler (2013), 9, § 4.

means clear if a patentee can file a lawsuit against a person who creates a CAD file – by drawing it directly from scratch or by means of scanning – representing a patented object that was originally created by a traditional manufacturing process; in such a case, as the invention was not originally created by means of 3DP, the patent claim would not cover the CAD file.

Some scholars contend, however, that essentiality may be established even where the digital file is not included in the patent claim[1161]. Most manufacturing processes regularly use digital modelling techniques throughout the design phase. In many instances, CAD files lie at the origin of the product's manufacture and are, thus, "essential" because, without them, the invention cannot be put into effect, notwithstanding the fact that they are not mentioned in the claim.

Likewise, whether the "*CAD file is suitable and intended to put the invention into effect"* remains an open question[1162]. As noted by literature, it is beyond doubt that providing a third party with a 3D printer, the printing materials and a CAD file would constitute indirect infringement; what remains unsettled at present is whether a CAD file distributed online may constitute a "suitable" means for putting the invention into effect[1163].

In fact, some scholars regard a CAD files as *definitely* "suitable", if it embeds an object falling within the scope of the patent claim. As others can access the file and print a replica of the patented item, the sharing of CAD files would suffice to facilitate direct patent infringement[1164].

The present writer does not give such an assumption for granted. Based on current law there is no clarity as to whether CAD files are suitable means. This is so because, even when the CAD file embeds a patented item, technical expertise is needed to produce an accurate replica. Under the current state of technological development, only expert users can make the invention by printing. Hence, the CAD file must be combined with other elements to directly infringe the patent. Whether the file as such is suitable or not would depend on the specific facts of the case.

In any case, the objective "suitability" of the means is not enough to find infringement. The supplier of the CAD file must know or it must be obvious in the circumstances that the receiver intends to use it in an infringing way[1165].

[1161] Van Overwalle (2016), 524.
[1162] *Id*., 523.
[1163] *Id*.
[1164] Mimler (2013), § 4.2.
[1165] Article 26 CPC.

It remains to be seen whether and under what circumstances providers of CAD files have the required (actual or constructive) knowledge. A crucial question that we must confront in the 3DP context is that the CAD file's supplier often is not aware of the patent claim. As U.S. scholars point out, it is rather unrealistic to expect a 3DP platform, as well as each and every user involved in digital-design-file-sharing, to be aware of patents[1166].

Having noted that, while knowledge of the patent by the indirect infringer is a determinative aspect of indirect infringement under U.S. law, it does not seem to be a necessary condition in Europe. In most European countries, it suffices that the supplier knows (or it is obvious from the circumstances) that the CAD file is suitable to make an object with the help of printers, even if he or she lacks awareness of the actual patent coverage.

A different line of objection, pointing towards the lack of adequate knowledge, relates to the fact that CAD files are not necessarily functional to 3D printing. Most CAD files can also have non-infringing use[1167].

Hence, patentees will face a major hurdle when giving evidence of knowledge if the CAD files are predominantly used in a non-infringing way. The existence of potentially non-infringing use does not, as such, exclude liability, but it makes evidence of knowledge less convincing, if taken in isolation[1168].

The following part delineates the subject matter of patents and the requirements for protection under the current patent statutory scheme in the U.S.

3. US Patent Law: Utility Patents v Design Patents

Like U.S. copyright law, patent law has its constitutional ground in Article I Section 8 of the Constitution. At its most basic, the patent system aims to promote the progress of science and useful arts, by conferring a limited time protection to new, useful, and non-obvious technologies, in return for a public disclosure of the technology.

Under U.S. law, patent protection comes in two different forms: utility patents and design patents[1169]. A utility patent protects the structure, composition or function of an invention; it may cover a physical device, a step-by-step method or process (i.e. software or method of

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[1166] *See* infra.

[1167] A CAD file may serve as a template for subsequent works or may be used for a variety of different purposes, such as rendering, video games' production, prototyping, advertising, etc. In all such cases, a physical copy of the object does not come into existence. The CAD file is merely used in its digital form.

[1168] Ballardini et al. (2015), 861.

[1169] 35 U.S.C. §101.

manufacture) and a composition of matter[1170]. Design patents protect ornamental designs, as well as computer-generated icons depicted on a computer screen[1171].

Utility patents are more expensive, difficult to obtain and commercially important as compared to design patents. The application for a utility patent includes a long written description of the invention, which ends with one or more claims that define the scope of protection.

It follows that the scope of protection may be broader or narrower depending on how the patent's claim is framed. Protection might be sought for the product as a whole or a part thereof, and it lasts for twenty years from the date of filing. For present purposes, it is also worth noting that, as opposed to copyright and trade secret protection, the grant of a utility patent prevents the sale of copies made through reverse engineering.

Unlike a utility patent, a design patent is very limited in scope, as it covers only the ornamental and non-functional aspects of a product – i.e. the appearance of an item, including elements such as product shape, colour arrangement and surface ornamentation – as shown in the patent drawings, with little or no verbal description.

Just as with a utility patent, a design patent could cover the design of the whole article or a portion thereof. Moreover, a design patent whose overall design is mandated by function is invalid, with a general presumption of non-functionality as a whole operating[1172].

A design patent lasts for fourteen or fifteen years from grant, depending on whether the application was filed before or after May 13, 2015. It should also be recalled that, unlike copyright that arises automatically, design patents must be registered to obtain protection. Whilst maintenance fees must be paid to the U.S.P.T.O. in order to avoid the lapse of a utility patent, no further action is required to keep a design patent in force.

It follows from the above that utility patents enable to protect 3DP technologies as such (printers, scanners, inks, etc.), the functional aspects of (3D-printed) patented objects, as well as their component parts. In contrast, design patents may cover the appearance of the entire article or individual design features applied to or embedded in the article.

The subsequent sections deal with the interface between 3DP and utility patents.

4. Three-Dimensional Printing and Utility Patents

[1170] See the INTA 3D Printing Task Force (2017), note 84, citing the Manual of Patent Examining Procedure, § 1504.01 (a)(I)(A) (9th ed., Rev. 7.2015, Nov. 2015).
[1171] *Id.*
[1172] *Id.*,14.

Some commentators suggest that the area least ready for the 3DP revolution is patent law: "*the historical anchoring to the physical has its roots in the industrial age",* when most innovation was embedded into corporeal things[1173].

With 3D printing, we are entering a new world of "physibles", i.e. data objects that are capable of becoming physical[1174].

U.S. courts have not yet addressed the issue of whether printable files are patentable as such. Therefore, a novel issue to unravel is whether eligible subject matter includes a CAD file per se, and whether patentability is contingent on the fact that the file incorporates an otherwise patentable product. In other terms, is it possible to submit an application to the U.S.P.T.O. claiming protection for the CAD file itself, (only) if such file enables printing a patent-eligible product? Can a patent claim cover the instructions to print a patentable artefact?

In order for a CAD file to gain protection under U.S. patent law, it must meet two types of patentability requirements: the statutory requirements, set forth in Section 101[1175], and the judicially crafted requirements, which consider an application ineligible for protection if it is directed at "laws of nature, natural phenomena, and abstract ideas".

Hence, a CAD file must fall within one of the exclusive categories of eligible subject matter, set out in section 35 U.S.C. §101 of the Patent Act of 1952, namely: a process, machine, composition of matter and manufacture.

As noted in *In Re Nuijten*[1176], courts must assure that *some* category has been satisfied; if, for instance, a claim encompasses either a process or a manufacture, there is no need to resolve the ambiguity: the claim is acceptable as long as it is within at least one category.

The major line in scholarly works seems to rule CAD files out of patentable subject matter, mainly because files are neither tangible things nor processes[1177].

Traditionally it has been argued that, in order to qualify as patentable subject matter, the claimed invention should exist in some physical, tangible form, the only exception being "process claims".

More precisely, to qualify as a "machine" under section 101, the claimed invention must be "a concrete thing, consisting of parts, or of certain devices and combination of devices"[1178]. To qualify as a "manufacture", "*the invention must be a tangible article that is given a new form,*

[1173] Holbrook; Osborn (2015), 1323.

[1174] Brean (2015), 838, noting that this is how the well-know platform "The Pirate Bay" has defined digital design files.

[1175] It must fall within one of the statutory subject matter categories and be a "new" and "useful" invention. The "new" and "useful" requirements apply to the four statutory categories.

[1176] *In re Nuijten*, 500 F3d 1346 (Fed. Cir. 2007).

[1177] Bradshaw (2010), 24; Finocchiaro (2013), 477; Desai; Magliocca (2014), 1691; Mimler (2013), 63.

[1178] *Digitech Image Technologies, LLC v Electronics for Imaging, Inc.* 758 F.3d 1344 (2014), 1350.

quality, property, or combination through manmade or artificial means"[1179]. Likewise, a "composition of matter" "*requires the combination of two or more substances and includes all composite articles"*[1180].

Therefore, three out of four categories of patentable subject matter refer to physical objects, whereas a "process" claim covers a series of acts. However, case law is not unequivocal in this respect. In light of technological advancement, courts have taken different roads when addressing the issue of whether subject matter should or not exist in some tangible form.

As described below in more detail, the Federal Circuit in *Digitech* held that "*data in its ethereal, non-physical form is simply information that does not fall under any of the categories of eligible subject matter under section 101* [1181]. The technology at issue was "*a collection of intangible color and spatial information*"[1182]. Accordingly, CAD files are out of patent law's reach.

One possible avenue of protection is to treat CAD files as software, and claim protection by submitting "process" claims or "*Beauregard*"-style claims. However, software patents usually come under severe criticism that Holbrook and Osborn likewise express in their contribution[1183].

First, the uncertain scope of claims for software patent makes infringement difficult to determine, whereas apparatus claims (such as those covering "manufacture") involve much less uncertainty[1184].

Second, "software patents may be less likely to be valid than other kinds of patents"[1185]. The Supreme Court in *Alice Corp*[1186] avoided drawing the boundaries between "abstract ideas" and "inventive concepts"; only a case-by-case assessment can provide the answer.

Third, "software patents are overbroad, using functional claims to cover more than what was actually invented"[1187].

One should also consider that copyright protection is already available for the software code uncombined with hardware, although such protection is limited to near-verbatim copying of the code's expression, as opposed to functionality. Hence, according to some legal scholars, software patents are not needed to protect CAD files.

1179 *Id.*
1180 *Id.*
1181 *Id.*
1182 *Id.*
1183 Holbrook; Osborn (2015), 1380.
1184 *Id.*, 1380.
1185 *Id.*
1186 *Alice Corp. PtY. Ltd. v V CLS Bank Int'l* 134 S. Ct. 2347 (2014).
1187 Holbrook; Osborn (2015), 1380.

A thread in academic literature, which seems preferable to the present writer, argues that CAD files should not enjoy patent protection as software, but as physical objects[1188]. CAD files for products fall under the subject matter category of "manufacture", since the invention that is claimed is the final printed object.

This line in scholarly thinking, whose pioneer is Lucas Osborn, stresses that CAD files are almost equally (if not even more) valuable than the final product as such, because they can be easily transformed in physical products, but are also sharable and adaptable. Hence, CAD files should enjoy equal protection as that already afforded to the ultimate, tangible product.

The next section, however, recalls a decision from the Court of Appeals of the Federal Circuit holding that, at least under the Tariff Act 1930, the term "article" refers to a material thing, not including pure data sets. Therefore, following this line of argument, CAD files must be treated as pure intangible things, not physical ones, for which no protection is available under the category of "manufacture".

5. The Tangible Nature of a "Manufacture"

For present purposes, the category of "manufacture" is of particular relevance[1189]. More precisely, the question should be answered whether this category covers only *tangible* articles of manufacture.

In fact, the definition of "manufacture" offered by the Supreme Court in *American Fruit*[1190] was forged in the pre-digital age. Such comprehensive definition – which encompasses every article except machinery, compositions of matter and designs – requires that hand-labour or machinery processes be applied to raw or ready materials, thereby changing the form, property or quality of such materials.

At first glance, this interpretation of "manufacture" calls for a tangible embodiment. Importantly, however, Judge Linn's dissenting opinion in *In re Nuijten*[1191] seems to go in the opposite direction, making the point that raw materials need not be tangible or permanent

[1188] Holbrook; Osborn (2015).

[1189] It is quite unlikely that CAD files would rather be claimed as "processes". As observed by some legal scholars, if this was the case, they would lack adequate protection. *See* Perlow (2016); Brean (2015).

[1190] *American Fruit Growers, Inc v Brodgex Co*., 283 U.S. 1 (1931). "Article of manufacture" has been interpreted broadly as encompassing "anything made 'by the hands of man' from raw materials, whether literally by hand or by machinery or by art".

[1191] In re *Nuijten* 500 F.3d 1346 (Fed. Cir. 2007), the court concluded that, although a "signal" with embedded supplemented data has physical properties is not patent eligible for being a *transitory* physical embodiment of data.

feedstock. Rather, the tangible result serves only as an indication that we are not in the presence of an unpatentable abstract idea[1192].

One may argue that the definition of "manufacture" must be reinterpreted in light of digital manufacturing techniques. Interestingly, 4D printing poses an additional question: to what extent is it still possible to imagine that a manufacture, consisting of a tangible product, will continue to exist in permanent form after its creation?

In fact, the main characteristic of 4D-printed products is that they change shape after being printed, because they are made with "programmable matter", that is substance pre-programmed to respond to various external factors such as water and heat[1193].

The fact that products have changeable shapes and properties calls into question their categorization as "manufactures" for the purposes of § 101. In fact, not only *tangible,* but also *stable* form seems to be a prerequisite for triggering patent protection[1194].

The International Trade Commission has recently held that digital datasets of patients' teeth, which were electronically transmitted from Pakistan to Texas and then 3D-printed, qualified as "articles of international commerce" subject to the ITC's jurisdiction[1195]. Such *articles* could be prevented from importation if they infringed U.S. patent law[1196].

The United States Court of Appeals for the Federal Circuit overruled the International Trade Commission's decision. As noted by scholarship, "*this case is particularly important not only because it is one of the few cases dealing with enforcement of 3DP related matters, but also because it highlights the role of the judge in steering the development of the law through their interpretative capabilities*[1197].

After a brief description of the facts of the case, we will then discuss whether CAD files can be considered to be the same as physical objects under U.S. patent law.

The patented invention in the case at hand relates to a process to create customized orthodontic appliances, also known as "aligners", aimed at repositioning the patient's teeth incrementally[1198].

The patented process, which also mentions CAD files or 3D models, works as follows. First, patients go to the dentist and obtain x-rays and pictures of their teeth. A digital recreation of the teeth is made and then electronically transmitted to the claimant's affiliate in Pakistan,

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[1192] *In re Nuijten*, 1353 (Linn, J., dissenting).
[1193] Perlow (2016), 179.
[1194] *In Re Nuijten*, signals were deemed to be not patentable because of their ephemeral, transitory nature.
[1195] Brean (2015), 852 et ss.
[1196] *Certain Digital Models, Inv*. No 337-TA-833, U.S.I.T.C. (Apr. 10, 2014), 34.
[1197] Chandler; Salmi (2017), 162.
[1198] See *ClearCorrect Operating, LLC v ITC*, 810 F.3d 1283, 1287 (Fed. Cir. 2015).

where the teeth are (digitally) manipulated and aligned. Digital data models of intermediate tooth positions are created. Such data models are transmitted to the U.S. (by uploading them to the claimant's server) and then 3D printed into physical models. Noticeably, it is only the digital information that travels between the two countries. Finally, the plastic aligners, based on the physical models, are created by using thermoplastic molding and then sent to the patients[1199].

The claimant Align filed a complaint with the International Trade Commission (U.S.I.T.C.) against ClearCorrect for unfair practices based on infringement of IPRs. Section 337 of the Tariff Act of 1930, as amended (19 U.S.C, § 1337), declares that importation into the U.S. of articles infringing patent, trademark or copyright laws are unlawful trade acts falling under the International Trade Commission's jurisdiction.

Accordingly, the ITC's jurisdiction to remedy (i.e. to stop the entry of goods at the border or to issue cease and desist orders to persons involved in unfair trade practices) is thus limited to those unfair acts that involve the importation of "articles". Hence, the first issue that the Commission had to unravel was whether it had jurisdiction in the case at hand.

In Align's view, the accused "articles of international commerce" that were "imported" into the United States were the "virtual three-dimensional models" of the patient's teeth, expressed as data sets. Such digital data were transmitted electronically, not transferred on a physical medium.

The Commission upheld the claimant's view, holding that the statutory phrase "importation … of articles" set forth in Section 337 "*should be construed to include electronic transmission of digital data*"[1200].

In reaching such conclusion, the ITC relied on the 1924 edition of the Webster's Dictionary that broadly defines the word "article" as "a thing of particular class or kind", "a commodity" or "an article of merchandise"[1201]. Merchandise, in turn, is defined as "the objects of commerce; whatever is usually bought and sold in trade"[1202].

Hence, the ITC took this definition to cover any identified item or unit that can be "*traded in commerce or used by consumers, and thus would include digital data"*[1203]; data carried by

[1199] *Id.*
[1200] *Id.*
[1201] *Id.*, [1291]-[1292].
[1202] *Id.*
[1203] *Id.*

electronic waves constitute articles that "*can be imported bought and sold, transmitted and used*"[1204].

A broad definition of "article" is also in line with existing remedies under the statute, such as cease and desist orders, which could be relied on when exclusion orders are unenforceable, such as when dealing with digital files[1205].

The Federal Circuit reversed the Commission's decision. The Court conducted its analysis under the two-step test of *Chevron*[1206] and found that there was no ambiguity in the meaning of "articles" under Section 337 – which is synonymous with *material* things, not including digital data, pursuant to most contemporary dictionaries – and that, in any case, the ITC's finding was unreasonable and inconsistent with the legislative history of the Tariff Act.

The Congress' intent to consider "articles" as tangible items can be inferred from numerous statutory provisions that would become superfluous, if the term "articles" was defined to include intangibles[1207]. The statute bestows upon the Commission the power to seize and forfeit articles, but an electronic transmission of digital data cannot be seized or forfeited. Also, the Secretary of Treasury shall notify all "ports of entry" upon the "attempted entry of articles", but electronic transmission does not enter through a port[1208].

Moreover, as far as enhanced remedies are concerned (i.e. "cease and desist orders"), the Federal Circuit took the view that such remedies were introduced as an *alternative* remedial tool (a lesser and "softer" remedy) when exclusion orders are too harsh, rather than as the *exclusive* remedy in case exclusion orders are not available, as in the case of digital files[1209]. Accordingly, there is no logical connection between cease and desist orders and an expanded definition of "articles"[1210].

It is important to note that the USITC did not go so far as to assert that it has jurisdiction over all intangible items, including services. On the contrary, it simply found that three-dimensional digital models (i.e. CAD files) are articles, i.e. things of commerce that can be "imported" in the U.S.

[1204] *Id.*, [1294].
[1205] *Id.*, [1296].
[1206] *Chevron U.S.A., Inc. v Natural Res. Def. Council, Inc.*, 467 U.S. 837, 843 (1984).
[1207] *ClearCorrect Operating*, [1295].
[1208] *Id*.
[1209] *Id.*, [1296].
[1210] Oudersluys (2018).

The CAFC did not touch on the fundamental question of whether importing digital files amounts to patent infringement, but examined only which goods are protected from infringement under Section 337[1211].

As a consequence, the decision under examination does not resolve the ambiguity as to whether patentable subject matter, and more specifically the "manufacture" category, might cover digital design files. Likewise, whether direct patent infringement can be committed by transmitting digital design files is not entirely clear.

It may follow from the ICT's decision that, in the same way as "articles" is limited to "material things" under the Tariff Act 1930, "manufacture" is likewise limited to tangible items under Section 101.

This conclusion is contrasted by a body of literature suggesting that, if CAD files were to be protected as such, they would be better off categorized as a "manufacture" under Section 101, as opposed to a "process" or "method". In fact, another way to protect CAD files would be to qualify them as software.

The next section elaborates on the protection of patent software under U.S. law and the possibility for a *Beauregard* claim to cover CAD files.

6. CAD Files as Patent Software

Traditionally, patent software has been claimed as a "process" or "method". That being the case, as the object of the invention is the software process or method, the final user who *executes* the software is the only direct infringer, since he or she performs the patented invention, whereas the software distributor, who does not execute the software, cannot be held directly liable[1212].

That being the case, patent owners would have to pursue indirect infringement proceedings against the distributors or sellers of software under the theory of inducement, showing the requisite level of knowledge and the actual inducement of an act of direct infringement.

In order to overcome the limits inherent in the procurement of a patent that claims a "method" or "process", *Beauregard* claims have been developed. *Beauregard claims* are now an established (and still valid) form of patent protection that does not cover a special process, but a tangible storage medium (e.g. a floppy disk, hard drive or flash drive) that has software embedded therein. Hence, the claim is usually directed to the apparatus (the computer-

[1211] *ClearCorrect Operating*, [1296].
[1212] Dillon (2014), IV, 448.

readable medium), as opposed to the process itself (i.e. the software invention or algorithm as such). Yet, novelty is assessed with respect to the code, not the medium.
This, in turn, facilitates patent infringement suits against the distributor of software: anyone who stores the software on a disk could be found liable as a direct infringer, rather than solely the ultimate user who executes the process[1213].
As reiterated below, direct patent infringement comprises "making, using, selling or offering to sell" a patented invention. Clearly, the fact that *Beauregard* claims are directed to a tangible medium of fixation means that only certain conducts do actually constitute infringement[1214].
In fact, providing a CAD file for download on an online platform does not implicate the act of "selling" or "offering to sell" the claimed invention – the latter being the "storage medium" containing the digital design file – since the intermediary is passively permitting access to the digital designs, rather than actively distributing the claimed (tangible) invention.
It can be argued, however, that by saving the CAD file on its server, an intermediary is either "using" or "making" the invention, i.e. reproducing the claimed storage medium with the embedded data on it[1215].
Therefore, the theory of direct liability is applicable against third parties who "use" and/or "make" the patented invention by providing CAD files on their platforms. For this reason, a strand of the literature suggests that *Beauregard* claims are the best avenue of protection in the 3DP context, as they facilitate enforceability of potential patent rights against upstream parties, on top of ultimate users[1216].
In that regard, it is worth noticing that not all CAD file formats contain digital instructions (i.e. the GCODE) that are similar to software and suitable for *Beauregard*-style claims. It is only once a CAD file is sliced that these instructions are generated.
Hence, academic literature suggests that only pre-sliced CAD files are claimable in the form of a *Beauregard*-style claim, rather than in the form of a "method" claim. The *Beuregard*-style claim will recite the computer-readable medium (such as a computer disk or storage device) incorporating the GCODE instructions[1217].
In particular, one commentator suggests that the *Beauregard*-style claim can be framed as follows: "*a computer readable medium storing computer readable instructions which, when*

[1213] Brean (2015), 843.
[1214] *Id.*, 846.
[1215] Dillon (2014), 454.
[1216] Brean (2015), 863.
[1217] *Id*., 848.

acted upon by a 3D printer, cause the 3D printer to print a widget"[1218]. Another legal scholar suggests the following claim formulation: "*a computer readable medium comprising a digital blueprint that when printed by a printing device creates an apparatus comprising: [a novel, non-obvious and useful device]*"[1219].

Hence, an important (technical) limitation of *Beauregard* claims relates to their apparent inadequacy to cover unsliced CAD files, which do not embed the digital instructions for a printer to follow.

It has already been noted elsewhere that CAD files and software are not the same sort of thing. A CAD file is just a file with embedded data that describe an item's form, properties and qualities; it is a not computer program that runs on a general-purpose computer to perform a certain function.

Hence, the first misconception is that CAD files fall under the definition of software. CAD files, instead, connote the collection of data used by CAD software programs. An analogy can be drawn between CAD software (such as AutoCAD) and Microsoft Word, on the one hand, and between CAD files and Word documents, on the other[1220].

An application program, such as a word processor, is software that runs on a computer, with a specific application for the user. Application software differs from "system software" that consists of "programs that run in the background, enabling applications to run", such as the underlying operating system[1221].

A CAD file is not the same as (application or system) software that is loaded on computer. On a par with a JPEG or MP3 file, a CAD file is a collection of *data* stored in one unit, identified by a filename on a computer.

Therefore, an accurate definition of CAD files might help carrying out adequate legal analysis: only the pre-sliced version of a CAD file, expressed in the form of GCODE, rather than the original CAD file itself, shall be deemed equivalent to the software-based instructions. Yet, scholars do not miss the opportunity to highlight that "*industry does not appear to trade in this format*" and, consequently, claiming the sliced version of a CAD file would not be disruptive[1222].

Even if CAD files were protected by means of *Beauregard*-style claims, other hurdles would need to be overcome.

[1218] *Id.*, 844.

[1219] Dillon (2014), 454.

[1220] Holbrook; Osborn (2015), 1378.

[1221] *Id.* See https://techterms.com/definition/application and https://techterms.com/definition/systemsoftware.

[1222] Brean (2015), 848.

6.1. Abstractness in Light of *Alice Corp*

The viability of *Beauregard*-style claims, and software patent claims in general, has been placed under pressure in the aftermath of the Supreme Court's decision in *Alice Corp*[1223]. Whatever the statutory category at stake is (i.e. a process, machine, manufacture or composition of matter), in order to be patent-eligible, a claim must not capture abstract ideas alone, natural phenomena, and laws of nature. As observed above, these are the three judge-made exceptions to patent-eligibility.

When ascertaining abstractness of a patent claim, it must be remembered that an invention is not unpatentable merely because it is based on a mathematical algorithm: the "*application*" of the mathematical formula may well deserve protection[1224]. Thus, not all software-related inventions fall outside the scope of patent protection.

Likewise, if a claim covers an abstract idea, it does not become eligible subject matter by merely including the words "apply it"[1225]. Invocation of computer implementation adds no *inventive* concept to an *abstract* concept. In fact, practical assurance should be given that the claim is not "*a drafting effort designed to monopolize the abstract idea itself*"[1226].

As far as *Beauregard* claims are concerned, embodying an abstract method or process on a tangible storage medium does not render the claim eligible. For patent-eligibility purposes, we have to look at the underlying invention, that in 3DP is the physical printed object[1227].

This approach was upheld by the recent Supreme Court's decision in *Alice Corp,* which has narrowed considerably what constitutes patentable subject matter in computer-related inventions. The Supreme Court has confirmed that abstract instructions are not capable of patent protection. More precisely, the Court has reaffirmed the two-step test, first created in *Mayo Collaborative Services*[1228], to ascertain whether a patent's claim is subject to one of the judge-made exceptions to patentability.

Hence, the first step of this framework requires courts to determine whether the claim at issue is directed to a patent-ineligible concept; if so, then the court must establish whether the claim's elements, considered both individually and as a whole, transform the originally ineligible claim into a patent-eligible application[1229].

[1223] *Alice Corp. Pty. Ltd.v CLS Bank Int'l*, 134 S. Ct. 2347, 2353-54 (2014).
[1224] *Digitech Image.*
[1225] *Id.*
[1226] *Alice Corp*, [2357].
[1227] Brean (2015), 18.
[1228] *Mayo Collaborative Services v Prometheus Laboratories, Inc.* 132 S. Ct 1298, 566 U.S. 66.
[1229] *Alice Corp* quoting *Mayo*.

Alice's patent concerned computer-implemented methods aimed at reducing the so-called settlement risk – namely the risk that only one party to a transaction receives payment – by employing a neutral intermediary. The Supreme Court concluded that Alice's claim was directed to a patent-ineligible idea, i.e. the concept of "intermediated settlement" that is a "*fundamental economic practice long prevalent in our system of commerce*"[1230].

The Court further ruled that the second step in examining claims requires drawing the line between claims that include "*the building blocks of human ingenuity*" and those that, when viewed as a whole, contain something that transforms those building blocks in something more, which is a patent-eligible invention[1231].

Interestingly, the Court noted that the fact that an abstract idea, as an algorithm or business method, is to be implemented on a general computer to perform its task does not render that abstract idea patent-eligible[1232]. Rather, software must "*improve the functioning of the computer itself or any other technology"*, in order to be patent eligible[1233].

Hence, the Court concluded that Alice's claim, which required generic computer implementation, could not transform an abstract idea into patentable subject matter[1234].

Applying the Court's reasoning to printable files, the fact that the CAD file is to be implemented on a computer, and then printed by means of 3DP, which are machines that exist in the physical, rather than virtual realm, does not, as such, render the subject matter of the claim patent-eligible.

In fact, *Alice* suggests that claims are to be treated on their substantive merits, rather than on their style, in order to avoid that the drafter's art dwarfs technological innovation[1235]. Hence, claims should not be used to cover something different from what is actually invented.

This, in turn, means that, for all categories of claims (whether CAD files are claimed as "software" in a process claim, as "storage medium" in a Beauregard-style claim or as "manufacture"), we must always look at the underlying invention for patent eligibility purposes.

One may argue that the current regulatory framework in patent law precludes protecting the digital and physical versions of the same thing. Paying more attention to the claim's substance, as opposed to the patent's form, might bridge this gap[1236]. Hence, applicants must

[1230] *Alice Corp*, [2356].
[1231] *Id.*, [2354]-[2355].
[1232] *Id.*, [2358].
[1233] *Id.*
[1234] *Id.*, [2352].
[1235] *Id.*, [2357].
[1236] Brean (2015), 860.

be given the possibility to have their patent claims directed to the physical product and the corresponding digital design.

The reason why abstract ideas are ineligible for patent protection is to avoid pre-emption (i.e. to stifle technological and scientific progress), aside from the express provision in this sense provided for in Section 101. As literature observes, "*a CAD file is intended to be precise, detailed, and suitable for use in tooling and manufacturing – it is not an abstraction of an object but an accurate representation of it*"[1237]. Hence, patenting a CAD file should be allowed – scholarship suggests – since it would not pre-empt the technological field anymore than a patent covering the physical product itself.

In fact, following the reasoning in *Alice*, CAD files are not the "basic tools" (i.e. abstract ideas) but finished products, meaning that there is no pre-emption concern that needs to be addressed[1238]. Rather than being a mere graphical representation of an object, CAD files define its physical properties and are printable on a 3D printer. If one adheres to the qualification of a CAD file as the digital equivalent of a physical product is ready to accept that the same file is not comparable to a pure data set.

As a result, cases such as *Digitech Image Technologies*[1239] and *Nuijiten*[1240] cannot be relied upon to exclude printable files from the patent realm, as they deal with information as such, unrelated to any specific physical object.

The decision in *Digitech*, issued in the aftermath of *Alice Corp*, provides useful guidance in determining whether data as such are patent-eligible. The claims were directed to "device profiles" that contained a set of data for describing colour and spatial information.

The claims were directed to information in its intangible form, thereby differing from those in *In Re Nuijten*, which required a transitory, *tangible* embodiment of data (i.e. signal)[1241].

One may contend that, on the one hand, what differentiates the device profile in *Digitech* from a CAD file is that the former merely constitutes a collection of intangible colour and spatial information, whereas the latter describes additional (physical) information, such as material, texture, and build information.

Since a connection can be easily established between a CAD file and its physical manifestation, the issue of abstractness shall not prevent such files (even if not pre-sliced) from constituting eligible subject matter.

1237 *Id.*, 852.
1238 *Alice Corp*, [2354]-[2355].
1239 *Digitech Image*.
1240 *In re Nuijiten*.
1241 *Digitech Image*.

As legal scholarship puts it, CAD files are not the same as "*data untethered to any specific device or object*"; rather, a CAD file is "*precise, detailed and suitable for use in tooling and manufacturing – it is not an abstraction of an object but an accurate representation of it"*[1242]. Contrary to this academic strand, the present writer considers it rather unlikely that, at present, CAD files would be deemed patent-eligible *per se*; most likely they would be treated as a string of "data" that, in its ethereal, non-physical form, falls outside the scope of Section 101.

7. Final Remarks on Subject Matter Eligibility

Amidst all the angst and uncertainty surrounding CAD files is whether they qualify as patent-eligible subject matter.

From a policy standpoint, some argue, the optimal legislative solution is to protect inventions irrespective of the medium in which they are incorporated. One should always keep in mind that CAD files are just means for incorporating a (tangible) product. Thus, if we want to protect printable files as such, this should be dependent on whether the object embedded therein is a new and non-obvious invention.

The presence of digital (software-based) instructions recited in the claim should not turn the claim covering a physical thing (i.e. the final product itself), in one directed to the process by which such thing is realized. The focus should rest on the underlying invention, regardless of the form that is chosen in framing the claim.

The present author tends to agree with existing scholarship recommending that, as current patent law stands, the best way to protect CAD files is to subsume them under the subject matter category of "manufacture", thereby accepting that the latter extends to digital manufacture[1243]. In fact, the case for granting patent protection to a CAD file may be more difficult if such file is claimed as a "process" or "method", instead of "manufacture".

As discussed above, the qualification of CAD files as processes suffers from major shortcomings. First, it has been suggested that CAD files (at least those in their native format) are to be distinguished from software. Second, the viability of patent software claims is in doubt in the aftermath of *Alice.*

CAD files would need to amount to something more than a basic principle or abstract idea under the second part of *Alice'*s test. However, what amounts to an "abstract idea", as

[1242] Brean (2015), 852.
[1243] Perlow (2016), 199.

opposed to an "inventive concept", is far from clear. Arguably, the Supreme Court's decision in *Alice* fell short of elaborating a clear test for abstractness.

The current state of affairs is that software patents can still be valid, as not all computer-implemented claims are necessarily directed to an abstract idea. Patent eligibility depends on whether the claimed invention is sufficiently rooted in computer technology to improve the functioning of the computer itself or to overcome a specific problem arising out in a computer-related or technical field.

A claim that recites the performance of abstract ideas or concepts using a generic computer, as well as the routine or conventional use of a given technology, lies on the wrong side of the "abstract idea" line.

Some scholars argue that, even if found to be patentable as processes (i.e. as a set of instructions or a blueprint), CAD files are not abstract, since they are closely related to the final, printed item that is the object of the invention.

In other terms, the patent claim would not cover a method or process as such, thus pre-empting ways of manufacturing things; rather, it would be limited to a specific tangible embodiment, i.e. the final product.

The present author entertains the idea that each given technology has some peculiar traits, which should carry due weight in legal analysis. From a policy standpoint, considering CAD files patent-eligible themselves as "manufactures" is advisable only to the extent that new enforcement issues do actually emerge. Only time will tell if patent owners will find it increasingly difficult to enforce their patent rights in a system of decentralized manufacture, thereby feeling the urge to protect their innovations at the source (i.e. patenting the CAD file itself).

In fact, the claim that protecting inventions from the moment they are first created in the form of CAD files would represent an effective way to prevent patent infringement bears little reality in a world where 3D printers are not widely distributed. Patenting the CAD file of an otherwise patentable product, as opposed to the final product itself, might be desirable in an era of widespread and worlwide file sharing, which is not the case at present.

The current patent system might need to be updated in the future, to reflect the advancement of 3DP technologies and digital manufacturing. Any patent-reform should be aimed at achieving the difficult task of balancing right owners' interests with the need of promoting innovation and technological advancement.

Arguably, it is not the time yet to introduce major changes. For the time being, no evidence suggests that conferring patent protection to CAD files would incentivize innovation.

8. The Exclusive Rights Conferred by a Patent

The exclusive rights conferred by a patent confirm the general remark made above, namely that the current regulatory framework was conceived in a world where products were traded in physical form[1244].

Traditionally, patent owners have been capable of targeting infringement at source, by enforcing their rights against acts of direct patent infringement. As a form of "strict" liability tort, direct infringement merely requires evidence of the unauthorized use of the invention, which has occurred by undertaking one of the acts expressly sanctioned under 35 U.S.C. Section 271(a).

As observed by Brean: "*a factory infringes a patent by "making" the patented product, a retailer infringes a patent by "selling" the patented product, and a purchaser of a product infringes a patent by "using" the patented product*"[1245]. Pursuing direct infringement claims, rather than indirect infringement claims, is more practicable: evidence of intent to commit infringement, which includes knowledge of both the patent and the direct infringement, is not required[1246].

Yet, it seems that patent law is anchored to the physical world; consequently, unless the invention if embodied into a tangible item, no direct infringement could be established. The act of 3D printing a printable file (and, likewise, the act of selling, offering for sale or importing the printed object) clearly constitutes infringement.

However, if we exclude that CAD files are patent-eligible *per se*, there would be no infringement if a third party creates and/or trades the digital design of an otherwise patentable invention. Put it otherwise, if the patent claim is directed solely to a tangible invention, the activities carried out in respect of CAD files alone – such as creating a digital blueprint of the patented invention and distributing it online – fall outside the scope of protection[1247].

The next part elaborates on the doctrinal position sustained by commentators such as Holbrook and Osborn that propose extending the reach of patent law beyond tangible objects. Hence, it recalls the Federal Circuit's decision in *Transocean Offshore Deepwater Drilling,*

[1244] As Brean argues, "*centuries of traditional manufacturing processes and commercial infrastructure have shaped patent law under the assumption that physical goods are traded in physical form*". Brean (2015), 838.
[1245] Brean (2015), 838.
[1246] Brean (2015), 839.
[1247] Assuming that infringing activities are tied to a tangible dimension, when the patented product is likewise tangible.

Inc.[1248], according to which the focus should rest on the commercial impact of sales and offers to sell CAD files.

There is likelihood that patent owners, if left with rather weak protection in the 3DP landscape, will attempt to find their shelter elsewhere. Hence, the analysis moves to the doctrine of equivalents and the indirect infringement regime under U.S. patent law.

9. Direct Infringement Under U.S. Patent Law

Pursuant to Section 271 (a) of the Patent Act, an act of direct infringement is deemed to occur when "*someone without authorization makes, sells, offers to sell or imports the patented invention in the U.S*".

The mere act of printing an item from a CAD file counts as an act of direct infringement, which is distinct from any subsequent use of the invention. Hence, manufacturers or consumers that use, offer for sale, sell or import the printed product, likewise are direct infringers.

As already suggested above, 3DP substantially alters the traditional manufacturing and transportation infrastructure, as well as sales methods. Manufacturers no longer need to make, sell and distribute physical products in their physical form, but can embrace a digital distribution model[1249].

We can imagine companies selling their own CAD files, and customers or intermediaries printing products on dislocated printers. While customers and intermediaries that print patented objects without the owners' authorization would be directly liable, it may be uneconomical and strategically inefficient to claim patent rights against individual infringers[1250].

Patentees will attempt to devise more viable strategies. As an alternative to seek protection for CAD files as such, by including them in the patent claim, patent owners might contend that the exclusive rights conferred by their patents (over tangible products) extend to the creation and/or transfer of 3D printable designs.

For some scholars, 3DP urges us to reconsider the traditional understanding of "*making*" the patented invention as a concept tied to a physical dimension. Accordingly, the mere creation of a digital design should be tantamount to constitute patent infringement, if such design

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[1248] *Transocean Offshore Deepwater Drilling, Inc. v Maersk Contractors U.S.A.*, Inc. 617 F.3d 1296.
[1249] Brean (2013), 781.
[1250] Brean (2013), 789.

replicates the claimed invention[1251]. Perhaps this argument goes too far. Extending the reach of the patent monopoly to the mere creation of CAD files might be detrimental to technological development and innovation.

The reason why it might be necessary to expand direct infringement doctrines to digital uses of the invention is related to the difficulty in suing end users who 3D print objects in their homes or in 3DP hubs. If tracking and suing end users is not practical, then perhaps the patent owner can allege that the individual who creates the CAD file commits an act of direct infringement[1252].

Nonetheless, even then, patent owners will have to surmount difficulties in tracking individual infringers and in enforcing rights against them, similarly to the case when individual *makers* who print the object are sued. Therefore, the option to target makers or creators of CAD files is not practical either and is certainly not ideal from a policy perspective.

Claiming that a digital representation and its tangible embodiment are the same sort of thing has major implications: such equation would cause a substantial expansion of the law. A matter of concern is that the category of "CAD files" is exceptionally diverse. Not all CAD files result in a perfect replica of the patented product, once printed[1253].

Having a CAD file is not effectively the same as having a finished product. It is simply not true that only a click divides the final artefact from the digital file. The CAD file can be seen as a precursor of the actual printed object, but the transformation from digital to physical requires taking some additional steps, before and after the printing process.

It is not advisable, however, to base legal treatment of CAD files upon the "time of transition, the complexity of transition, and the degree in transformation from intangible to tangible"[1254]. The present writer, therefore, disagrees with the body of literature holding that these comparisons between the CAD files and physically printed objects should be the new test in the infringement analysis.

Judges are not trained to carry out this sort of technical analysis. It is important that lawmakers address the most fundamental question of whether intangibles still deserve different treatment under patent law as compared to tangibles.

[1251] *Id.* While the statute does not define "make" or "making", the Supreme Court has clarified that "*the right to make can scarcely be made plainer by definition, and embraces the construction of the thing invented*". *See Bauer & Cie v O'Donnel 229*, U.S. 1, 10 (1913).
[1252] Osborn (2016a), 261.
[1253] Ballardini et al. (2015).
[1254] Ebrahim (2016), 17.

In principle, makers or distributors of CAD files might also be regarded as direct infringers under Section 271(a) of the Patent Act, because they are "*using*" (rather than making) the invention. The Supreme Court has construed the term "use" as "the right to put into service any given invention"[1255]. An infringing use, however, must "*incorporate in some fashion the principles of the claimed invention*"[1256].

It follows that, activities undertaken in respect of CAD files not likely will count as relevant "uses" of the invention, insofar as the (physical) patented product is not put into service according to the intended function of the invention.

Another avenue that patentee might decide to pursue is to claim that the electronic transmission of a CAD file in exchange for money amounts to a "sale" or "offer to sell". There is no agreement among scholars regarding whether the sale or offer to sell a CAD file should be equated to an infringing sale or offer to sell the corresponding physical item.

The word "sells" postulates a "transfer of property or title for a price"[1257] which has as its object "the patented invention", i.e. the patent claim. If the subject matter of such claim is a physical product, that physical product must be placed on the market.

Yet, when looking at the statutory text, there is no requirement that something tangible be transferred for an infringement by selling or by offering to sell to take place. Arguably, the entrenchment of patent law in a physical dimension is anachronistic.

Hence, the key issue of whether a sale or offer to sell involves a transfer of ownership loses importance in the 3DP context. The *ratio legis* of direct infringement doctrines is to prevent the appropriation of the invention's economic value. After a CAD file is transferred, the patented invention can be printed with ease from a CAD file, at the time chosen by the consumer.

As far as the transfer of the file is itself liable to reap the economic value of the patented item and harm the commercial interest of the patentee – some argue – such activity shall be regarded as an infringing act under the law.

Some commentators draw this conclusion from the reasoning underlying the *Transocean Offshore Deepwater*[1258] ruling, in which the court imposed liability on the ground that the

[1255] *Bauer &Cie v O'Donnell*, 229 U.S. 1, 10-11 (1913).
[1256] Brean (2013), note 121. The mere possession, display or demonstration of an accused product at a trade show does not infringe as such, absent some proof that the claimed invention has been practiced to perform its function. *Medical Solutions, Inc. v C Change Surgical LLC*, 541 F3d 1136, 1140 (Fed. Cir. 2008).
[1257] Brean (2013), 790, quoting the Federal Circuit in *NTP, Inc. v Research in Motion, Ltd.* 418 F.3d 1282, 1319 (Fed. Circ. 2005)
[1258] *Transocean Offshore Deepwater Drilling, Inc. v Maersk Contractors*, 617 F.3d 1296 (Fed. Circ. 2010).

purpose behind direct infringement is to "*prevent generating interest in a potential infringing product to the commercial detriment of the rightful patentee*"[1259].

The just-mentioned decision builds on *Pfaff v Wells Electronics*[1260], in which infringement under Section 271(a) was established based solely on the offer to sell diagrams and other descriptions of an invention, absent a physical embodiment of the invention thereof.

Endorsing this view, the theory of direct infringement shall be broadened to include (sale) activities carried out with respect to printable files alone, in order to obviate the risk that patent owners will lose sales or be forced to lower their prices in the face of competition. Supporters of this view, therefore, suggest that only in this way could the law aptly accommodate technological change, and adequately prevent misappropriation of (the commercial value of) patented inventions.

The same commentators, however, give weight to the fact that *Transocean* is a decision concerning the offer for sale of a physical item, i.e. an oil rig. Hence, one may argue that CAD files are to be distinguished from the *Transocean* scenario, in which the lost sale is tied to a single, individualized item.

In contrast, once a CAD file is distributed online, it can be used to replicate the patented invention in multiple copies[1261]. Consequently, "*there is no correlation between the sale and the item. The CAD file, in some sense, is just the potential for infringement, and there is no infringement until an item has been produced. Thus, infringement should be limited in the context of CAD files solely to the "making" of the invention, once the CAD file is used to direct the printer*"[1262].

Moreover, it is questionable whether any adjustment to the law regulating direct infringement should be guided by considerations on the patent owner's commercial interest alone. On the contrary, the interests of subsequent innovators and of the public at large should also be given a thought.

In fact, a perspective that focuses on the patentee's economic interest carries the risk of making a distinction between "*larger, more established companies that have a clear economic incentive*" and smaller companies and individuals that are not exclusively led by commercial gain[1263].

[1259] Holbrook; Osborn (2015), 1363.

[1260] *Pfaff v Wells Elcs., Inc*., 525 U.S. 55, 67-68 (1998).

[1261] Holbrook; Osborn (2015), 1363. INTA 3D Printing Task Force (2017), 15.

[1262] *Id.* As already stressed, however, this would be extremely difficult to prove.

[1263] Ebrahim (2016), 53.

The *Transocen* decision, however, deserves credit. It stresses that the law might become ill suited to regulate current technological means of trading goods that cause harm to the patentee's commercial interest[1264]. Especially because of its nature as a digital file, which can be easily reproduced, it would seem that the distribution of CAD files could cause even greater harm to the right owner, as compared to the sale of a physical, isolated product.

Accordingly, there shall be no correlation between liability and the nature of the item transferred, whether the file or the ultimately printed item. What counts for there to be infringement is the appropriation of the invention's economic value, regardless of whether or not such appropriation implies a physical incarnation or not[1265].

The presence of a physical item might have an impact on the available remedies (injunctions or damages), but not on the actual finding of liability. In other terms, liability must be affirmed in the first place; the fact that the product is offered in digital form, however, might prevent the award of damages, as it might be difficult to provide adequate evidence of actual harm.

Unlike remedies provided for under U.S. copyright law, remedies against patent infringement do not include statutory damages, but only actual damages. Hence, the patentee can recover only those damages that are adequate to compensate for the infringement, i.e. lost sales or price erosion.

Price erosion is the lost profit resulting from a price drop, due to the offer of an infringing product, which, in turn, forces the patentee to offer its products at a lower price, in order to win back customers in the competition with the infringer. Hence, if it was not for such offer, the patentee could have marketed its products at a higher price.

Applying this reasoning to CAD files, damages can be awarded only to the extent that such files supplant the sale of the actual product or force the patentee to lower its price. It is also worth noticing that a remedy against *free* digital-design-file-sharing might not be available, insofar as sharing CAD files without charging money does not trigger a "sale" or "offer to sell" the patented invention.

The Federal Circuit has clarified that the term "offer" should be given a meaning that is in line with "*the norms of traditional contractual analysis*"[1266], and must constitute a

[1264] Osborn (2016), 4.
[1265] Holbrook; Osborn (2015), 1357.
[1266] For a detailed analysis of the potential (positive and negative) effects of giving a broader definition of "offer" under Section 271(a) *see* Osborn (2014). Clearly, if advertisements alone could infringe, the number of patent lawsuits would raise substantially.

"*manifestation of willingness to enter into a bargain, so made as to justify another person in understanding that his assent to that bargain is invited and will conclude it*"[1267].

Hence, this contract-law definition of "offer" does not include most advertisements or similar promotions (and other potentially infringing activities such as advertisements of CAD files), being mere invitations to make an offer that may lead to formal contract-law offers[1268].

The concept of "sale" implies a transfer of ownership through a commercial transaction (i.e. in exchange for money) and does not cover a free transfer, donation, gift or other transactions where the infringing good is given away at no cost[1269]. Therefore, digital-design-file-sharing that takes place on online platforms, by means of Creative Commons licenses, is not equal to a "sale".

There are, however, unique challenges that 3DP might pose if the technology becomes ubiquitous and the cost of CAD files goes down. As scholarship queries, has an actual "sale" occurred if the CAD file's proprietor ends up transferring the file at a very low price or nearly free cost?[1270]

Moreover, the sharing of CAD files for patented inventions, even when it occurs for free, may cause a substantial harm to the patent owner in terms of price erosion and lost sales. This is why a body of literature considers it necessary to expand the doctrine of direct infringement to the "making" of a CAD file embedding a patented invention.

To sum up, the decision in *Transocean* seems to postulate that a physical embodiment of the patented invention is not required to capture infringing "sales" or "offers to sell". Having noted that, Brean recalls two earlier rulings that, at first glance, seem to be in tension with *Transocean* suggesting that U.S. patent law does not protect against the sale of a CAD file for use in 3DP[1271].

In particular, in *Ecodyne Corp.*[1272], a U.S. District Court held that a sale couldn't relate to a thing that has not yet come into existence. In *Lang*[1273] the Federal Circuit confirmed that, to establish direct infringement by sale or offer to sell, a physical embodiment of the complete and "actual" patented invention must be present.

Hence, while the above-mentioned case law leaves a certain degree of uncertainty as to whether the transfer of a CAD file would suffice to trigger liability, it seems rather

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[1267] Holbrook; Osborn (2015), 1346.
[1268] *Id.*, note 221.
[1269] Ebrahim (2016), 97.
[1270] Ballardini et al. (2016).
[1271] Brean (2013), 790.
[1272] *Ecodyne Corp v Croll-Reynolds Engineering Co.*, 491 F.Supp. 194 (D. Conn. 1979).
[1273] *Lang v Pacific Marine & Supply Co.*, 895 F.2d 761.

straightforward that, under current law, the mere creation or replication of a CAD file does not amount to an act of "making" or "using" the patented invention under Section 271(a).

These acts can occur only in the presence of a tangible manifestation of the patented invention[1274]. For the time being, it is not advisable to substantially expand the law on direct patent infringement – in a way that creating or copying a CAD file for a patented item would count as an infringing "making" or "using" the invention.

Absent a physical embodiment of the invention, other doctrines, such as the doctrine of equivalents or indirect infringement should rather be called upon.

10. The Doctrine of Equivalents

Under the doctrine of equivalents, as set out in *Graver Tank*[1275] in 1950, "*a product or process that does not literally infringe upon the express terms of a patent claim may nonetheless be found to infringe if there is equivalence between the elements of the accused product or process and the claimed elements of the patented invention*"[1276].

The doctrine of equivalents is a judicially crafted doctrine, which prevents third parties from escaping liability by making insubstantial or minor changes to a patented invention. It protects against forms of non-literal infringement, i.e. copying that goes beyond the literal terms of the patent claim.

By directing protection towards all the equivalents to the invention recited in the claim, the doctrine under scrutiny prevents patent's obsolescence: it ensures that the claimed invention will not be supplanted by the so-called "after-arising" technologies – i.e. technologies were not known at the time of the filing date – thereby extending the patent's life and increasing the incentive to invent[1277]. A side effect of protecting after-arising equivalents, however, is that follow-on inventors may be deterred from building on earlier technologies.

The Supreme Court in *Graver Tank* has developed two different tests for assessing infringement in accordance with the doctrine of equivalents: (1) the so-called "function-way-result" test, according to which courts should ask "*whether the accused element performs substantially the same function, in substantially the same way, to achieve substantially the same result"*[1278]; and (2) the "insubstantial differences" test, according to which courts should

[1274] Osborn (2016a), 254.
[1275] *Graver Tank & Mfg. Co. v Linde Air Prods*. Co., 339 U.S. 605 (1950).
[1276] *Id.*, 609.
[1277] Holbrook; Osborn (2015), 1368.
[1278] Holbrook; Osborn, 1369.

ascertain whether "*there is a substantial difference between an element of the patented product and the accused product"*[1279].

The court in *Warner-Jenkison*[1280], whilst confirming the vitality of this doctrine after the 1952 revision of the Patent Act, it has also set out its limits: the doctrine of equivalents should not be relied upon to enlarge the scope of protection beyond what is claimed.

In the court's view, the focus should rest on each element of the invention, as opposed to the invention as a whole. Hence, an element-by-element comparison must be carried out.

Some commentators believe that the doctrine of equivalents can cover CAD files of patented inventions[1281]. In their views, the patent owner can, in theory, contend that 3DP and digital manufacturing technologies are follow-on technologies that could not be anticipated and predicted at the date of the patent's issuance. Hence, a CAD file is a type of modification or variation of a patented item that has emerged after patenting, but is still covered by the patent's exclusivity.

In fact, only to a "*pre-digital mind*" do CAD files appear to differ substantially from physical devices; by contrast, in the post-digital manufacturing world, CAD files are not dissimilar to the finished, tangible products just as an e-book is not dissimilar to the printed version"[1282].

This approach builds on the same assumption that would prompt the expansion of the law against literal copying, namely the interchangeability of digital design files and end products. If one accepts that there is a strict correlation, if not even an overlap, between CAD files and what can be printed, then all traditional doctrines of patent law can suddenly be expanded to the digital realm.

If literal infringement cannot help, patent owners should be able to target the creators and distributors of CAD files under the doctrine of equivalents, by claiming that such files are a type of modification of the patented device "*that is simply a button press away from being printed into an actual physical form that would literally infringe on the patent owner's claim*"[1283].

The same commentators concede, however, that courts will hardly make a comparison between a physical product and a digital file based on the doctrine of equivalents. CAD files as such are not physical devices and do not have constituent elements that serve as a basis of

[1279] *Id.*
[1280] *Warner-Jenkinson Co. V Hilton Davis Chem. Co*., 520 U.S. 17, 39-40 (1997).
[1281] Osborn (2016a), 587.
[1282] Holbrook; Osborn (2015), 1369.
[1283] Ebrahim (2016), 67.

comparison[1284]. Arguably, the only plausible way to compare a CAD file with the claimed invention is to consider what the CAD file can print (i.e. the ultimate product). In fact, the argument that, substantially, CAD files accomplish the same function, in the same way, to achieve the same result of the patented invention is weak. CAD files merely enable printing an item that might satisfy, in its physical form, the "function-way-result" test.

By the same token, courts might be resistant to accept that a digital file is "substantially the same" as the patented invention it incorporates, since they do not share the same physical form. Therefore, patent owners may put forward the argument that what is substantially similar to the patented invention is not the CAD file as such, but the finished 3D-printed product.

If attention is placed on the product embedded in the file, there is no need to ascertain whether the file as such is the equivalent of an earlier invention. The inquiry into whether the digital version of a patented invention differs substantially from the physical version becomes meaningless.

In other terms, a plausible argument is that, even when the technology advances to the point that the CAD file is essentially the same thing as the final product[1285], the doctrine of equivalence must be applied taking into consideration such physical product.

It is not conceivable that courts will make a comparison between the elements of the patent claim and the features of a CAD file, imagining what can potentially be printed from such file. In the 3D printing context, it does not actually matter if the variant of a claimed invention is expressed in digital form or incorporated in a physical device: in any case, the latter should represent the basis of comparison.

One may also argue that, if 3DP becomes a commonly used technology, printable files will not be considered an after-arising technology, but a normal instrument that is used in manufacturing processes. At some point in the future it might even seem absurd to contend that the after-arising equivalent of a product is a printable file representing it.

Arguably, patent owners who have filed their applications when 3DP technology was not yet of general awareness would gain an unjustifiable competitive advantage, as compared to those who will file their applications in the next years to come.

11. Indirect Patent Infringement: Contributory Infringement and Inducement

[1284] Holbrook; Osborn (2015), 1369.
[1285] Osborn (2016a), 587.

As noted above, under current law, patent holders can pursue direct infringement claims against anyone who 3D-prints an item from a CAD file, but not likely against upstream parties, such as the designers of CAD models, the manufacturers or suppliers of 3D printers, and the distributors of CAD files.

We have already examined the academic proposal to expand direct patent infringement to cover activities such as the creation, sale or offer for sale of a printable file. This proposal can be criticized for being too deeply entrenched in a futuristic vision of 3DP technologies, where anyone could print a patentable product at a click of a button. Only if the capabilities of 3D printers expand, and the array of patented products that can be printed gets wider, might it be desirable to consider an expansion of the direct infringement doctrine.

Under the current version of the statute, however, direct infringement of a patent does not seem to cover activities in the 3DP landscape such as the creation and/or transmission of CAD files. In fact, direct liability can occur with respect only to the tangible, 3D-printed object, rather than the 3D digital representation thereof.

A more plausible way to extend liability to upstream parties is to enlist the doctrine of indirect infringement. Liability for indirect infringement of a patent has first been developed to fill the vacuum in the scope of protection in all such situations in which it was impractical or ineffective to sue direct infringers, as when it was necessary to stop the manufacture of the components of a patented invention before they were distributed[1286].

Hence, the main justification for introducing indirect liability doctrines is the difficulty in suing the direct infringers, because they are numerous, dispersed around the globe and incapable of paying damages. Also, a party labelled as an indirect infringer in patent law is usually considered to be more "culpable" than a direct infringer, since only the latter might be found liable even if he or she has independently created the invention[1287].

Hence, the indirect infringement regime embraces active inducement under Section 271(b) and contributory infringement under Section 271(c). As Holbrook and Osborn note, for active *inducement* to occur, the following conditions should be met: (1) an act of direct infringement; (2) a specific intent to induce a third party to infringe; and (3) an affirmative act by the inducer[1288].

[1286] Brean (2015), 839.
[1287] Holbrook (2006), 400.
[1288] Section 271 (b). Holbrook; Osborn (2015), 1335.

Claims against *contributory* infringement are pursued against whomever offers to sell or sells within the U.S., or imports into the U.S., the "components" of a patented invention to be later assembled by individual customers.

As opposed to inducement, contributory infringement does not require evidence that the infringer had intent to cause infringement, but that he or she had knowledge of the patent and knowledge that the component has no substantial non-infringing uses.

As the Supreme Court has clarified in a case dealing with indirect copyright infringement, Grokster[1289], under the contributory infringement doctrine, the absence of a non-infringing use of the good enables to presume intent to cause infringement. The (presumed) intent is "*that of inducing actual infringement, not merely the acts that constitute infringement. If the good has both infringing and non-infringing uses, intent cannot be presumed"*[1290].

It follows that these two heads of liability differ with respect to a fundamental aspect: if the product is capable of non-infringing uses, the accused infringer can escape liability for contributory infringement, but can still be regarded as an active inducer, as was the case in *Grokster.*

In principle, the upstream parties that can be addressed by indirect infringement claims include manufacturers of 3DP devices, producers of printing materials, as well as creators or distributors of CAD files. In the abstract, each of these devices and digital tools may cause potential indirect liability, since they ultimately contribute to replicate the patented invention.

The different modes of induced versus contributory infringement are examined below, taking into consideration all potential actors involved.

11.1. Contributory Infringement

The first form of indirect infringement examined in this section is contributory infringement.

Contributory infringement under U.S. patent law occurs if someone offers to sell or sells or imports into the U.S. a "component" of a patented invention, "knowing" the same to be especially made or especially adapted for use in an infringement (Section 271(c)).

More precisely, to hold the supplier of a component liable for contributory infringement, a patent holder must show, inter alia, that: (a) the supplier's product was used to commit acts of direct infringement; (b) the product constituted "a material part of the invention"; (c) the supplier knew its product was "especially made or especially adapted for use in an

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[1289] *Metro-Goldwyn Mayer Studios, Inc. v Grokster, Ltd*, 125 S. Ct. 2764 (2005).

[1290] Holbrook (2006), 408.

infringement" of the patent; (d) the product is "not a staple article or commodity of commerce suitable for substantial non-infringing use"[1291].

11.2. Liability of Three-Dimensional Printers' Suppliers

Patent owners could try to defend their rights against the manufacturers of 3D printers and related devices or the suppliers of 3DP materials, on the grounds that these devices or tools enable making copies of patented products.

As noted, the doctrine of contributory infringement is addressed towards third parties that knowingly sell either a component of a patented product or a special-purpose device aimed at implementing patented process, provided the component or device is not "*a staple article or commodity of commerce suitable for non-infringing use*"[1292].

According to the "staple article of commerce" doctrine, contributory infringement cannot be established if the technology can be used for non-infringing uses. 3D printers, scanners, CAD software and filaments can be used in so many non-infringing ways that outlawing them would stifle innovation and harm society[1293].

One may draw an analogy between 3D printers and VCRs, which were under scrutiny in *Sony*, a copyright case that ended up before the Supreme Court[1294]. The Court in *Sony* rule out liability of VCRs' manufacturers, for contributory infringement of copyright law, because VCRs are capable of "substantial non-infringing uses", such as time-shifting (i.e. the possibility to record shows and watch them later), which constitutes legitimate fair use.

Perhaps, the probability that 3DP devices will be used for non-infringing purposes – such as printing objects that do not qualify for patent protection for lack of novelty or non-obviousness, as well as things that belong to the public domain – is even greater than for VCRs[1295].

On the other hand, the fact that 3DP tools are capable of non-infringing uses does not, as such, shield an accused infringer from liability if he or she has *induced* infringing use. However, indirect infringement theories might not offer a viable solution because of the strict "knowledge" requirement.

1291 *Arris group Inc. v British Telecommunications Plc.*, 639 F.3d 1368 (Fed. Cir. 2011). See also U.S.I.T.C. Washington D.C. 20436, *Certain Network Devices, Related Software and Components Thereof*, Investigation No. 337-TA-944, p. 38.

1292 *See* 35 U.S.C. § 271(c).

1293 *Inter alia*, this is the opinion of Weinberg (2010).

1294 *Sony Corp. v Universal City Studios*, 464 U.S. 417 (1984).

1295 Desai; Magliocca (2014), 1715.

Both inducement and contributory infringement requires evidence that the alleged infringer has knowledge both of the underlying patent and of the act of direct infringement that he or she is facilitating.

However, 3D printers, as well as other 3D printing devices and tools, are not specific to a patent. They are used to manufacture a broad array of products, including (but not restricted to) patented products. As suggested by Holbrook and Osborn, “3D printers are generic”, meaning that “every patent that involves a material object could arguably be created by a 3D printer”[1296].

The same holds true for companies that produce 3DP materials, such as plastic filaments, metal and ceramics, which can be used for various purposes, and are not directly associated with the infringed patent. The company may lack actual knowledge that the 3D-printed object is patented.

Therefore, it is here suggested that indirect infringement lawsuits based on 3D printers, 3D scanners or 3D printing materials alone are not viable. Indirect infringement will not sufficiently help the patentees, lacking the required knowledge of the patent claim and of infringement.

The most likely scenario is that of patentees going through the indirect infringement avenue to stop the sharing of CAD files embedding their patented inventions.

11.3. Liability of CAD Files’ Distributors

Under current law, patent owners that go after the creators or distributors of CAD files do not have to show that the CAD file as such infringes their patent. In fact, liability arises for the mere fact that a third party has facilitated direct infringement, i.e. the actual print of the object.

Yet, as Weinberg pinpoints: “*unlike with copyright infringement, the mere possession or downloading of a file is not enough to create infringement liability*”[1297]. In fact, the patent owner has to prove that the patented invention was duplicated in the real world by the direct infringer, at least by circumstantial evidence.

The following discussion purports to clarify under what circumstances a party who creates, disseminates or hosts a CAD file for a patented product can be held liable as a contributory infringer.

[1296] Holbrook; Osborn (2015), 1334.

[1297] Weinberg (2016), 28.

In the first place, 3DP begs the question of whether a CAD file can be accused to be a "component" of a patented object under patent statute. In this respect, one can get inspiration from the *Microsoft*[1298] decision, concerning the interpretation of Section 271(f), a provision on extraterritorial activities that adopts the same language of Section 271 (c) and, therefore, must be interpreted consistently.

In that case, Microsoft sent its software (the Windows operating system) from the U.S. to computer manufacturers abroad, via electronic transmission (by email) or by sending a disk, which was then installed onto computers made and sold abroad[1299].

The question at hand in *Microsoft* was whether software sent to foreign computer manufacturers was a "component" of the patented invention "supplied" by Microsoft from the United States, within the meaning of Section 271(f)[1300].

The Supreme Court found that the term "component" has a *tangible* meaning and could encompass only software recorded on a medium, like a CD-ROM. Software in the abstract – i.e. a set of instructions detached from a tangible copy – is "intangible information" that cannot be typed a "component"[1301].

In the Court's opinion, an analogy can be drawn between abstract instructions and a blueprint that "*contains precise instructions for the construction and combination of the components of a patented device, but it is not itself a combinable component*"[1302].

Following the Court's reasoning, one may see a CAD file as a set of instructions in the abstract – or a blueprint containing the building information – that is not itself a "component" combinable into a patentable device, but a tool from which those components can be readily manufactured.

Holbrook and Osborn criticize those commentators that misapprehended the Court's reasoning in *Microsoft* by holding that a CAD file can never be a component; on the opposite, CAD files encoded on a medium may well be[1303].

However, the following counterargument could be raised: a CAD file that enables printing the *whole* finished product cannot be regarded as a "component". In fact, traditionally cases against contributory infringement have concerned the unauthorized sale of physical pieces of the whole patented product, not covered by the patent claim as such.

[1298] *Microsoft Corp. v AT&t Corp*., 550 U.S. 437, 449-52(2007).

[1299] *Microsoft*, [441]- [442].

[1300] *Id.*, [441].

[1301] *Id.*, [449].

[1302] *Id*. In fact, components of a patented invention should be differentiated from "information, instructions, or tools from which those components readily may be generated".

[1303] Holbrook; Osborn (2015), 1350-1351.

By contrast, a CAD file, rather than being a *part* of a patented article, it is a digital representation of the *whole* article, which has separate existence from the latter. In fact, "*once the file is printed, the file continues to exist separate and apart from the physical device, and the physical device no longer needs the CAD file for its existence*"[1304]. In this respect, a CAD file plays a role in digital design manufacturing that is similar to that of a mould in a traditional manufacturing process, being a precursor of the final product[1305].
A different scenario may occur if the CAD file is the digital correspondent of a patent's component, since it reproduces a part of the patented invention, as opposed to the entire invention[1306]. Once again, the fundamental issue to unravel relates to a possible equation between the physical component and its digital representation under U.S. patent law.
One thing is to equate the CAD file as such to a "component" that is later assembled in the finished product; another is to claim that, when such file represents a component of the patented device, it should be treated equally to its physical correspondent (i.e. the tangible component) for the purposes of contributory infringement.
In light of the foregoing, an argument can be made against the qualification of the CAD file itself as a "component" under Section 271(c), with the obvious conclusion that conducts such as creating, disseminating and hosting CAD files cannot be charged under the head of contributory infringement.
It is also worth noting that the "staple article of commerce" doctrine might also prevent the finding of contributory infringement against online sharing platforms, such as Thingiverse and Shapeways, which enable substantial non-infringing activities and lawful uses of user-generated CAD files.
Finally, on a par with direct infringement and unlike with inducement, the doctrine of contributory infringement has a territorial scope, prescribing that the infringing acts must take place in the United States. Hence, patent owners cannot enforce their rights against firms making and selling infringing products abroad, and knowing that these products will then be imported in the United States.
The only viable avenue to prevent these infringing activities is to turn to Section 271(b)'s inducement provision, which has no territorial limitation.

11.4. Active Inducement

[1304] *Id.*, 1348.
[1305] *Id.*, 1348.
[1306] *Id.*, 1347.

As discussed, "active inducement" is a variant of indirect liability according to which one party is held liable as an infringer for "actively inducing infringement of a patent", pursuant to Section 271(b).
Therefore, the first hurdle that a patent owner would have to overcome, in order to succeed in a lawsuit for induced patent infringement, is proving the underlying *direct* infringement (i.e. the actual print of the patented item) or that the accused product necessarily infringes, because it does not have substantial non-infringing uses.
As discussed, proving direct patent infringement might be costly and burdensome, in light of the decentralized nature of 3DP and the anonymity that characterizes online distribution of CAD files. It is well settled, however, that patentees may well meet the burden of showing direct infringement with circumstantial evidence[1307].
Evidence that a CAD file of a patented product has been downloaded is not, as such, sufficient to prove that the patented invention has been implemented by printing the item. There must be at least circumstantial evidence that the CAD file was used to print the object. Arguably, it is not even possible to contend that CAD files are incapable of non-infringing uses, since they may well be used for legitimate purposes along with infringing ones.
In addition to giving evidence of direct infringement, patent owners have to prove that the alleged infringer had a certain mental state: the specific *intent* to induce infringement. A subject of discussion is whether, in order for active inducement to be established, it is sufficient to prove that a party induced acts that happened to be infringing or, on the contrary, it is necessary that the same party specifically intended to cause infringement.
There is a substantial difference between having a *generic* intent to induce others to commit particular acts, which then result in infringement, and the *specific* intent to induce others to commit infringement: only in the latter instance is knowledge of the patent necessary[1308].
In *DSU Med.*[1309], the Federal Circuit clarified that "inducement" requires *specific* intent to cause infringement on the part of the alleged infringer, i.e. a culpable conduct directed to

[1307] For example, in *Moleculon Research Corp. v CBS, Inc.* 793 F.2d 1261, 1272 (Fed. Cir. 1986), the patent was directed to a method of solving a cube puzzle (the Rubik's cube). Evidence of direct infringement (i.e. that puzzle users were practicing the method) could be established by circumstantial evidence of extensive puzzle sales by defendant (i.e. sales of products by which the patented method could be practiced), and distribution of instructions explaining how to solve the puzzle. Yet, the possibility for the patent owner to rely on circumstantial evidence is in doubt in all such cases in which CAD files can have non-infringing uses, in addition to infringing uses. *See* Holbrook; Osborn (2015), note 79.
[1308] Holbrook (2006).
[1309] *DSU Med. Corp. V JSM Co., Ltd*., 471 F3d 1293 (Fed. Cir. 2006).

actively encourage, influence or persuade another person to infringe the patent. Evidence that the inducer knew that an act of direct infringement took place will not be sufficient[1310].

Hence, the Federal Circuit in *DSU* did not specify the kind of knowledge that is required for establishing active inducement: is *actual* knowledge of the underlying patent necessary – as it is the case for contributory infringement under Section 271 (c) – or is *constructive* knowledge sufficient?

In *Global-Tech* the Supreme Court confirmed that the knowledge requirement for establishing inducement relates both to "*the patent and to the infringing nature of the induced acts*".

As noted by Holbrook, by adopting such knowledge requirement, the Court "*avoided making induced infringement a form of "strict liability", which could ensnare truly innocent actors"* that, despite being ignorant of a patent, are found liable for acts of others. In the Court's view, in some sense, a bad actor[1311].

The Court further specified that the requisite mind-set consists in either *actual* knowledge of the patented invention or *wilfully blindness* of the patent's existence[1312].

Interestingly, wilful ignorance is a more specific than a generalized knowledge that somewhere, out there, there is a patent that could possibly cover the produced item[1313], and presupposes that (1) "*the defendant subjectively believes that there is a high probability that a fact exists*"; (2) "*the defendant takes deliberate actions to avoid learning that a fact exists"*[1314].

It should also be noticed that, while the infringer's *good faith* belief that the patent is not infringed may exclude the *subjective* element of wilful blindness, in contrast, following the Supreme Court's decision in *Commil*, the defendant's belief that the patent is invalid is not a defence in an action against inducement[1315].

[1310] *Id.* at 1306. *See* also the Supreme Court's decision in *Global-Tech Appliances, Inc. et al. v SEB S.A.*, 563 U.S. 754 (2011), clarifying that, even if not expressly required under Section 271 (b), some "intent" is required. In fact, the verb to "induce" means "to lead on; to influence; to prevail on; to move by persuasion or influence". Furthermore, the "*adverb "actively" suggests that inducement must involve the taking of affirmative steps to bring about the desired result"*. The "intent" element can also be proved through circumstantial evidence, such as advertising an infringing use or providing instructions, tutorials or other materials directing users to operate the accused products in an infringing manner. *DSU Med.*, [1305].

[1311] Holbrook (2016), 1015.

[1312] As noted by Holbrook, the Court, therefore, did not go so far as to require actual knowledge of the patent. If it had done so, a party could avoid liability by simply refusing to review patents. By contrast, under the "willful blindness" standard, a party that does not take the necessary steps to inquiry about, search for and review patents may be found liable.

Id. [1015].

[1313] *Global-Tech Appliances*, [2070].

[1314] See *Global-Tech Appliances*, [2068].

[1315] Osborn (2016), 21. Holbrook (2016), 1020.

Finally, in *Grokster,* the Supreme Court transposed the provision on inducement (Section 271(b)) into the copyright realm, to conclude that "*one who distributed a device with the object of promoting its use to infringe copyright, as shown by clear expression or other affirmative steps taken to foster infringement, is liable for the resulting acts of infringement by third parties*"[1316].

Accordingly, in the online context, a website is not subject to liability merely because it has knowledge that its peer-to-peer network can potentially be used for infringing purposes or knowledge of actual infringing activities occurring on the platform; unequivocal evidence of intent must show that that the website had a purpose to cause patent infringement by use of its network[1317].

In *Grokster*, evidence of intent was particularly notable, given that Grokster and StreamCast directed their services to former Napster users[1318]. Second, "*neither company attempted to develop filtering tools or other mechanisms to diminish the infringing activity using their software*"[1319].

Applying the considerations made so far to 3DP, in theory, designers, hosting websites and users may all be vulnerable to litigation for creating, hosting, uploading or downloading infringing CAD files. However, proving the requisite mind-set in the context of digital patent infringement might be cumbersome[1320].

The specific intent requirement implies that designers, who have independently created a CAD file for a patented product, without knowing of the patent's existence, shall not be held liable. Likewise, most 3DP websites are passive hosting websites that merely give access to third party CAD files. Arguably, these websites are not aware of infringing activities occurring on their platforms, since they shift the burden to users who accept the "Terms and Conditions" before they upload or download potentially infringing material. By the same token, users who share CAD files with their peers are inexperienced actors not aware of the patent system, who have little to no consciousness that certain objects are patented[1321].

By following this line of thought, one may easily draw the conclusion that most actors in the 3DP scenery are to be treated as "laypeople" that are innocently ignorant about the existence of a patent.

[1316] *Grokster*, [936]-[937].
[1317] *Id.*, [937].
[1318] *Id.*, [939].
[1319] *Id.*
[1320] Ebrahim (2016), § 80.
[1321] Holbrook; Osborn (2015), 1338.

Moreover, intermediaries should not be held liable merely because their system allows users to upload and exchange protected material.

This seems to be the approach followed by most commentators. For example, Desai and Magliocca note that Napster and eBay were found liable for contributory infringement under copyright and trademark law because they had more than a general knowledge or reason to believe that their services were used to trade illegal copies or counterfeits[1322]. Hence, upon receiving notice that infringing activities were taking place on their platforms, these websites refuted to take appropriate action to purge such illegal content from the system.

Likewise, Dillon considers induced infringement to be the most applicable theory for extending patent liability to upstream parties, whilst acknowledging that only the most flagrant inducers will be found liable[1323].

Dillon describes a likely scenario in the 3DP context, in which evidence of direct infringement and evidence of inducement can be readily provided. Many designers who upload their CAD files on Thingiverse – he notes – explicitly encourage other users to print the design, and include instructions or technical support for product manufacture and assembly[1324].

Likewise, Thingiverse encourages its users to upload pictures of 3D printed products manufactured from available CAD files.

As Dillon contends, providing designs and technical support so as to enable someone else to infringe a patent can be induced infringement, whereas simple publication of a CAD file is not enough to induce infringement[1325]. For indirect patent infringement to occur, one needs to actually encourage someone to make the invention.

Even so, the patent owner would also have the burden of proving prior knowledge or wilful blindness on the part of the accused infringer as to the existence of the patent. Arguably, the knowledge requirement would be satisfied by giving sufficient notice to Thingiverse that the accused products infringe upon patent rights[1326]. Hence, if Thingiverse had notice that a CAD file was infringing a patent, and it nonetheless refused to remove the design, any proof of further direct infringement would suffice to extend liability to the website[1327].

[1322] Desai; Magliocca (2014), 1718.

[1323] Dillon (2014), 444.

[1324] *Id.* This is the case of Matthieus, a designer who uploaded onto Thingiverse the design for a turbine compatible with a 12V DC motor, with all complementary instructions on how to print the desired product and assemble it with the motor.

[1325] *Id.*, note 145.

[1326] Dillon (2014), 445-447.

[1327] *Id*.

Dillon makes two important considerations. First, proving liability of file-sharing websites such as Pirate Bay would be much more difficult, as this platform indicates only the number of downloaders who are sharing the CAD files without any other solicitation or encouragement to infringe[1328].

Second, whilst a platform such as Thingiverse already provides a mechanism for reporting designs that violate third party patent rights, a platform such as Pirate Bay offers no mechanism to report allegedly infringing activities[1329].

This, in turn, aggravates the situation, as it will always be necessary to send a cease-and-desist letter to the platform and then wait for proof of further direct infringement (i.e. evidence that the item was printed after the notice was sent).

Macik draws upon the Supreme Court's findings in the seminal copyright case *Grokster* and in *Global-Tech* to conclude that hosting websites' unlawful objective is evident only where the networks fail "*defd*"[1330].

Hence, Macik suggests that the accused inducers would include those defiant websites that host CAD files "*with titles, descriptions or references to patented objects and do nothing to prevent or filter such files*"[1331].

Doherty believes that a patent owner will hardly proceed against a platform such as Thingiverse, given that "*its status as a passive host of content will make it difficult to establish either knowledge or wilful blindness on its part*"[1332].

Osborn and Holbrook opine that secondary liability is not the best avenue to pursue against hosting websites, given that they are "unsophisticated" (in a patent law sense) actors, not having due knowledge that a patent exists and is infringed[1333].

As they observe, before the development of digital manufacturing techniques, "*the quintessential inducer was a relatively wealth company that had access to sophisticated legal counsel*"[1334]. With the advent of 3DP, potential infringers will include passive platforms hosting CAD files that, at first glance, resemble those operating in the copyright system.

Yet, in the copyright context the entire existence of hosting websites is about facilitating the peer-to-peer exchange of musical works, which are evidently copyright protected. It is

1328 *Id.*
1329 *Id.*
1330 *Id.*
1331 *Id.*
1332 Doherty (2012), 361.
1333 Holbrook; Osborn (2015), 1338.
1334 *Id.*

therefore easy to assert that these hosting websites have the intent to pursue illegal activity[1335].

On the contrary, in the patent landscape, intermediaries may lack the required knowledge of the patent and that the induced activity is infringing. Such actors are not sufficiently familiar with patent law, because they have not engaged in the patent system before.

On the other hand, Ebrahim proposes an alternative approach to indirect liability in the 3DP context[1336]. Simply assuming that all users and entities that participate in sharing CAD files are not cognizant of existing patents, and lack the appreciation of the legal consequences of their activities, gives rise to a too restricted view.

It is not correct to dismiss indirect infringement claims on that basis, especially because "*further development in the 3D printing industry would yield sophisticated actors*" involved in CAD file sharing, that are familiar with patent law and aware of the patent landscape[1337].

Hence, Ebrahim criticizes Holbrook and Osborn for missing the perspective that, as in the copyright arena, new entities will emerge in the patent context with the purpose of facilitating digital-design-file-sharing, having a deep appreciation of the patent system and, therefore, making the strict knowledge requirement less difficult to be established.

These companies will gradually implement risk mitigation strategies, to avoid the costs associated with litigation, and employ (in-house or external) legal counsel to perform clearance searches, send notice letters and provide opinions on the validity and/or infringement of patents[1338]. By adopting such a defensive strategy, companies can avoid being accused of wilful blindness and have a more adept response to an eventual patent lawsuit.

In sum, if the entire organizational infrastructure of a company is centred on digital-design-file-sharing, it is plausible to presume that such company would be sufficiently acquainted with the patent system and constantly check the presence of infringing material on its online interface.

Another issue that, in prospect, needs to be clarified is whether marking a product with the issued patent number(s), as prescribed by 35 U.S.C. § 287(a), would or not suffice to satisfy the knowledge requirement on the part of the active inducer.

[1335] *Id.*

[1336] Ebrahim (2016), § 88.

[1337] *Id.*

[1338] *Id.*, § 86.

Osborn and Holbrook, building on the decision in *Mendenhall*[1339], suggest that the fact that the infringed product is marked is not sufficient to impute knowledge, given that the accused infringer might still contend that the mark remained unnoticed[1340].

Thus, patent owners will have to ponder what is the best form of publicity of their patent in the 3DP context: arguably, press releases regarding a newly issued patent might not be sufficient [1341].

In theory, a useful tool for informing active inducers about the patent claim is to send them a notice letter alleging infringement[1342]. By doing that, the patentee may be able to impute knowledge of the patented invention and prevent the inducer from engaging in future infringing activities. In fact, upon receiving such notice, the platform that does not act to remove the infringing material would show the intent necessary to establish inducement, at least with respect to further direct infringements taking place on the same platform.

Hence, one may argue that cease-and-desist letters serve as an incentive to comply, given that the alternative is to get involved in litigation[1343]. However, Doherty pinpoints one the shortcomings of a system that premises knowledge on cease-and-desist letters[1344].

Most users act under pseudonyms on 3DP platforms, thus making their identification very complicated. A cease-and-desist letter does not provide a method to directly detect and target the final user. In fact, the targeted intermediary is not forced to disclose the identity of the infringer.

The importance of identifying the allegedly infringing user can be better appreciated if one thinks that, once the content has been removed by the platform, users may still upload the same content onto other platforms, and find alternative distribution channels, before the patentee has found them and has taken steps to enjoin their actions[1345].

Likewise, nothing prevents other users from uploading, onto the same platform, similar digital designs under a different pseudonym.

The patent owner has the burden of ensuring compliance by the platform for subsequent infringements. In fact, as discussed, it is only after the letter has been sent to the platform, and

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[1339] *Mendenhall v Cedarapidis* 5 F.3d 1557, 1579 (Fed. Cir. 1993).

[1340] Holbrook; Osborn (2015), 1339.

[1341] *Id*. As Holbrook; Osborn (2015) highlight, “at a minimum, patent owners will need to police activities more rigorously .. to trigger the requisite knowledge on the part of many lay infringers”.

[1342] Doherty suggests that, from a patent owner perspective, a rapid and logic response to digital patent infringement will likely be sending a traditional cease-and-desist letter to the online platform, explaining that an infringing CAD file of his or her patented product has been uploaded onto the platform and demand that such offending material be removed. Doherty (2012), 362.

[1343] *Id.*

[1344] *Id*., [362].

[1345] *Id.*, [363].

evidence of subsequent direct infringement is collected, that indirect infringement claims can be pursued.

Arguably, the shortcomings associated with cease-and-desist-letters become apparent if one compares them with the other method of enforcing copyright in the online environment, i.e. DMCA takedown notices.

The DMCA system postulates that the website receiving the takedown notice must first authenticate the claim and then send a notice to the infringer to remove the content. If the offending party does not do so, the website will take down the infringing content itself, which is restored only if the accused infringer challenges the validity of the notice and no suit is filed by the right holder within ten days.

The patent owner becomes aware of the infringer's identity in case a counter notice is filed. Moreover, in case of multiple notices against the same offender, the hosting website should block the infringer's account and website.

Moreover, giving notice to the online platform by cease-and-desist letters is only partially effective, since it may prevent future infringing activities, but does not address past conducts. More precisely, evidence of good faith belief of non-infringement may preclude the award of pre-suit damages, but not the issuance of a prospective relief, such as a permanent injunction[1346].

This is so because, if the inducer's belief is found to be incorrect at trial, and he or she continues to carry out infringing activities from that point forward, he or she will be accused of patent infringement. Thus, there is no reason why a prospective remedy, such as a permanent injunction, should not be available[1347].

On the contrary, if the belief is found to be correct at trail or the patent is found to be invalid or unenforceable, no direct infringement and, correspondingly, no indirect infringement could be established. Hence, that being the case, the designer or distributor of a CAD file would not be liable at all[1348].

In a recent active inducement case, the Supreme Court clarified that a good faith belief that the patent is invalid, as opposed to not infringed, is not a state of mind that excludes liability [1349]. Hence, some commentators suggest that the Court has created "*an artificial bifurcation between invalidity and infringement that does not exist in practice*"[1350].

[1346] Holbrook (2006), 406.
[1347] *Id*.
[1348] *Id*.
[1349] *Commil*. On this *see* Holbrook (2016), 1024.
[1350] Holbrook (2016), 1032.

For present purposes, it is worth noting that the ruling under consideration did not answer the question of whether "good faith" is a subjective or objective element, and whether the answer differs depending on the infringer being a layperson or a business[1351].

In other terms, is it necessary to obtain sophisticated opinions of counsel (i.e. *objective* evidence of good faith) in order to avoid induced infringement, or is it sufficient to otherwise prove the inducer's subjective state of mind? How can *subjective* good faith be demonstrated? The answers to these questions may have enormous consequences in the 3DP context, if one thinks that most users are laypeople that cannot afford legal counsel[1352].

The ultimate condition to pursue inducement claims is that the accused infringer must have "*actively*" induced infringement, i.e. he or she must have taken affirmative steps to bring about the desired result (i.e. the direct infringement consisting in the act of making, using, offering to sell, selling, or importing a patented invention).

Hence, the question should be answered whether the inducer must have carried out activities beyond merely creating, hosting or exchanging the file. As discussed, in order to prove that an online platform has induced infringement, it might not be sufficient to claim that it has facilitated the sharing of allegedly infringing CAD files.

The mere availability of digital designs on a platform is not tantamount to infringement. Rather, it seems that intermediaries must have "actively" encouraged infringing activities, by taking additional steps, such as promotional or informative activities (i.e. providing instructions or tutorials on how to print the object).

What kind of persuasion or influence is needed for an act to be labelled as "*active*" inducement remains unsettled. Activities such as advertisement or solicitations and other messages that urge the adoption of the infringing service for unlawful purposes might suffice to this end[1353]. However, each conduct would need to be seen in context. Hence, it is difficult to predict what kind of activities, taken in isolation, may justify an inference of unlawful intent.

To conclude, it seems that, at present, in order to establish indirect liability of 3DP platforms, a three-step process must take place. First, the patentee must provide appropriate notice to the website of the alleged direct infringement occurring on its network. Evidence that users have

[1351] Holbrook; Osborn (2015), 1340.

[1352] Osborn asks what standard will the courts apply to establish a defendant's good faith belief of non-infringement when the accused infringer is legally unsophisticated. For example, an average 18-year-old user, after having disseminated a CAD file, carries out a rapid search and – (subjectively) in good-faith but unreasonably (objectively) – decides that the patent is not infringed; should this user be held liable? Osborn (2016), 21. *See* also: Holbrook; Osborn (2015), questioning whether good faith is a merely subjective inquiry into the accuser's state of the mind or is it composed of an objective element.

[1353] *Grokster*.

downloaded the CAD file would not suffice, whereas at least circumstantial evidence that the patented product has been printed should be given.

Second, upon receiving a plausible compliant from the patent owner, the platform should avoid taking appropriate action to remove the allegedly infringing content, such as refuting to take down the accused CAD file.

Third, the patent owner must provide at least circumstantial evidence of further direct infringement, which must have occurred after the notice was sent.

12. "*Digital Millennium Patent Act*"

A body of literature advocates that the most effective means for tackling digital patent infringement is to introduce a notice and takedown system that mirrors the one already in place for copyright infringement.

The argument goes as follows. Amongst others, Doherty portrays a scenario in the 3DP landscape in which all parties (patent owners, ISPs, DIYers and users) acting in good faith will attempt avoiding the expense and hassle of litigation[1354]. This system, however, is extremely unstable and risks falling apart.

Patentees most likely will avoid targeting individual users who 3D print patented products, given that the costs involved in pursuing infringement proceedings would be too high. By the same token, users will not stop infringing upon the patentees' exclusive rights, given that the cost of infringement is very low. If infringement becomes a common practice, however, patent holders might eventually bring an action in order to create a precedent that establishes clear rules on liability or to obtain an early-stage settlement[1355].

Some commentators maintain that digital-design-file-sharing will generate years of litigation to define the contours of ISPs' liability for indirect patent infringement, especially in the absence of a DMCA-like procedure[1356].

Hence, the best solution to foster technological development and growth in the 3DP industry, while protecting right holders, is the implementation of a DMCA-like system. The notice and takedown system provides an important example of how litigation could be prevented. This procedural framework has already been used by ISPs as a template to process trademark claims and other claims.

[1354] Doherty (2012), 362.

[1355] *Id*. 364.

[1356] Desai; Magliocca (2014). Doherty (2012). The DMCA has established a notice and takedown system, a primary tool for resolving copyright disputes in the United States. Section 512 DMCA sets forth the safe harbour provision that is applicable if ISPs comply with the notice and takedown procedure.

It is also worth noticing that platforms such as Shapeways[1357] and Thingiverse[1358] have already implemented a "notice and takedown" system. For instance, Thingiverse provides for two different systems of infringement notification: one covers the notification of any violation of copyright, in accordance with the DMCA; the other is a separate system for the removal of 3D models that infringe on IPRs other than copyright.

The type of information that must be submitted to the platform, in the form of a written notification, is substantially the same in both cases[1359]. Hence, the system implemented for IPRs other than copyright mirrors that under the DMCA.

In Doherty's opinion, Congress should pass a "Digital Millennium Patent Act", so that "*patentees more easily assert their rights, and protect the nascent "inventive commons*" developing within the 3D printing community[1360].

Doherty advocates the implementation of "a notice and takedown procedure for hosting providers, such as Thingiverse and Shapeways, with a safe harbour provision that applies if these sites did not have actual knowledge of infringement[1361].

The basic structure of this system would mirror that established by the DMCA. Hence, "*a patentee who believes a hosted CAD file embodies his or her patented invention"* should, in the first place, send a notice to the website, which must contain: (1) *"the number of the infringed patent";* (2) *"the claims allegedly infringed"*; and (3) "*a brief, non-legal explanation for the belief that the claims are infringed"* (since "*the language of patent claims is often extremely difficult for non-lawyers to understand"*); (4) "*a standard information packet, provided by the patent-holder with basic information about the nature of patent rights"*[1362].

[1357] https://www.shapeways.com/legal/content_policy. In case a 3D model subject to a takedown request has already been printed, Shapeways retains the right to destroy it, provided it is still in its possession, and cancel the user's order. Shapeways might also require the user to indemnify the platform for its damages.

[1358] https://www.thingiverse.com/legal/ip-policy. With respect to notice and takedown requests directed to 3D models that infringe on copyright, Thingiverse's policy expressly clarifies that, notification of infringement from a copyright owner that does not provide all required information, pursuant to the platform's copyright policy, "*shall not be considered as providing actual knowledge or awareness of facts or circumstances from which infringing or otherwise unauthorized activity is apparent*". Hence, in the absence of actual knowledge of infringement, the site can rely on the safe harbour provision.

[1359] See Doherty (2012), 363, stressing that the language employed in these websites' policies is very ambiguous, since it generically refers to "intellectual property right holders", which seems to suggest that patent holders can also request takedowns.

[1360] *Id.*, 365. Note that in the EU the same outcome may already be achieved under the E-Commerce Directive, which, differently from the DMCA, is "transversal" and potentially covers digital patent infringement.

[1361] *Id.*

[1362] *Id.*, 366.

The accused infringer that wants to challenge the notice could send a "counter notice"[1363]. Hence, websites that adhere to this procedure should be immunized from liability[1364], whereas the parties that misuse the notice or counter notice instruments should be liable for resulting damages (including attorney's fees)[1365].

In the present writer's opinion, the most evident shortcoming of Doherty's proposal relates to the recommendation that the notice must be accompanied by "*a good-faith explanation in plain English of the patent claims"* and the reasons why they are infringed. Arguably, this might result in patentees drafting overly-broad claims in their notices and asserting inexistent infringing activities on the part of users, with a deterrent effect on subsequent DIYers wishing to upload their CAD files onto the same platform.

Ambiguity may also reinforce the conviction on the users' side that their activity is non-infringing. Imagine a DYIer who feels accused of "copying" or "stealing" a patent that is recited using non-technical language: he or she will feel entitled to avoid compliance with such an unclear request and be further motivated to infringe.

Hence, it is at least questionable whether sending takedown requests that are inclusive of a user-friendly explanation of the patent claims would serve the purpose of discouraging infringement or would actually have the opposite effect of incentivizing users to find other channels for distributing their digital designs.

It is here suggested that inaccurate takedown requests have a potential for greater exposure to infringement. If claims go beyond what is actually protected by a patent, and patent infringement is misunderstood, a set of negative consequences might ensue.

Moreover, if patent owners were given the chance to describe with their own words the patent's coverage and the nature of the alleged infringing activity, they would probably use improper and non-technical terms, adding uncertainty to the takedown request and making liability of ISPs unpredictable.

Arguably, patent law experts would not occupy a decisive role in the just described DMCA system. Both right holders and ISPs might find it superfluous to obtain specialized legal counsel and to carry out in-depth and robust investigations, given that generic claims of patent infringement may nonetheless result in CAD files being taken down.

[1363] Under the DMCA rules, if the user submits the counter notice, the ISP forwards it to the right-holder, who has ten days to decide whether to sue the user. If a suit is filed, the content stays down pending the outcome. If no suit is filed, the ISP may restore the content and retain safe harbour protection.

[1364] As under the DMCA rules, websites should not be held liable if: they do not have actual knowledge that the CAD file uploaded on their system is infringing; the infringing activity is not evident from other circumstances; upon obtaining such knowledge or awareness, they act expeditiously to remove or disable access to the infringing CAD file.

[1365] Doherty (2012), 366.

Little information would be sufficient to stop users' activity, thus stifling innovation. Furthermore, a highly specialized field such as patent law might end up being impoverished by the use of debased language[1366].

The success of a takedown request would be dependent on how the takedown request is framed, rather than on its legal merits. Also, evidence suggests that when there is doubt about the substance of the claim, ISPs tend to take down content. In fact, most ISPs act conservatively in order to avoid liability, opting to remove borderline material when they are uncertain of the strength of the underlying claim[1367].

Finally, the number of counter notices sent by the alleged infringers might be extremely low, since the typical DYIer has little to no knowledge of the patent system. Additionally, the imbalance of power in lawsuits between patent owners and users undermines the whole idea of a counter notice procedure[1368]. Users are discouraged to assert their rights, and ISPs will not do much for convincing them. Moreover, ISPs typically remove content without waiting for a potential counter notice.

The same author who advocates implementing a DMCA system for combating digital patent infringement seems to acknowledge the limits thereof. In fact, Doherty notes that, in order to prevent misuse of patent claims, the accused infringer should have the opportunity to prove – using "*the notice as evidence of misuse*" – that "*the owner has engaged in an inequitable behaviour with regard to the patent"*[1369]. It seems rather odd, however, to propose as a solution to a (potential) problem (widespread file-sharing of patented objects) a system that would potentially cause additional problems.

A recent empirical study conducted by Urban, Karaganis and Schofield sheds some light on how, at present, the DMCA system operates in practice[1370]. Overall the general picture that emerges is not bright. One of the most troubling findings in this study is the high number of inaccurate, abusive, low quality and mistaken notices that are sent, coupled with the extremely low number of counter notices[1371].

Moreover, the study touches on the increased use of automated filtering systems and the related issues of accuracy of algorithms and due process[1372]. In recent years, we have assisted

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[1366] Although it is true that a bad faith patentee may incur in a penalty and be liable for resulting damages (including attorney's fees).
[1367] Urban, Karaganis, Schofield (2017), 41.
[1368] *Id.*, 45.
[1369] Doherty (2012), 367.
[1370] Urban; Karaganis; Schofield (2017).
[1371] *Id.*, 73-77.
[1372] *Id.*, 57.

to an increased use of automated systems to detect and remove infringing material, by both right holders and ISPs.

On the one hand, right holders increasingly rely on "crawler" programs that search through the web and identify infringing content[1373]. After identifying infringing material, the system sends a takedown request to the ISP, requesting that it "remove or disable access" to the identified material, pursuant to Section 512.

This, in turn, has led to an exponential increase in the number of notices. Moreover, such notices concentrate thousands of takedown requests into single submissions[1374]. As a result, many ISPs have developed automated systems for removing all material targeted by a takedown request, whether or not the allegedly infringed work qualifies for protection and the defendant's activity is infringing, rather than constituting fair use.

Other ISPs have gone beyond the statutory requirement set forth in Section 512 by developing filtering methods, such as YouTube's Content ID, that prevent content from being uploaded without employing takedown notices at all. Therefore, although most ISPs still practice human review of incoming notices, the rising use of automated systems to detect infringement is undeniable. Automated systems prompt concerns about their accuracy, as they often mistake.

In the copyright realm, takedown requests raise, *inter alia*, the following problematic issues: subject matter categorization; thin copyright protection for follow-on creations; the fair use defence; ownership issues (for instance, a person portrayed in a photograph, rather than the photographer, has sent the notice); targeted material that appears likely to be in the public domain; notices that are sent merely to harass competitors, silence critics, threaten the ISP or damage its relationship with its users[1375]. In each of these cases it is difficult for an Internet service provider to form a judgement.

Arguably, concerns related to subject matter, thin copyright protection, fair use, and freedom of speech will not likewise be raised in the patent realm. By contrast, most takedown requests would require considering the accuracy of the stated claims, the scope of patent protection, the extent of the alleged infringement and public domain concerns.

[1373] *Id.*, 31.
[1374] *Id.*, 32.
[1375] *Id.*, 40.

It takes time for an ISP to evaluate notices that eventually might prove to be "false positives". The threat of statutory damages could motivate ISPs to remove content that is not clearly unlawful[1376].

It appears plain to the present writer that the proposal to extrapolate from the copyright system a set of rules and transpose them into the patent system suffers from some drawbacks. Nonetheless, it is also true that the DMCA rules continue to provide right holders with an "*enforcement alternative that is cheaper and easier to use than lawsuits*"[1377].

As discussed above, a notice and takedown system would enable patent holders to prevent the distribution of third-party CAD files by ISPs, when the sites are not cognizant of the availability of infringing material on their platforms. This would enable patentees to combat mass-scale patent infringement more effectively.

Therefore, the question whether it is advisable to extend the DMCA system to the patent landscape should remain open. In large part, the answer is dependent on whether 3DP practices evolve to a significant extent in the years to come. The driving factor should always be the need to strike a fair balance between fostering innovation and adequately protecting patent owners.

Final Remarks

At the time of writing no case on the intersection between 3DP and patent law has yet reached courts in the EU and the United States. Multiple avenues can be explored in an attempt to enforce patent rights in the 3DP landscape.

It is not beyond doubt that patentee will attempt to manipulate existing direct infringement doctrines, by stretching the boundaries of the exclusive rights conferred by a patent. While it may be difficult to identify the individual user who has actually printed the object, detecting who is the creator of the CAD file could be an alternative route for the patent owner[1378]. It is questionable whether the creators and distributors of CAD files are "making", "selling" or "using" the patented products under existing direct infringement doctrines.

Literature suggests that a CAD file is "*a powerful tool that, in a world of ubiquitous 3D printers, renders ... (its) possessor ... as satisfied as if he possessed the physical object itself*"[1379]. The interest in possessing the CAD file is not related to the file as such, but rather

[1376] *Id.*, 39.
[1377] *Id.*, 3.
[1378] Ebrahim (2016), 50.
[1379] Holbrook; Osborn (2015), 1331.

to the ultimate product that can be printed. An individual wants a CAD file in order to print the object embedded therein, not to simply own and use the file.

Thus, it is possible to consider the file on a par with an individualized physical item that causes harm to the right owner, if shared without the latter's authorization. To support this argument, one can think of other commodities that are now sold or offered for sale in digital form, such as e-books and MP3 files, which can be treated identically to the corresponding physical goods[1380].

These considerations bring us back to a most fundamental question: how do we define the existing relationship between the intangible data embedded in the CAD file and the resulting tangible product? In the future courts might be faced with the critical issue of whether a physical product and a CAD file shall be regarded as interchangeable and, therefore, the making available of a CAD file shall be deemed as a form of commercial exploitation of the patented invention, which could result in lost sales or price erosion.

When dealing with U.S. patent law, we have discussed the opinion of Holbrook and Osborn, who consider the infringing sale and offer to sell the patented invention as "*an appropriation of the economic value of the invention*", which takes place irrespective of whether a physical embodiment comes into existence or not[1381]. The fact that the patentee's economic interest can be seriously affected by sharing CAD files alone weighs in favour of an expansion of the doctrines on direct patent infringement.

Nonetheless, it is at least questionable whether an analogy can be drawn between a CAD file and the corresponding physical product for the purposes of patent infringement. Is it really the same to have a file from which an object can be produced or the final object itself?

A source of concern is that, even if CAD files may be transformed into physical products at some point, this is not always the case. CAD files can also be used for different purposes than manufacturing (especially CAD models). A CAD file can be used as a digital file per se, and remain in its digital form throughout its entire life, or can be shared to enable viewing, modifying, building upon, and customizing the digital version of the object.

Moreover, even when the CAD file (such as the STL file) is acquired with the purpose of printing it, the purchaser will incur substantial manufacture costs and technical difficulties. Following this line of reasoning, an argument can be raised that the purpose of sharing a digital file is not only to reap the economic value of the final printed object.

[1380] Ebrahim (2016), § 60.
[1381] Holbrook; Osborn (2016), 1367.

It is also difficult to uphold the view that a CAD file should be subject to the same treatment as the tangible object embedded therein, in view of the fact that we are currently surrounded by digital media that are treated identically to their physical equivalents (e-books v books, MP3 files v songs).

Unlike other digital goods, a printable CAD file is not valuable as such, but only when the item is printed. On the contrary, digital media such as e-books and MP3 files are valuable for the sole fact that users can access their content. It is true that an e-book can be sold in digital form and then be converted again into physical form, but this does not affect the value of its content.

The differences between a digital file and its tangible incarnation are many. According to Ebrahim, the following criteria shall guide the comparison between what is tangible and what is intangible in patent law: the "*time to transition*"; "*the complexity in transitioning"*; and "*the degree in transformation from intangible to tangible"*[1382].

Hence, following this test, "*if the transition time, complexity and degree of transformation are substantial, then the intangible electronic representation and the tangible electronic representation should not be treated alike"*[1383].

In the opinion of the present writer this approach does not seem to be appropriate and advisable. In fact, a test that focuses on the amount of time that is needed, and the complexity in converting a file into the ultimate product, will much depend on the type of digital file at stake and the printer to be used.

As discussed, certain file formats contain additional and more detailed information than others, thus making the conversion from digital to physical easier (STL and GCODE). Likewise, if a 3D printer is more sophisticated than another, the manufacturing process is faster. Nonetheless, patent protection should not be dependent on this sort of technical and ever-changing considerations.

Moreover, as Ebrahim notes, such a test might result in an arbitrary discrimination between CAD files for products whose structure and shape can be more easily reproduced – i.e. in case the claimed invention is a "*blocked shaped, planar and smooth surface object*" – and CAD files for products having a more complex shape that cannot be easily duplicated – i.e. in case the claimed invention has a curved geometrical shape with multiple textured surfaces[1384].

[1382] Ebrahim (2016), 51.
[1383] *Id.*
[1384] *Id.*

Hence, it is here argued that the decision to treat CAD files in the same way as tangible, patented products, in a potential direct patent infringement lawsuit, should not turn on how complex the transition from a file to a product is. It is not just a matter of degree. Such a decision, instead, needs further policy support, for the serious implications it has.

For the reasons explained above, patent owners might prefer to bring a secondary infringement action against the person who has facilitated the infringing acts, instead of suing the direct infringer.

Literature seems divided between some authors who suggest that the theories of indirect infringement offer the most efficient remedies within the 3DP industry, and some authors who hold the opposite.

The manufacturers of 3DP-related devices and the suppliers of 3DP materials will hardly be found liable as indirect infringers in light of the "staple article of commerce" doctrine. Moreover, following *Microsoft* and subsequent case law, a CAD file does not constitute a "component" of a patented product for the purposes of contributory infringement, unless it is encoded on a physical medium.

Creators and distributors of CAD files will most likely be the target of induced infringement claims. In order to pursue such claims, patent owners will have to prove actual knowledge or, at least, wilful blindness on the part of the inducer that the file incorporates a patented product.

As discussed, proof of the required knowledge poses a significant limitation to the viability of secondary liability doctrines. Marking a product with the issued patent number(s) or publishing general press releases might not suffice to impute the required state of knowledge.

It has also been argued that notice letters, while triggering the required knowledge, may nonetheless lead the inducer to submit competent opinions of counsel showing a good-faith belief that the patent is not infringed. That being the case, patent owners could only prevent future infringement, but not recover pre-suit damages.

What types of conducts are liable to "actively" induce another under 35 U.S.C. § 271(b) is not altogether clear. It seems that, for there to be inducement, some affirmative steps to bring about the desired result must be taken[1385].

As scholarship notes, on the one hand, this hurdle serves to "*ensnare the most egregious and deliberate infringing activity*", while on the other it immunizes from liability the passive providers that merely offer CAD files for download on their platforms[1386].

[1385] *Global Tech.*

[1386] Brean (2013), 804.

Some commentators suggest that it might take considerable litigation to clarify the position of similar intermediaries in the 3DP context, especially in the absence of a procedure similar to the DMCA for patents[1387]. Hence, the smae scholars advocate that DMCA takedown notices be introduced for patent infringement.

3DP websites already have in place a notice and takedown policy for CAD files that infringe on copyright works. Extending the rules of the DMCA to patents is the simplest solution, as it would be pointless to have two different sets of rules.

Doherty's proposal to implement the DMCA procedure within the patent system invites criticism, since the patentees are required to send explanations of the patent claims in plain English, along with the takedown request.

Finally, whilst indirect infringement theories could be a more efficient means of enforcing patent rights as compared to direct infringement, they attract the following main criticisms. Even if infringing CAD files are taken down by hosting websites, most likely other websites will be distributing the same infringing files[1388].

We might also experience an additional collateral effect: aggressive enforcement strategies might raise a general feeling of resentment among DIYers, thereby encouraging the creation and distribution of infringing CAD files.

In fact, from the DYIers and users' perspectives, the likely response to their content being taken down is finding new distribution channels for disseminating the same content, perhaps considering it unfair that their independent creation is typed as infringing. As a result of more widespread violations, tracking infringing activities and taking down offending material might become even more cumbersome.

Following this line of reasoning, it is questionable whether filing a lawsuit against indirect infringers is the best route to pursue in the 3DP landscape.

[1387] Desai; Magliocca (2014), 1717.
[1388] Macik (2015), 157.

Chapter VI

EU Trademark Law and Three-Dimensional Printing: Opportunities and Challenges

Introduction

This chapter explores whether the scope of trademark protection, as conceived in the current European regulatory framework, applies adequately to 3DP, and in particular to the reality of digitized goods.

The first part sets out the legal basis of trademark protection, in order to answer a novel question that 3DP poses: whether and to what extent a trademark that is used in relation to a CAD file can gain protection and, relatedly, whether CAD files shall be regarded as goods or services under the Nice classification.

The conditions under which 3D-printed products may warrant protection as unconventional trademarks are also scrutinized.

Thereafter, the discussion examines whether customization of products on the part of consumers may have an impact on the scope of trademark protection, leading to the abandonment of the mark.

The second part of this chapter inquiries into potential liability issues that may arise if an earlier trademark is applied to a CAD file and/or the CAD model embedded therein.

To this end, the discussion addresses the following main questions: 1) whether the use of an earlier trademark in relation to CAD files constitutes "use in relation to goods" for infringement purposes; 2) under what circumstances the "use in the course of trade" requirement is satisfied, in the event that a CAD file, embedding another person's mark, is distributed online; 3) which functions of a trademark could be adversely affected by the distribution of a CAD file alone; 4) who should be the target of liability claims.

1. The Legal Framework for The Protection of Trademarks

At an international level, the legal sources of trademark protection include the TRIPs Agreement, the Paris Convention, the Trademark Law Treaty and the Madrid Agreement and its related Protocol, alongside with some sector-specific conventions, such as the Nice and Vienna Agreements, concerning the classification of goods and services.

At the EU level, trademark protection is based on the Trade Mark Directive 2015/2436/EC ("TMD"), repealing Directive 2008/95/EC, and the Trade Mark Regulation 2015/2424/EU ("TMR"), amending Regulation 207/2009/EC.

The TMD does not endeavour to achieve full-scale harmonization of national trademark laws, but to approximate those substantive provisions that most directly affect the functioning of the internal market[1389].

The TMR expressly regulates Community trademarks, which are "*unitary in character and valid throughout the Union*", and potentially coexist with national trademarks[1390].

This chapter focuses on both the TMD and the TMR, highlighting, where necessary, the differences between the two. Relevant case law from the CJEU will also be taken as a reference point, given the crucial role that it plays in guiding the interpretation of these legislative instruments.

2. Requirements for Trademark Protection in Europe

2.1. Signs That Can Be Registered as a Trademark

It must be noted at the outset that a trademark can be registered or acquire protection through use. EU trademarks are protectable only if registered. Unregistered trademarks exist in the EU only where the national laws of the Member States so provide.

While some Member States do not provide protection for unregistered trademarks, some others require additional conditions to gain protection, such as "use" of the mark and/or a certain degree of market recognition or goodwill[1391].

Pursuant to Article 8(4) TMR, national unregistered trademarks can be relied upon to oppose or invalidate the registration of a EU trademark, provided that the conditions set forth therein are met. Moreover, all EU Member States protect well-known trademarks regardless of registration, pursuant to Article 6bis Paris Convention and Article 16 TRIPS.

Based on the wording of the TMD, almost any kind of sign can be registered, provided that it is "*capable of distinguishing goods and services as originating from one undertaking"* and of being represented on the register in a manner which is "*clear, precise, self-contained, easily accessible, intelligible, durable and objective"*[1392].

All trademarks are excluded from protection if they do not comply with the definition of "trademark" set forth in Article 3(1) TMD and Article 1(1) TMR, and if they are devoid of

[1389] Recital 2 TMD. For instance, the TMD establishes uniform conditions that trademarks must satisfy in order to be registered at the national IP offices, whereas Member States are given significant leeway with respect to procedural norms and the protection of trademarks acquired through use.
[1390] Recital 3 TMD.
[1391] On this *see:* von Bomhard; Geier (2017).
[1392] Article 3 and Recital 13 TMD. Note that the previous requirement of "graphic representation" has been abandoned. A CAD file may constitute a suitable means for representing a 3D trademark on the register, considering the level of precision that can be attained with CAD-based images and the possibility to rotate such image when it appears on a computer screen.

any distinctive character, descriptive or generic, unless they have acquired a "secondary meaning" (i.e. distinctiveness trough use). Furthermore, protection is not available for trademarks that are deceptive or contrary to public policy or morality, as well as for marks that conflict with a geographical indication or designation of origin[1393].

The other absolute grounds for refusal that apply with respect to 3D shapes will be detailed in the next section.

The relative grounds for refusal or invalidity concern the conflict with earlier trademark rights (registered trademarks, trademarks acquired through use, trade names, trade dress, etc.). As these grounds mirror the conditions set forth in Article 10 TMD to establish trademark infringement, they will be considered below in that context.

2.2. The Protection of (3D-printed) Shapes

Historically, the shape of a product and packaging were not deemed eligible for registration, on the ground that the purpose of trademark law is to protect signs that act as indicators of trade origin, not the appearance of the goods themselves[1394].

The definition of a "trademark" has been recently expanded, so as to encompass unconventional marks such as colours, sounds and shapes[1395]. Accordingly, a trademark could be protected not only in case a product bears a distinctive word, phrase or symbol, but also if it has a shape, packaging or colour combination that are not devoid of any distinctive character.

The recent legislative reform of EU trademark law is particularly relevant in the context of 3DP, a technology that facilitates the creation of remarkable shapes or aspects of packaging, which may be sufficiently distinctive to enjoy trademark protection[1396].

In theory, a shape mark can be inherently distinctive, meaning that is has a distinctive character *ab initio*[1397]. In most instances, however, a three-dimensional mark will only acquire distinctiveness through use, considering, inter alia, "*the market share held by the mark, how intensive, geographically widespread and long-standing use of the mark has been; the amount invested by the undertaking in promoting the mark*", etc.[1398]

[1393] Not all absolute grounds for refusal have been recalled in the present section. To have a comprehensive overview of all absolute bars to protection see Article 4 TMD and Article 7 TMR.

[1394] *See* Derclaye; Leistner (2011), p. 62.

[1395] Article 3 TMD.

[1396] Bradshaw; Bowyer; Haufe (2010), 28, Osborn (2017), 880, Desai; Magliocca (2014), 1709.

[1397] For example, the shape of a bottle of water was considered to be inherently distinctive by the General Court in Case T-305/02, *Nestlé Waters France v OHIM*, ECLI:EU:T:2003:328.

[1398] Case C-24/05 P, *August Storck KG v OHIM*, 22 June 2006, ECLI:EU:C:2006:422, [75].

In the *Henkel*[1399] decision, the CJEU has also clarified that, while (in theory) the criteria to establish distinctiveness of 3D shapes of products in no way differ from those applicable to other signs[1400], the perception of the public might not be the same, since consumers do not usually make predictions about the origin of goods by simply looking at their shape or packaging, absent any graphic or word element[1401].

Hence, the CJEU has repeatedly held that, in order to show distinctiveness, a 3D mark must "*significantly depart from the norm or customs of the sector*"[1402]. It follows that the bar of distinctiveness with respect to 3D marks is quite high[1403].

Moreover, a 3D shape, even if sufficiently distinctive, has to overcome some restrictions that are in place for its registration and/or validity[1404]. In particular, both the TMD and the TMR rule out the registration and validity of signs that consist exclusively of a "shape" (or "another characteristic"[1405]) that: "*results from the nature of the goods themselves*"; "*is necessary to obtain a technical result*"; and "*gives substantial value to the goods*"[1406].

It remains to be seen whether the number of 3D marks will rise, as a consequence of the increased use of digital modelling techniques and 3DP, which, in turn, can be relied on to make significant alterations to what is the natural and conventional form of a product.

Significantly, however, it may also be that an unusual shape, which departs from the shapes traditionally used for the same product category, is inherently distinctive, but have some extraordinary features or eclectic style that give substantial value to the good, thereby constituting a bar to trademark protection[1407].

As a final remark, in case a product's shape is protected as such, being sufficiently distinctive, it will nonetheless have a very narrow scope of protection, against third-party use of an identical or very similar sign in relation to identical or very similar goods and services.

[1399] Case C-218/01 *Henkel KgAA v OHIM* [2004] E.C.R. I-1715; [2005] E.T.M.R. 45.

[1400] Distinctiveness is assessed by reference to the goods and/or services bearing the trademark, and the perception of the average consumer, who is reasonably well-informed, observant and circumspect.

[1401] *Henkel*, [52].

[1402] *Henkel*, [49].

[1403] For instance, the General Court considered the simpler version of the Coca-Cola bottle not inherently distinctive and the evidence submitted to prove acquired distinctiveness trough use (i.e. user surveys from ten Member States) not sufficient. Case T-411/14, *The Coca-Cola Company v OHIM*, ECLI:EU:T:2016:94.

[1404] The absolute grounds for refusal or invalidity, set forth in Article 4(1)(e) TMD, preclude marks from acquiring distinctiveness through use.

[1405] Note that the term "another characteristic" was added to the TMR on March 2016. Most likely it refers to signs other than shapes, such as a two-dimensional patterns or colours, which would be typically protectable by other IPRs (i.e. design or copyright) or reserved to the public domain.

[1406] *See* the CJEU's judgement in *August Storck*, [75]. The CJEU has clarified that these absolute bars to protection must always be interpreted in the light of the underlying public interest. More precisely, certain shapes must remain in the public domain or be subject to time-limited IPRs, such as designs and patents.

[1407] On this *see* Gielen (2014).

In fact, the low degree of distinctiveness that characterizes unconventional marks exerts an impact on their scope of protection. Moreover, because of their special characteristics, unconventional trademarks do not enjoy protection against dilution under Article 10(2)(c) TMD.

2.3. CAD Files as Means for Representing Signs on The Register

When looking at the intersection between 3DP and trademark law, one should first consider that, in theory, a sign, such as a word or figurative sign, can be represented graphically in digital form, and then applied to a digital model contained in a CAD file. The same word or image may also be used in the CAD file's heading or in the description of the file (as distinguished from the CAD model contained in the file), which may be available on online platforms to be downloaded.

It is also possible to conceive a sign that corresponds to the product's shape, which is represented as a CAD model. Moreover, in theory, the colour or colour combination that is used in relation to a product represented digitally as a CAD model may likewise be eligible for trademark protection.

While all these signs potentially fall within the definition of a "trademark" under Article 3 TMD, being a word, an image, a shape or a colour/colour combination capable of distinguishing trade origin, they must be "capable of being represented" on the register, in order to be eligible for registration.

As discussed, one of the most important changes introduced by the recent EU trademark law's reform is the replacement of the requirement that a mark must be "capable of being represented graphically" with the requirement that a mark must be "*capable of being represented on the register in any appropriate form, using generally available technology*"[1408].

Interestingly, the EUIPO accepts, as a suitable means for representing shape trademarks, file formats that are used in 3DP, such as STL and OBJ, which detail with extreme clarity the sign for which protection is sought[1409]. It remains to be seen whether national offices will also align to the EUIPO's practice, by accepting CAD files as representations of 3D marks[1410].

[1408] *See* Recital 13 TMD and Recital 9 TMR.

[1409] Thanks to a 3D-model viewer, the image of the 3D trademark can be easily rotated, zoomed in and zoomed out.

[1410] As pointed out by the European Trade Mark and Design Network in the *"Common Communication on the representation of new types of trade marks"*, published in January 2018, hopefully national IPOs will soon adopt uniform standards, in relation to the acceptable file formats. The document is available at:

At present JPEG is the most commonly used file format for other marks, such as marks that consist of words, letters, numbers, figurative elements and/or colours. For these types of marks there is no reason to submit a CAD file, which mainly serves to represent a sign in three-dimensions.

Arguably, the option to file an application based on a CAD file increases the risk of counterfeiting, to the extent that hackers may find a way to download such files from the databases of the competent European/national office(s) and then share them online. Hence, other less vulnerable forms of representation may be preferable for trademark applications.

3. Registering a Mark for CAD Files

A relevant issue that 3DP poses is whether a trademark could be registered, in order to be used in relation to CAD files *qua* files, the question thus being whether CAD files qualify as goods or services under the Nice classification.

In the opinion of the present writer, CAD files may be assimilated to other "downloadable files" listed as goods in class 9 of the Nice Classification. If not, another possibility would be to amend Nice in order to expressly include "CAD files" as a separate class of goods, and thus enable the registration of trademarks for such digital files[1411].

It must also be observed that the intangible *content* of the file – i.e. the digital model or design drawing – is distinct from the CAD file *qua* file, which serves as the *container*.

If a trademark is registered in relation to CAD files – assuming that such a thing is possible at all – a question arises as to whether use of the mark within such file (i.e. in relation to the digital model or design drawing) performs the function to indicate the origin of the file as such.

In fact, a sign, in order to be registered and "genuinely" used within the meaning of Article 15 TMR, must accomplish the essential function of indicating origin of the goods and services for which it is registered.

Questionably, a sign is not used as an indicator of the file's provenance, if it appears on the CAD model (i.e. in the file's content), unless the same sign is also used in the file's heading

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https://www.gov.uk/government/publications/common-communication-on-representation-of-new-types-of-trade-marks.

[1411] An alternative route delineated below is to rule out (*ab initio*) protection of marks in relation to CAD files, but consider the latter as a means of manifesting a physical product. That being the case, a trademark owner could prevent – under the double identity rule – third-party use of his or her mark in connection with a CAD file, whenever the product contained in such file falls within the same product category of the earlier trademark.

or description[1412]. This issue will be further developed below, with respect to trademark infringement.

4. Product Customization and Trademark Protection

3PD raises both opportunities and concerns with respect to product customization. On the one hand, customization may constitute a remarkable opportunity for companies, which may adopt new business models premised on the collaboration with consumers. By the same token, customization may bring considerable benefits to consumers, who can express their preferences and personal taste when purchasing a product.

Yet, once a trademark is registered, there should be a genuine use of such mark on the part of its proprietor, in order to maintain a valid registration and avoid an application for revocation of the mark; if consumers customize goods, it is questionable whether the trademark will continue to operate as an indicator of a single source of origin, thereby satisfying the condition that the mark is genuinely used.

In other words, if consumers can intervene in the design/manufacturing processes and provide their input in the selection of certain features that the final printout shall have, a sign may cease to function as a trademark[1413].

Likewise, the possibility for consumers to customize and 3D-print trademarked products casts doubt on whether trademark owners exercise sufficient quality control over the licensees.

In the U.S., a trademark licensor is deemed to have granted a "naked" or "bare" licence – which may result in the abandonment and then cancellation of the trademark – whenever the quality of the licensees' products is not monitored[1414].

Determining, in the abstract, what kind of inspection or control over the licensees is required, in order to ensure that the mark will not become deceptive, is not an easy task.

It is advisable, however, to include in the licence agreement between the trademark proprietor and the licensee, who is authorized to perform some form of customization, specific clauses dealing with quality control. For instance, a clause may specify that all acts of customization should meet a certain standard, be consistent with the licensor's practice and in accordance

[1412] For example, the CAD model of a shoe may bear a distinctive sign or have an inherently distinctive shape, but such signs do not serve to designate the origin of the file in which the model is contained.

[1413] This would not be the case, however, if the trademark were registered for customizable goods. For example, LEGO is a trademark used in connection with building blocks that users could assemble in whatever forms the components permit. Alternatively, one may think of a brand for modular furniture that allows the consumer to make the ultimate decisions about how to assemble the modules.

[1414] See, *inter alia*, *Barcamerica International USA Trust v Tyfield Importers Inc*, 289 F.3d 589 (9th Cir 2002).

with all specifications and procedures communicated in writing by the licensor from time to time.
Yet, in practice, the licensor may find it extremely difficult to police end-users. Hence, it seems preferable to require quality controls over the distributor of CAD files for customizable products, instead of the end-user, if that person is a licensee rather than the trademark owner itself.
In Europe, instead, as clarified by the CJEU in *Verein Bremer Baumwollbörse*[1415], the fact that the trademark owner fails to carry out quality controls on the licensees does not lead, as such, to a declaration of invalidity of the mark for deceptiveness under Article 52(1)(a) of the former Regulation, insofar as what counts is that the mark was not deceptive *per se* at the filing date, rather than on the basis of its subsequent use[1416].

5. The Transfer of CAD Files in the Era of Three-Dimensional Printing: Trademark Infringement Under the Current European Framework

This part explores what sorts of activities, undertaken in relation to CAD files alone, might constitute trademark infringement.
The conditions to establish infringement, set forth in Article 10 TMD and Article 9 TMR, are open to possible rival interpretations in the 3DP context[1417]. Hence, the following discussion aims to clarify whether and to what extent using a sign in relation to a CAD file corresponds to the use of a sign "in the course of trade" and "in relation to goods" that are "similar or identical" to the goods for which the earlier mark is registered.
The analysis goes on to propose some ideas on the application of Article 11 TMD to a CAD file alone, and on potential acts of infringement caused by customization.
The principle of exhaustion is then touched upon. Finally, the inquiry concludes with some considerations on liability of 3DP online platforms.

5.1. Reinterpreting Article 10 TMD and Article 9 TMR in Light of Three-Dimensional Printing

[1415] Case C-689/15, *W. F. Gözze Frottierweberei GmbH and Wolfgang Gözze v Verein Bremer Baumwollbörse,* ECLI:EU:C:2017:434.
[1416] Another provision, however, which was not referred to in the case at hand, may come to the aid of licensees, namely Article 58 (1)(c) TMR, mirroring Article 51(1)(c) of the former Regulation, which expressly deals with the revocation of a mark that, as a result of use made by the proprietor or with his consent, has become deceptive.
[1417] For the sake of simplicity, reference is made to Article 10 TMD only, since this provision mirrors Article 9 TMR.

When looking at Article 10(2) TMD, it appears that the proprietor of a trademark is entitled to prohibit any third party from using in the course of trade, without the proprietor's consent, a sign that is identical or similar to the trademark, in relation to goods or services which are identical or similar to those for which the trademark is registered.

The protection conferred by Article 10(2)(a) TMD affords an "absolute" protection in case of identity of signs/goods, which is more extensive than that provided by Article 10(2)(b) TMD. The latter requires evidence of a "likelihood of confusion" on the part of the average public, which includes a likelihood of association.

Article 10(2)(c) TMD, instead, offers an enhanced protection for trademarks that have a reputation in a Member State, against the use of a sign that, without due cause, takes unfair advantage of, or is detrimental to, the distinctive character or the repute of the trademark.

Therefore, in order to have an infringement under Article 10 TMD, there should be a third-party use of a sign that is identical or similar to an earlier trademark: (a) in the course of trade; (b) in relation to goods or services; (c) which are identical or similar to the goods for which the trademark is registered. The following part of this paper analyses each of these requirements in turn.

5.2. Using a CAD File in The Course of Trade

In *Arsenal*, the CJEU has clarified that the "use of a sign in the course of trade" could take place only in the context of a commercial activity, with a view to economic advantage and not as a private matter[1418].

Furthermore, in the event that trademarked goods are sold, following the CJEU's finding in *L'Oréal*[1419], the seller will be acting "in the course of trade" only where the sales made go beyond the realms of private activity, owing to their volume, frequency, or other characteristics.

It must also be noted that "use in the course of trade" does not correspond to "use for profit". For example, activities of not-for-profit organizations, such as a charitable association, may well constitute use in the course of trade[1420].

This argument seems to be reinforced by the fact that, with respect to the separate requirement of "genuine" use, the CJEU has clarified that "*the fact that goods and services may be offered*

[1418] Case C-206/01 *Arsenal Football Club plc. v Reed* [2002] ECR I-10273, [40].

[1419] Case C-324/09 *L'Oréal SA and Others v eBay International AG and Others* [2011] ECR I-6011, [55].

[1420] Case C-442/07, *Verein Radetzky-Orden v Bundesvereinigung Kameradschaft 'Feldmarschall Radetzky'* [2008] ECR I-9223, [17].

free of charge does not prevent genuine use from being shown"[1421], if the intention behind is that of creating or maintaining an outlet for those goods or services in the EU and, therefore, of competing with other undertakings[1422].

Thus, "use in the course of trade" is incompatible only with those activities that are carried out in the private sphere, with no direct or indirect economic advantage. It follows that trademark infringement is not actionable against individual users, who merely print trademarked goods at home, for personal use.

Yet, for the first time, 3DP raises the question whether "in the course of trade" requires a different understanding when the production of goods devolves to consumers. If ordinary people are in charge of the production phase, the line between what is private and what is commercial may suddenly blur: activities carried out in the private realm may gain new commercial significance.

One may argue that consumers, by 3D printing products, save the price of purchasing the manufactured good, thereby attaining an indirect economic advantage.

Similar considerations apply with respect to CAD files embedding a third party's trademark. CAD files of trademarked products can be sold in exchange for money. For example, an eBay seller, calling itself "just3dprint", downloaded from *Thingiverse* thousands of CAD files, made available by other users under Creative Commons licences, and listed them for sale on eBay[1423].

If a sign similar or identical to an earlier trademark were embedded in such files, it would arguably be used in the course of trade[1424].

Distributors of CAD files, however, often license their files for free, rather than selling them, under Creative Commons licences (CC) or General Public Licences (GPL). These licences employed in digital-design-file-sharing may also include a "Non Commercial Use" clause, which restricts the possibility for the licensee to use the CAD file for commercial purposes[1425].

[1421] Judgement of the General Court, in Case T-289/09, *Omnicare, Inc. v OHIM*, ECLI:EU:T:2011:452, [67]-[68].

[1422] *Id.* See also: the EUIPO Guidelines for Examination of European Union Trade Marks (01/10/2017), Part C, Opposition, Section 6, Proof of Use, 2.3.2.

[1423] Grunewald (20 February 2016) available at: http://3dprint.com/120727/ebay-licensing-3d-models/.

[1424] Noteworthy, the list of acts that may be prohibited under Article 10(3) TMD is non-exhaustive. New ways of using a sign that are made possible by digital technologies, and potentially include the distribution of CAD files, may fall under the scope of this provision.

[1425] Note that usually the licence terms do not further define "commercial purposes", thus leaving a certain degree of ambiguity.

The question should be answered whether, by structuring agreements as CC and GPL, distributors of CAD files may avoid the application of Article 10 TMD, since their trademarks would not be used in the course of trade.

In light of the considerations made so far, it is possible to contend that the sharing of CAD files may be carried out in pursuit of (indirect) economic advantage, regardless of whether it is free of charge. Arguably, distributors of CAD files derive economic gain from using a third-party trademark, by attracting more viewers and drawing consumers to their digital designs.

However, it clearly makes the difference if the CAD file is distributed through an online marketplace, where it can be downloaded by multiple users, or made available to just few users for personal use only.

5.3. Use in Relation to Goods or Services: The Unclear Nature of CAD Files

Both in the *Arsenal* case and in *Adam Opel AG v Autec*[1426], the CJEU concluded that the requirement to use a sign "in respect of goods and services" is satisfied when one of the acts listed in Article 10(3) TMD is performed.

The different conducts listed in Article 10(3) TMD constitute different forms of use of the mark in relation to goods[1427]. This, in turn, means that this requirement may be satisfied even where the sign is not affixed directly to the products or their packaging.

For example, pursuant to Article 10(3) TMD, a sign can be used in the course of advertising, without being applied to the goods themselves (e.g. on business papers, brochures, etc.)[1428]. Likewise, the use of a sign on the Internet pages, where the goods are offered, is generally considered sufficient, even if the mark does not appear on the packaging or the goods themselves[1429].

Following the CJEU's ruling in *Céline*[1430], if the sign is not affixed to the goods provided by the third party, the condition of "use in relation to goods" will be met whenever a "link" could be established between the sign and the goods in question[1431].

From the foregoing it follows that a sign affixed to a third party's 3D-printed product is certainly used in respect of goods. A certain degree of uncertainty surrounds, instead, the use

[1426] Case C-48/05 *Adam Opel AG v Autec AG* [2007] ECR I-1017.
[1427] *Arsenal*, [41].
[1428] *See* Article 10(3)(e) TMD.
[1429] Article 10(3) TMD provides a non-exclusive list of activities that the holder may prohibit under Article 10(2)(a), (b) and (c) TMD.
[1430] Case C-17/06, *Céline SARL v Céline SA* [2007] ECR I-7041, [23].
[1431] The goods under consideration are those of the defendant, rather than those of the trademark owner.

of a sign in relation to CAD files alone, which is not expressly regulated by Article 10(3) TMD.

As discussed, the exchange or sale of CAD files is at the core of new business models that have emerged in recent years, including: intermediaries that offer printing services, online marketplaces, and CAD files' repositories. Some of these business models allow designers to share their creative works for free, whereas others do so in exchange for money[1432].

A trademark can be used in the CAD file's heading and/or be affixed to the digital model embedded in the CAD file, thereby appearing also on the (tangible) 3D-printed item at a second stage.

In order to answer the question of whether the use of an earlier trademark by the creator/distributor of a CAD file constitutes use in relation to a "good" for infringement purposes, one must first figure out what is the infringing good under scrutiny: the digital file *qua* file, the digital model of an object or the physical product that will be realized when the CAD file is sent to a printer?

Following a first line of reasoning, in principle, a CAD file *qua* file can be regarded as a tangible (and allegedly infringing) "good" bearing a registered trademark[1433]. Accordingly, the good in relation to which the mark is used is the digital file itself (i.e. the printable software), whereas the final 3D-printed product must not be the point of reference, insofar as many steps must be taken before the digital file is converted into a physical item.

Hence, whenever CAD files containing trademarked goods are distributed online, any claim of trademark infringement shall be directed towards the digital file as such.

Considering that the good in question is the CAD file *qua* file, under certain circumstances, the use of a sign in the file's heading and/or accompanying description may well count as use of a sign in relation to a good for infringement purposes[1434].

In such cases, an argument can be put forward that the sign is used to identify the goods offered by the alleged infringer (the CAD files), rather than as a reference to the trademark owner's goods. If the sign is similar or identical to an earlier trademark, it may mislead consumers as to the file's source, suggesting that the latter originates from the trademark's proprietor or an economically linked undertaking.

A separate question would then be whether use of a trademark within the file (i.e. onto the digital model) counts as use in relation to a good. It is debatable whether a mark that is

[1432] Ebrahim (2016).
[1433] Alternatively, a CAD file can be regarded as a "service".
[1434] Infringement may in principle be established in a similar scenario: a CAD file is named "CAD file for a Gucci bag" and is accompanied with the following description: "this CAD file enables 3D printing a Gucci bag".

applied to a digital model, in order to make the latter more verisimilar, signifies the origin of the file itself, rather than the origin of the intangible content of the file.

From a U.S. perspective, Osborn clarifies that whenever a trademark is contained in the file, and applied to the digital model, it does not have a bearing to establish the file's source. Even if the mark appearing on the CAD model may convey intellectual origin (i.e. suggest who is the author of the file's content), U.S. trademark law is concerned only with the origin of tangible goods (i.e. the file), as opposed to authorship of intangible content[1435].

In other terms, the use of a sign merely to indicate who is the author of the digital model should not be banned under U.S. trademark law[1436].

Following a second line of reasoning, a CAD file shall not be regarded as a separate good, but as a form of manifesting what will then be the final 3D-printed product. From that premise it follows that a third party, who distributes a CAD file containing a trademarked product, is using the trademark in relation to that product; it is not possible to claim, instead, use in relation to software.

Therefore, if the good that the CAD file enables to print is a cup, the trademark will be used in connection with cups, although manifested in digital form.

As noted in the next section, a fundamental issue that remains partly unsettled is whether the "use in relation to goods" requirement, within the meaning of Article 10 TMD, must be understood as use for the purpose of distinguishing the origin of the goods and services in question ("use as a sign" or "trademark use"), which is aimed at preserving the essential function of the trademark, i.e. that of indicating trade origin.

5.4. Use as a Trademark: Still a Requirement for Infringement?

A controversial issue is whether trademark owners could prevent only third-party uses of a sign made for the purposes of distinguishing goods and services.

The structure of Article 10 TMD seems to suggest so: Article 10(6) leaves to Member States' discretion the introduction of a form of protection against "*use of a sign other than use for the purposes of distinguishing goods and services*" (i.e. use of a sign that "*takes unfair advantage or is detrimental to the distinctive character or repute of the mark*"), thereby implying that paragraphs 1, 2, 3 and 5 relate to the protection against the use of a sign as a trademark.

[1435] *Dastar Corp. v Twentieth Century Fox Film Corp*., 539 U.S. 23 (2003).

[1436] Yet, although indication of authorship falls outside the scope of U.S. trademark law, even after *Dastar*, Section 43(a)(1)(B) may still apply, i.e. a person uses a sign, in commercial advertising or promotion, misrepresenting the nature, characteristics, qualities, or geographical origin of his or her or another person's goods.

The CJEU's conflicting case law has only added to the general confusion stemming from the wording of Article 10 TMD. In the first place, the Court seems to have expanded the "trademark use" requirement to include referential, comparative and decorative uses.

In *Céline* [1437] and *BMW* [1438] the Court postulated that the alleged infringer must use a trademark in order to distinguish his or her own goods and services, rather than those of the trademark proprietor. Following this line of reasoning, the so-called "referential use" – i.e. use made in order to refer to the goods and services as originating from the proprietor of the trademark – shall not amount to infringement.

The opposite view was however taken in *02 v Hutchison*[1439], a case dealing with comparative advertising: the referential use by an advertiser of a competitor's sign, for the purposes of identifying the goods and services offered by the same competitor, shall be regarded as "*use for the advertiser's own goods and services*".

The CJEU's decisions in keyword advertising cases suggest that the use of a sign merely to *promote* the marketing of a competitor's goods and services constitutes "use in relation to goods" – i.e. when a third party uses an earlier mark as a keyword, triggering adverts to sites offering his or her own goods and services, even if the mark is not also included in the adverts[1440].

Furthermore, in *Adidas v Fitnessworld Trading*[1441] the CJEU concluded that the use of a sign as an embellishment is not in itself an obstacle to the protection conferred by anti-dilution law: even if a relevant portion of the public perceives that a sign is used for decorative purposes, such a use may be infringing if a *link* is established between the earlier mark and the later sign, by virtue of their similarity.

Nonetheless, if the public perceives the sign *purely* as an embellishment, such link could not be established (for example, a sign that consists of two vertical stripes, may be regarded purely as a decorative motif)[1442].

[1437] *Cèline*, [20].
[1438] Case C-63/97 *BMW and BMW Nederland v Deenik* [1999] ECR I-905, [38].
[1439] Case C-533/06 *02 Holdings Ltd v Hutchinson 3G ltd* [2008] ECR I-4231, [36].
[1440] Cases C-236/08 to C-238/08, *Louis Vuitton v Google France* [2010] ECR I-2417.
[1441] Case C-408/01 *Adidas-Salomon v Fitnessworld Trading Ltd* [2003] ECR I-12537, [38].
[1442] The Court, in Case C-252/07 *Intel Corporation Inc. v CPM United Kingdom Ltd* [2008] ECR I-8823, further elaborated on the meaning of "link": it suffices that the later sign calls the earlier mark to one's mind. Proof of the link is not by itself sufficient to succeed in an infringement action under Article 10(2)(c) TMD. Rather, proof of a change in the consumers' economic behaviour – that in turn evidences the risk of unfair advantage or detriment – must be given.

For other cases, the mere fact that the mark's essential function of indicating origin is adversely affected or jeopardized weighs in favour of finding infringement, even if the alleged infringer has not used a sign as an indicator of source of his/her own goods.

This may happen, for example, when a notice is given to the purchaser that products are not official, and that the earlier mark is used merely to adorn the products or as a badge of support or loyalty, rather than as a badge of origin[1443].

Finally, the CJEU took a step further, postulating that protection conferred by Article 10 TMD could also be invoked when any function of a trademark, other than the essential function, is adversely affected by the third-party use of a sign (such as the communication, advertising or investment functions).

To recapitulate, the CJEU's jurisprudence has been interpreted as suggesting that "use in relation to goods" within the meaning of Article 10(2) must not necessarily be "use as a trademark"; rather, use of a mark that is merely referential (i.e. that refers to the trademark owner's goods), as well as use of a mark that is not meant to indicate source but ends up affecting the origin function, are both liable to infringe. Decorative use can likewise be relevant for infringement purposes, at least under Article 10(2)(c) TMD (i.e. for famous marks).

Finally, most recent case law from the CJEU signifies a shift in perspective from the third-party use of the mark to the harm caused to one of the functions of the mark. Such an expansion of trademark law's reach postulates that interests that have traditionally pertained to famous trademarks only are now relevant also for non-famous trademarks and enjoy protection against uses that do not cause confusion as to the source.

Scholarship suggests that 3DP will gradually diminish the importance of the conventional functions of a trademark[1444]. 3DP shows the potential to bring about an increased decentralization of manufacturing and distribution processes[1445].

As a consequence, the presence of a trademark may no longer serve to indicate that a product comes from a given undertaking, which has directly produced it. Also, when products are customized by consumers, it is likewise difficult to attribute their origin to a single source.

Furthermore, in a decentralized manufacturing system, trademark owners cannot exercise strict control over the quality and quantity of their products[1446].

[1443] *Arsenal*.
[1444] Grace (2014).
[1445] *Id.*

Scholarship likewise suggests that consumers will become more reluctant to make assumptions about the scarcity of the goods to which a trademark is applied. Among others, Pihlajarinne raises the argument that "*unlimited, easy and free of charge printing possibilities would naturally be harmful to the reputation of a trademark*", since the sense of scarcity or quality associated with the brand will gradually vanish[1447].

Accordingly, while the importance of the origin and quality functions of a trademark is expected to decrease if 3DP becomes mainstream, the investment function, aimed at protecting the reputation of brands regardless of consumers' confusion, might be particularly significant to prevent the creation of poor quality products via 3DP[1448].

Arguably, whether the very notion of scarcity will become illusory, if consumers gain the ability to reproduce goods, is strictly dependant on how such goods are reproduced: for instance, if myriads of 3D-printed bags, bearing a famous mark, are manufactured in plastic, this does not make the leather original bags less scarce.

6. Identity of Physical/Digital Goods

Article 10(2)(a) TMD sets forth the so-called "double identity" rule. Infringement does not extend beyond the use of a sign, which is identical to the trademark, in relation to goods or services, which are identical to those for which the trademark is registered.

The CJEU has interpreted the double identity standard strictly. The very definition of identity implies that two elements compared should be the same in all respects[1449]. Therefore, identity between a trademark and a sign covers "*identical reproductions without any addition, omission or modification other than those which are either minute or wholly insignificant*"[1450].

The comparison between the goods covered by the earlier mark and those covered by the later mark shall be based on the *wording* used to identify the goods concerned, in relation to a certain class under the Nice Classification[1451].

Identity exists insofar as the contested goods or services fall within the broader category of the earlier mark, or when and insofar the contested goods include, in their category, the more specific goods or services of the earlier mark.

[1446] As noted above, in jurisdictions such as the U.S., if consumers are authorized by virtue of a licence agreement to customize the licensor's trademarked products, the absence of quality controls on the part of the licensor might lead to the abandonment of the mark.
[1447] Pihlarjarinne (2017), 312.
[1448] *Id*.
[1449] Case C-291/00 *LTJ Diffusion SA v. SA Sadas* [2003] ECR I-2799, [50].
[1450] Opinion of the Advocate General Jacobs in *LTJ Diffusion*, at I-2815.
[1451] EUIPO Examination Guidelines (01/10/2017), Part C, Opposition, Section 2, Chapter 2, 2.3.

In the present discussion we assume that the later sign, used by the proprietor of the CAD file, is an exact (digital) reproduction of the earlier mark. As for the identity of goods, it must be established whether a CAD file that enables printing a third-party trademarked good shall be deemed identical to such good.

This issue is strictly correlated to the qualification of a CAD file as a separate good, to which the sign is applied, or as a form of manifestation of a physical product.

In the first scenario, if one looks at the file *qua* file, rather than as a means of representing the physical good embedded therein, it is plausible to argue – in light of the strict interpretation given to the notion of identity – that such file cannot be considered "identical" to its physical counterpart, as many steps should be taken before the production process is over.

Following the CJEU's reasoning in *LTJ Diffusion*, Article 10(2)(a) TMD should not expand beyond the situations for which it was envisaged, in particular to those situations which are protected by Article 10(2)(b) TMD (likelihood of confusion). Thus, if in the offline world a registered trademark is used in connection with a physical good (i.e. a cup), its third-party use in connection with a CAD file does not satisfy the identity standard.

Only if the registration of the earlier mark covers CAD files, then the use of an identical mark by a third-party in relation to his or her own CAD files would constitute infringement under the double identity rule, provided that one of the functions of the trademark is adversely affected.

Under the second scenario, a CAD file is regarded as a form of manifesting the good embedded therein. Hence, the good taken for comparison in an infringement action is not the file itself, but the physical product incorporated therein. It follows that, in the example of a trademark registered for cups, a CAD file that incorporates a cup can be deemed identical to the trademarked cup, for trademark purposes[1452].

6.1. Detriment to One of the Trademark's Functions

In principle, the protection afforded by a registered trademark should be absolute – and the likelihood of confusion should be presumed – when dealing with "double identity" cases, falling under Article 10(2)(a) TMD. Nonetheless, it seems that the CJEU has introduced further requirements for an infringement under Article 10(2)(a) TMD to take place.

[1452] In this respect, it must also be noticed that the CJEU, in *BMW v Deenik*, found that the use of the BMW trademark by the supplier of repair services for BMW cars – services in respect of which the same BMW mark was not registered – fell under the scope of the double identity rule, provided that the mark was used to distinguish the *goods* (i.e. the BMW cars) in respect of which the services were rendered, not the services as such. By way of analogy, one may argue that the person who applies a mark to a CAD file is actually using the sign to distinguish the final 3D-printed good.

More precisely, in *Arsenal* the CJEU found that one of the protected functions of the trademark must have been adversely affected, *in particular*, the essential function of indicating to consumers the origin of the goods. This is the case where a third party uses a sign to create the impression that there is a material link in the course of trade between the goods concerned and the trademark proprietor[1453].

In *Google France*, the CJEU further clarified that the application of article 10(2)(a) is not limited to uses of a sign that are liable to affect the trademark's essential function, but also its other functions, "*in particular that of guaranteeing quality of the goods or services in questions and those of communication, investment, or advertising*"[1454].

The following inquiry, therefore, aims to evaluate under what circumstances the use of an earlier trademark, in relation to a CAD file, can be opposed, since it is liable to cause detriment to any of the interests that Article 10(2)(a) TMD is intended to protect.

The first issue to address is whether the essential function of indicating origin could be jeopardized, when Internet users are shown a third party's CAD file associated with the proprietor's trademark. It is argued that the answer depends on the manner in which such CAD file is presented.

Mendis suggests that the use of an earlier mark merely to name a CAD file and/or to describe, in few sentences, the nature, the intended purpose and the particular characteristics of the product that can be printed (in particular as accessories or spare parts) may fall foul of the exception provided by Article 14(1)(c) TMD, especially when the same mark is not also contained in the file[1455].

By way of example – mentioning a well-known company – the CAD file may represent a car body panel or a hubcap for a BMW car. The use of the trademark "BMW" in order to designate the purpose or intended use of the goods that can be printed is a purely descriptive one, not capable of being perceived as an indicator of origin (e.g. "this CAD file contains a car body panel compatible with a BMW car").

In the opinion of Mendis, there would be no infringement where a CAD file is "*uploaded or scanned and sold without the trademark embedded onto the product*"[1456]. In such a case protection would still be available under Article 10(2)(c) TMD, if the earlier trademark enjoys

[1453] *Arsenal*, [56].
[1454] *Google France*, [77].
[1455] Mendis (2013), 162.
[1456] *Id*.

a reputation[1457]. Furthermore, following the CJEU's finding in *Google France,* the trademark owner could still oppose the non-confusing use of its mark, if one of the other functions of the mark is harmed.

If one adheres to Mendis' view, when the BMW logo appears in the CAD file's description and also features on the car body panel itself, there can be a question of the trademark used being perceived as a sign indicative of the undertaking of origin[1458]. A reasonably well-informed and reasonably observant Internet user might detect with difficulty the origin of the CAD file concerned. The use of the mark might suggest that the CAD file had originated from the proprietor of the trademark or from an undertaking economically connected to the latter.

Osborn invites us to pay particular attention to indicia that are external to the CAD file's content, in order to ascertain whether consumers may be confused about the file's origin. He makes the example of a CAD file available on Turbosquid's website, which depicts a "*Chevrolet truck, complete with trademarks appearing on the (digital) car just as on a "real" Chevy truck*"[1459].

A user coming across this CAD file will immediately realize that the platform "Turbosquid" is not the trademark owner's official website. Furthermore, other external elements – such as the username of the person who uploaded the file and/or the disclaimer that the digital model (including the mark appearing on it) is not sponsored or endorsed by the IP owner – may contribute to tell consumers that the CAD file as such does not originate from the trademark's proprietor[1460].

Differently, the origin function of the mark could be undermined if such mark is used not only to name the CAD file, but also to make the digital model more verisimilar, without any disclaimer or indication of the person who created and/or uploaded the file, and the website on which the CAD file is offered appears to be owned or endorsed by the trademark owner.

[1457] If a famous mark is not incorporated in a CAD file, but merely used to describe the goods that can be printed (for instance, "this is a CAD file for *Louis Vuitton* purse"), such a use of the sign can be prohibited under Article 10(2)(c) TMD, provided that the trademark enjoys a reputation. The degree of similarity between the sign and the earlier famous trademark must be such that a relevant section of the public establishes a link between the two, although the later sign is not used as an indicator of origin. Yet, such link does not as such suffice to constitute infringement: proof of the effect on economic behaviour must be given.

[1458] Assuming that a trademark registration covers the digital representations of goods, as well as the physical goods.

[1459] Osborn (2017).

[1460] Compare with the CJEU's finding in *Adam Opel* [23], that "*the average consumer of the products of the toy industry … is used to scale models being based on real examples and even accords great importance to absolute fidelity to the original*", so that that consumer will understand that the trademark appearing on the toy signifies that this is a reduced-scale reproduction of the real car, rather than thinking that the car model comes from the car manufacturer or an economically linked undertaking.

The risk of causing detriment to the essential function of a trademark might increase in the future, if firms begin to produce and distribute online their own "authentic" and "authorized" versions of CAD files[1461]. That being the case, third parties' "unauthorized" CAD files, incorporating the proprietor's trademark, may be misleading.

Internet users would not be capable of distinguishing, without any possibility of confusion, the digital files originating from one undertaking from those that have a different origin. This claim is supported by the fact that users of CAD files could remain anonymous. Hence, it is not always possible to attribute the creation of the file to its creator.

The other functions of a trademark may likewise be adversely affected. A trademark may no longer be perceived as a synonym of quality. In fact, the quality function of the trademark ensures that the proprietor has met the necessary quality control standards, when producing its goods. In contrast, 3D-printed goods, produced from unauthorized CAD files, do not always guarantee quality and safety standards. They might be inferior to their respective authentic products.

The materials that are used in 3DP may be of lower quality than the materials used by the trademark owner, and the external surface of the product may reveal that it has been built layer upon layer. Finally, the advertising and investment functions of a trademark might be undermined in the 3DP context. Noteworthy, as a result of substantial commercial campaigns, a trademark could acquire a favourable image and transmit a message that is additional to the indication of origin. It might become capable of conveying lifestyle messages, so that consumers buy a certain product because of the particular brand image and trademark experience associated with it[1462].

The proprietor of a trademark, therefore, is entitled to prohibit a third party from using an identical sign as a factor in sales promotion and as an instrument of commercial strategy[1463]. In other words, the advertising and investment functions of a mark are adversely affected when consumers have less motivation or desire to buy the original goods.

Although the investment function of a trademark may overlap with the advertising function, it has a broader meaning: it is intended to protect the proprietor's interest to use his or her own mark with commercial techniques other than advertising[1464].

[1461] Among others, the company *Nokia* has released its own CAD files for the removable shell of the smartphone *Lumia 820*.

[1462] Schroeder (2008), 161-176.

[1463] *Google France*, [92].

[1464] Case C-323/09, *Interflora v Marks & Spencer* [2012] ETMR 1, [71].

The CJEU in *Interflora has* clarified that "*the mere fact that the use, by a third party, of a sign identical with a trademark ... obliges the proprietor of the trademark to intensify its advertising in order to maintain or enhance its profile with consumers*" is not a sufficient basis for concluding that the advertising function is harmed[1465].

By the same token, the investment function may be adversely affected where the use by a third party of an earlier mark interferes *substantially* with the trademark owner's efforts to acquire and maintain a reputation and consumer loyalty[1466]. The mere fact that the trademark proprietor has to adapt or enhance such commercial efforts is not a sufficient ground to establish infringement.

Likewise, the fact that some consumers have switched to the alleged infringer's products because of the mark's use is not enough by itself. The purpose of a trademark is not to protect its proprietor against practices inherent in competition.

It follows that, even if in principle a trademark may lose its capability of communicating additional messages such as luxury or exclusivity, if others are printing goods resembling authentic goods, the use by a third party of a trademark in connection with a CAD file, in order to attract more viewers and downloaders, might not be enough to cause detriment to the advertising and investment functions, if it takes place under conditions of fair competition, without affecting the origin function. In fact, such a use of the mark would not prevent the proprietor from using his or her mark effectively to inform and win over consumers[1467].

7. Similarity of Physical/Digital Goods

We have argued above, on the assumption that a CAD file is just a form of manifesting a physical product, that the infringement analysis shall be based on a comparison between the trademarked product and the physical product that the file enables to print.

That being the case, a CAD file shall be considered *identical* to its physical counterpart, for trademark purposes. The alternative option would be to regard a CAD file as an autonomous good, which is nonetheless similar to the trademarked (physical) good.

As for assessing the similarity of the goods or services, the CJEU in *Canon*[1468] stated that the factors that should be taken into account include, *inter alia*, "*their nature, their end users and their method of use and whether they are in competition with each other or are complementary*".

[1465] *Id.*, [57].
[1466] *Id.*, [62]
[1467] *Id.*, [59].
[1468] Case C-39/97 *Canon Kabushiki Kaisha v Metro-Goldwyn-Mayer Inc.* [1998] ECR I-5507, [23].

The EUIPO guidelines define the *nature* of goods as the essential qualities or characteristics by which a product is recognised[1469]. Hence, one should consider the composition of the goods to be compared – meaning the ingredients and materials of which the goods are made – and their physical condition (i.e. hard/soft, liquid/solid, etc.).

Interestingly, one should also look at their intended purpose, *i.e.* the reason for which they are done or created (the purpose of a bag is to carry items, even if it can be used as a protection against rain). In other words, one should ask what need do these goods satisfy, and what problem do they solve[1470]. The method of use, instead, determines the way in which goods are used to achieve their purpose.

It appears that similarity between a physical good and the same good represented digitally as a CAD file, for the purposes of Article 10(2)(b) and (c) TMD, could be established only by considerably stretching the law. One may argue that physical goods, by their very nature, are dissimilar to their digital counterparts, because of their diverse composition, physical condition, method of use and function. The sale of tangible goods entails the transfer in title of something physical, as opposed to the sale of a CAD file.

An argument can be raised, however, that the similarity between goods and their corresponding CAD files may be inferred from what 3DP enables to do. The intended purpose of a CAD file is to send instructions to a printer in order to create a physical object. One may contend that, in the same way as the unauthorized use of a trademark on blueprints or kits to build replica of – for example – cars constitutes infringing use, even though the car is merely incipient in the kit, likewise using a sign in connection with a CAD file is infringing, since the final product is incipient in the CAD file[1471].

Furthermore, a rather low degree of similarity is required in accordance with the CJEU's jurisprudence, namely more than a "complete lack of similarity"[1472]. Besides, whenever the products to be compared appear to be rather dissimilar, other factors could be vital in reaching the conclusion that there is a likelihood of confusion on the part of the public. As noted in the

[1469] EUIPO Examination Guidelines (01/10/2017), Part C, Opposition, Section 2, Chapter 2, 3.2.
[1470] *Id.*
[1471] In the U.S., the manufacture and sale of kits were found to infringe the trade dress of a car in *Rolls-Royce Motors Ltd v a & a Fiberglass Inc.*, 428 F.Supp. 689 (1976). On the other hand, however, it can be said that a CAD file as such is not interchangeable with the final good, and is not offered to the same or actual potential customers, at least for the time being. It is not a common practice for consumers to print items at home or outsource the actual production to a local service provider. One should, therefore, contemplate how likely the trademark owner is in the future to sell a CAD file as the functional equivalent of a physical product.
[1472] Case C-398/07 P, *Waterford Wedgwood plc v Assembled Investments (Proprietary) Ltd and OHIM*, ECLI:EU:C:2009:288.

next paragraph, likelihood of confusion is assessed globally, on the basis of some interdependence between all the relevant factors.

8. Likelihood of Confusion

Likelihood of confusion, within the meaning of Article 10(2)(b) TMD, includes likelihood of association. It is not sufficient for the defendant to show that there is simply no likelihood of the public being confused about the trade origin of the goods; the public should also believe that such goods do not come from an economically linked undertaking (likelihood of association).

The CJEU often utilizes the global appreciation test for determining likelihood of confusion [1473], which implies some interdependence between the relevant factors. Accordingly, a greater similarity of the earlier mark and the later sign may lead to a finding that there is a likelihood of confusion even where there is a lesser degree of similarity between the goods in question. Furthermore, the more distinctive the earlier mark, the greater the risk of confusion[1474].

In assessing likelihood of confusion, courts should also take into account that the average consumer's level of attention varies according to the category of goods concerned[1475]. Where it is established that the level of attention is particularly high (e.g. with respect to very expensive or highly technological goods), this factor may reduce the risk of a likelihood of confusion between the marks.

At present, however, most CAD files relate to categories of goods for which consumers display a low level of attention at the time of purchase, thereby increasing the likelihood of confusion.

It must also be noted that the principle of confusion has been adapted to the digital environment thanks to the "initial interest confusion" doctrine[1476]. More precisely, the initial interest confusion might surge in all those circumstances where consumers are confused about the origin of the goods and services when they are selecting them, but the confusion no longer exists at the time of purchase.

This theory has proved particularly pertinent in cases involving domain names confusingly similar to earlier trademarks. Hence, as Pihlarjarinne suggests, trademark law has the

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1473 Case C-39/97 *Canon Kabushiki Kaisha v Metro-Goldwin-Mayer Inc* [1998] ECR I-5507, [17].
1474 Case C-251/95 *Sabel BV v Puma AG and Rudolf Dassler Sport* [1998] ECR I-6191, [24].
1475 Case C-361/04 *Ruiz-Picasso v OHIM* [2006] ECR I-643, [38]-[39].
1476 Pihlarjarinne (2017), 303 et ss.

flexibility necessary to accommodate future changes in consumers' behaviour, which 3DP may potentially bring about[1477].

Additional questions surround post-sale confusion[1478], according to which trademarks must be protected against possible confusion not only at the time of purchase of the products concerned, but also before or after such a purchase[1479].

Assuming that a user prints at home a trademarked product, is he or she infringing the trademark if the item is then showed in public?[1480] Is there a risk that consumers, coming across that product, could interpret the mark as designating the undertaking of origin?

The risk of downstream confusion does seem greater if everyone could print fake trademarked products at home. Hence, post-sale confusion may be detrimental both to the quality function of a trademark and to its capability of designating the social status of those who own trademarked products[1481].

Yet, as far as 3DP users are concerned, their familiarity with 3DP technology diminishes the potential for post-sale confusion[1482]. In fact, those users who are acquainted with the inherent limits of 3DP technology, most likely imagine that the poor quality and/or unusual material of a 3D-printed product are attributable to the printer's deficiencies, rather than to the lack of control by the trademark's owner.

Hence, a potential scenario is that an increasing number of consumers begin to use 3D printers, and are not confused when coming across a 3D-printed product bearing an earlier trademark. That being the case, if consumers no longer rely on trademarks to infer the origin and quality of goods or the social status of the owners of such goods, the rationale underlying post-sale confusion could be significantly undermined[1483].

Having noted that, at present it seems rather unrealistic to assume that the ordinary street consumer, who is not also a 3DP user, recognizes that a trademarked product has been 3D-printed, without the owner's authorization.

[1477] *Id*.

[1478] The decision of the CJEU in *Arsenal* has first introduced post-sale confusion in EU trademark jurisprudence.

[1479] *Ruiz-Picasso* [35].

[1480] Osborn (2014), 585.

[1481] Grace (2014).

[1482] In the first place, post-sale confusion might be established when consumers are confused about the source of goods in the post-sale environment, making a negative assessment of the products' quality and, therefore, moving to the competitor's products. Second, post-sale confusion might arise if consumers misbelieve that trademarked products are in abundance (i.e. not scarce) and, therefore, do not enjoy a particular status. As a consequence, consumers might show less willingness to purchase those products, whose value automatically decreases.

[1483] Grace (2014).

9. Dilution

As noted above, Article 10(2)(c) TMD sets forth an enhanced protection against dilution, for trademarks that have a reputation in the EU. This provision – amending Article 5(2) of Directive 2008/95/EC – expressly states that anti-dilution law is applicable to any and all situation, whether the goods are similar or not.

Therefore, in principle, Article 10(2)(c) TMD is applicable when a sign, identical or similar to the earlier and well-known mark, is used in relation to a CAD file or a 3D printed product, regardless of any likelihood of confusion[1484]. Dilution does not require evidence of the essential function of the trademark being adversely affected.

The concept of "detriment to the distinctive character" of a mark includes blurring and tarnishment. "Blurring" means detriment to the mark's distinctiveness, so that the mark is no longer capable of arousing immediate association with the goods for which it is registered. Evidence of a change in the economic behaviour of the average consumer of the goods for which the mark was registered is required.

"Tarnishment" means detriment to the trademark's repute or esteem, which results from a negative image transfer to the senior mark (e.g. the senior mark is used in a disparaging form or context, by an undertaking with a negative reputation or in relation to low-quality goods)[1485].

In contrast, "taking unfair advantage" signifies free-riding on the coat-tails of a famous mark. More precisely, a sign is deemed to take unfair advantage of a famous mark's distinctiveness if it receives particular attention because of its association with such mark, without necessarily exploiting the esteem of the latter (i.e. a famous mark is used for decorative purposes).

On the contrary, taking unfair advantage of the mark's repute means benefitting from the latter's goodwill, recognition, prestige and, more in general, positive image (e.g. the 3D-printed products are described as having the same characteristics, quality and material of the original products).

[1484] For example, if a sign is used to name a CAD file (such as: "CAD file for *Louis Vuitton* purse"), but all elements external to such file indicate that the trademark owner is not the file's creator. The degree of similarity between the sign and the earlier famous trademark could be such that a relevant section of the public establishes a link between the two, although the later sign is not used as an indicator of origin.

[1485] On this see, Luepke (2008).

To determine whether unfair advantage has been taken, courts should undertake a global assessment that takes into account all relevant factors provided in *L'Oréal SA v Bellure NV*[1486].

10. Preparatory Acts Under Article 11 of Directive 2015/2436/EC: Affixing a Sign on a CAD File

One of the key changes introduced by Directive 2015/2436/EC relates to the provision set forth in Article 11. A trademark owner is now entitled to prohibit certain preparatory actions that precede the act of affixing an earlier mark to the goods or their packaging.

These include preliminary activities, such as affixing a sign identical or similar to the trademark on "packaging, labels, tags ... or any other means" ("Means"), where there is a risk that such Means will be used in relation to goods or services, and that such use would constitute an infringement of the owner's rights under Article 10(2) and (3) TMD. The fundamental objective of this provision, therefore, is to help right owners to identify and act against counterfeiting more effectively and at an earlier stage.

A controversial issue, therefore, is whether Article 11 TMD confers on the trademark owner the right to prevent an identical or similar mark from being applied to a CAD file, and also to prevent others from offering and placing on the market any infringing CAD file.

In fact, the use of an earlier trademark in relation of a CAD file might be opposed, in so far as it constitutes the preparatory activity that precedes the actual production, via 3D printing, of counterfeit goods. Distributing an infringing CAD file, therefore, could be viewed as a prohibited "ancillary" activity to the actual infringement. If this is the case, this measure will facilitate considerably enforcement actions in the 3D printing landscape.

11. (Digital) Exhaustion

Due to the principle of exhaustion, set forth in Article 7 TMD, the proprietor of a trademark is not entitled to prohibit its use in relation to goods, which have been put on the market in the EEA under that trademark, by the proprietor or with its consent.

Consent constitutes the decisive factor when determining whether the trademark owner's rights are exhausted[1487]. Such consent should be unequivocally demonstrated, and must be

[1486] Case C-487/07 *L'Oréal SA et al. v Bellure NV* et al. [2009] E.C.R. I-5185, [44]-[45].
[1487] Case C-324/08 *Makro Zelfbedieningsgroothandel CV v Diesel SpA* [2009] E.C.R. I-10019, [17].

obtained in relation to each and individual item of the product in respect to which exhaustion is pleaded[1488].

This, in turn, means that the trademark owner's consent to put on the market certain tangible goods does not automatically extend to the corresponding "intangible" goods embedded in the CAD files. In other words, by authorizing the marketing of the goods bearing its trademark, the owner has not unequivocally renounced its right to distribute the respective goods in a digital form.

Furthermore, pursuant to Article 7(2) TMD, exhaustion does not apply where there exist legitimate reasons for the proprietor to oppose further commercialisation of the goods, especially where the condition of the goods is changed or impaired after they have been put on the market.

This might be the case once the goods are converted into 3D models, without the trademark owner's authorization, and then 3D printed. Exhaustion of the rights conferred by a trademark should not apply in this case.

Another key issue is whether the principle of exhaustion should be reshaped, in order to reflect the reality of digitized goods. In recent years, the notion of "digital exhaustion" has been the subject of an intense debate. The CJEU's decisions in *UsedSoft* [1489]and *Nintendo*[1490] have opened new perspective on the extent to which such principle should apply in copyright law[1491].

Arguably, 3DP stimulates discussion about digital exhaustion of all IPRs. Assuming that in the future trademark owners will sell – or grant a perpetual and irrevocable licence to use – their CAD files, should the exclusive rights conferred by the trademark be exhausted? Should we, instead, confine the scope of application of Article 7 TMD solely to the distribution of physical products?

12. Liability of Internet Operators Involved in Three-Dimensional Printing

In *Google France* the CJEU held that a search engine operates "in the course of trade", when "*it permits advertisers to select, as keywords, signs identical with trade marks, stores those*

[1488] Case C-173/98 *Sebago v GB-Unic SA* [1999] E.C.R. I-4101, [22].

[1489] Case C-128/11 *UsedSoft GmbH v Oracle International Corp* [2012] ECDR 19.

[1490] Case C-355/12 *Nintendo Co. Ltd and Others v PC Box Srl and 9Net Srl,* EU:C:2014:25.

[1491] Yet, as noted in the second chapter of the present thesis, the CJEU in *Allposters* has emphasized the continuity of a particular *tangible* copy, as far as exhaustion of the distribution right is concerned.

signs, and displays its client's ads on the basis thereof"[1492]. Nonetheless, it does not follow from those factors that the search engine itself "uses" those signs.

Any finding of trademark infringement implies that a third party uses the sign in "*its own commercial communication*". The CJEU, therefore, ruled out liability for search engines that merely *sell* keyword advertising. As opposed to the search engine, the advertiser - that *purchases* that keyword advertising – is unlawfully "using" the trademark in the context of its commercial activity.

In *L'Oréal v eBay*, the CJEU further explained that a sign is not "used" within the meaning of Article 10(2)(a) TMD, by Internet marketplaces and auction platforms, such as eBay. The latter merely provides a service, consisting in enabling its customers to display, on its website, signs corresponding to trademarks.

Following on from the CJEU's case law, it transpires that certain 3DP marketplaces, on which users share and sell their CAD files, shall not be found liable for direct trademark infringement. The most likely scenario is that a platform such as CGTrader – the equivalent in the EU of a platform such as Thingiverse – will easily escape direct liability. It might be found liable, instead, as a secondary infringer. These claims, however, are left to national courts to determine.

A question mark hangs over direct liability of 3D platforms that provide printing and delivery services. Taking as an example the architecture of Sculpteo, the 3DP process takes place in the following way: individual users upload their CAD files onto Sculpteo website; Sculpteo automatically repairs any defect and optimizes the digital blueprint, with its own 3D tools; then, it prints the object and delivers it worldwide, charging a price for its activities.

In this respect, suffice it to note that Sculpteo is operating "in the course of trade". Let us assume that the object produced by this platform is a trademarked good. One might argue that Sculpteo should be held *directly* liable for trademark infringement. In fact, Sculpteo has the ability to intervene in the design process of the CAD file: it could easily remove the earlier trademark from the digital file, and it is also in charge of the actual production and distribution of the product, thereby playing an active role in all the subsequent phases of the 3D process.

To the extent to which the service provider "produces" the goods in its own commercial activity, it does not merely enable a third party's infringement. Rather, it is "using" a third party's mark in the course of trade within the meaning of Article 10 TMD.

[1492] *Google France*, [55].

On the other hand, one may argue that intermediaries merely act on behalf of users and, therefore, could only be held liable for indirect infringement. Furthermore, 3DP platforms usually include in their terms of use a specific clause exempting them from liability.

Concluding remarks

The ease of converting a CAD file into a tangible good raises the argument whether the current European framework in trademark law should accommodate greater protection for trademark owners.

To achieve this end, it is possible to argue that the trademark registration shall also cover CAD files, as an autonomous class of goods. Alternatively, a CAD file may be deemed "identical" or "similar" to the corresponding physical good for which the trademark is protected. If one does not equate CAD files with the goods they embed, the liability for provision of "ancillary" goods, under Article 11 TMD, may gain particular importance instead.

The whole enquiry allows for the following conclusions. First, the use of a sign in relation to a CAD file potentially meets the "use in relation to goods" requirement.

Second, a mark is likely to be used "in the course of trade", when the CAD file is transferred to a third party with a view to gain and not merely as a private matter.

Third, a sign may or not be perceived as an indicator of the file's origin, depending on whether it is used internally or externally, and on the other indicia surrounding the file, such as the website's name, the uploader's username or the presence of a disclaimer.

Fourth, in principle all functions a trademark could be adversely affected by the transfer of unauthorized CAD files.

Fifth, at present, the principle of exhaustion does not cover online distribution of goods in the form of CAD files.

Finally, an argument can be raised that certain 3DP platforms should be the target for primary liability claims.

Some Concluding Remarks

1. Looking Ahead For Possible Policy Option

2. Conclusions Reached From the Side of *Protection* Under Different IPRs

3. Conclusions Reached From the Side of *Infringement* of Different IPRs

3.1. Direct Infringement

3.2. Indirect Infringement

1. Looking Ahead For Possible Policy Option

3DP is a technology that may carry considerable socioeconomic implications and likewise pose unprecedented legal and regulatory challenges.

Digitization of real world things, together with the possibility to share digital files over the Internet and 3D print them in a decentralized manufacturing system, characterized by the compression of supply chains and the redefinition of distribution channels, may have a profound impact on our society and economy and, at the same time, raise quandaries across different areas of law.

This work highlights the implications that 3DP may have for Intellectual Property Law. In particular, the aim of this work is to answer the following main research question: whether the current legislative framework governing different IPRs is ill-suited to regulate 3DP, in general, and the digitization of real-world things, in particular.

The urge to address such a question is reinforced by the proliferation of academic scholarship describing 3DP as a breakthrough technology that will cause disruption to the whole body of IP law.

Unlike the effects brought about by revolutionary technologies of the past, the implications of 3DP cut across different branches of IP law: the objects that this technology enables to produce are diverse and, therefore, may potentially attract protection under different IPRs. Less evidently, however, such implications will be disruptive, at least in the foreseeable future, thus calling for an immediate legal response.

This outcome is strictly intertwined with, and largely dependent on, the development of the technology and its spreading among consumers. Nonetheless, whether 3D printing (consumer 3DP especially) will reach its full potential in the near future cannot be easily predicted.

Therefore, by untangling all IP-related issues that are currently raised by 3DP and may emerge in the years to come, this work attempts to prepare the ground for future legislative or judicial intervention.

It is argued that, even if, in theory, some IP concepts, theories and doctrines[1493] might prove inadequate in light of a more nebulous distinction between the real and digital realm, in practice, this might not lead to severe consequences if 3DP does not become a widespread technology.

[1493] Especially in the fields of patents, designs and trademarks, and less evidently with respect to copyright.

Thus, the question of whether 3DP shall entail an enlargement of the subject matter of protection conferred by various IPRs, a redefinition of the acts that constitute infringement and/or a reallocation of liabilities must be (re)assessed when the technology is more mature.

In fact, the conjectures about potential detrimental effects of 3DP to the interest of right owners might not become concrete. Arguably, there is no pressing need to tackle hypothetical problems that 3DP might eventually cause in the future.

Against this background, according to the present writer, the best policy option is to follow a "wait and see" approach, rather than to amend the law. For the time being, a legislative proposal in this area may prove inadequate and premature, in light of unpredictable pace of technological development, and may equally hinder innovation.

In the meantime, it is important to facilitate dialogue between different stakeholders involved, and envision a way to reconcile a high level of protection of the legitimate interests of right owners, on the one hand, and technological progress, on the other.

The speed of advancement in 3DP technology shall prompt legal academics, practitioners and policy makers to properly understand the phenomenon and propose a set of possible solutions to a series of IP-related conundrums that 3DP poses. These options will need to be further assessed as the technology evolves.

In an attempt to better achieve the goal of creating general awareness about the IP implications of 3DP, this contribution underscores that many aspects of this technology fit well within the current framework of various IPRs.

For instance, patent law may well protect the "3DP toolkits", comprising printers, scanners and/or 3DP materials. Likewise, the fact that a product is produced through an "additive" manufacturing process, rather than a traditional "subtractive" process, does not, as such, have a bearing on the protection available under different IPRs.

In other words, if the 3D-printed product is a sculpture or a work of applied art, it may be eligible for copyright protection, irrespective of whether it has been built layer by layer or, for example, by stone carving.

Likewise, the product's shape may be inherently distinctive to qualify as a protectable, non-conventional trademark, or satisfy the novelty and individual character requirements under EU design law, unrelatedly to the fact that the product has been 3D-printed.

By the same token, if the item is a useful article, it may enjoy protection under patent law, provided that the conditions for protection are met.

Furthermore, the final printout may well cumulate protection under different IPRs, but this is not a direct consequence of the 3DP process. Whether a product attracts protection under one or more IPRs generally does not ensue from the manufacturing technique that has been employed; rather, the product's own nature and its (artistic, functional, technical, distinctive, etc.) features contribute to determine the availability of protection under various IPRs.

On the other hand, it must be noted that (industrial) 3D printers can already be used to manufacture products with complex geometries, as well as technical, mechanical or electronic devices. Unlike with traditional manufacturing processes, printing just one unit of a complex product can still be cost-effective.

Hence, products that traditionally have not been exposed to the risk of counterfeiting, given the difficulty of, and the high costs involved in, replicating them, can now be more easily copied. A body of literature observes that, especially in the field of patent and design law, the physical and financial barriers to infringement are thus falling: plenty of capital is no longer needed to commit serious infringement[1494].

Possibly, consumer 3DP will likewise mature to the point that it will allow for the manufacturing of all sorts of products. Furthermore, although at present personal 3D printers are not sophisticated enough to produce more complex products, the possibility to entrust an intermediary with this task already exists.

Hence, the first general conclusion to be drawn is that the use of 3DP, as an additive manufacturing technology, as such does not carry weight in the assessment of whether the tangible printout warrants protection under IP law; at the same time, by making economies of scale unnecessary, 3DP may facilitate infringement of different IPRs, including patents and designs.

Yet, one should also consider that the costs associated with 3DP hardware and raw materials may limit the DIY universe of infringement to those products that are not prohibitively expensive for end users to produce.

A second remarkable aspect of 3DP that exacerbates the risk of (widespread) infringement of different IPRs, and raises new and unprecedented theoretical quandaries from the side of protection too, is that, by virtue of 3DP, all products can now be converted into a digital file and vice versa.

More precisely, a product may first come to existence in digital form. The CAD file can then be shared trough an online platform and be printed directly by the consumer or by an intermediary, which may be in charge also of the distribution phase.

[1494] Desai; Magliocca (2013), 1693.

Alternatively, scanning techniques enable to digitize pre-existing physical items, in order to either replicate them faithfully by means of 3DP or modify the digital representation to some extent, with the assistance of software. Depending on the type of alteration that is made to the scanned representation of an object, the final 3D-printed output will or will not bear a resemblance to the original product.

The attempt throughout this work is to envision the reasons why the blurred line between the digital and analogue world could be revolutionary from different standpoints, as far as IP law is concerned.

Significantly, the regulatory framework of most IPRs was conceived in an ecosystem dominated by tangible assets, rather than by digitized goods. This is reflected in the provisions regulating both protection and infringement.

Hence, first and foremost, when dealing with the form of *protection* available under different IPRs, the thought-provoking question of how to treat the digital version of the final item, and whether such a treatment should or not be dependent on what is the physical product that will be printed, is addressed.

Secondly, this work elaborates on right owners' concerns relating to the digitization of things, and its potential for widespread *infringement* of different IPRs. In this respect, scholarship drawing an analogy with the tremendous effects that digitization of songs, movies, images and books has had for the creative and publishing industries is critically reviewed.

The aim of the following discussion is to recapitulate the main conclusions reached in this thesis with respect to such points of contention, dealing first with protection and then with infringement issues.

2. Conclusions Reached From the Side of *Protection* Under Different IPRs

When dealing with copyright protection in chapter II, this research endeavours first to dispel certain misconceptions about the nature and legal status of CAD files: a CAD file *qua* file does not qualify as a protected "work" of authorship; rather, it is just a medium of fixation of one or more copyright protected works, in the same way as an MP3 file is an instrument to record a musical work.

Hence, it is argued that, when looking at the interface between 3DP and copyright law, the best theoretical approach is to consider whether the final 3D-printed output is a protected work of authorship. That being the case, the digital (i.e. CAD-based) and physical (i.e. 3D-printed) manifestations of the same product are either instruments of fixation or copies of a sole work of authorship.

In other words, a CAD file may be used to fix a sculpture, a work of architecture or a work of applied art in some tangible form. From the moment the CAD file is created, a work of authorship comes to existence in a tangible medium of fixation. In countries such as the U.S. and the U.K., the fixation requirement is thus met.

From this preliminary assumption it follows that copyright owners will have the exclusive rights to reproduce and make available to the public the CAD file, as well as to 3D-print the item embedded therein. By contrast, the file could be freely used to print an item that is not the subject matter of copyright.

The design drawing contained in the file may also be eligible for protection as a separate work of authorship, provided that it passes the functionality and originality hurdles.

Then, as far as the code component of the file is concerned, in principle two different perspectives could be adopted: first, the code may be regarded as a set of literary instructions eligible for protection under the InfoSoc Directive and, second, the same code, or part of it, may qualify as “software” within the meaning of the Software Directive, that is *lex specialis*. Under both scenarios, protection could arise only if the code is the author’s own intellectual creation.

When looking at the code as a set of literary instructions, copyright protection would extend only to the literary expression that is not dictated by function and is sufficiently original. These requirements for copyright subsistence, however, may not always be met.

If the code is seen through the lens of software copyright, one must dissect the lines of code that instruct the printer to bring about a certain result, thereby complying with the definition of “computer program”. Again, the code’s expression might be entirely dictated by the underlying function, being a set of commands to print an item that must necessarily be expressed in a certain way in order to achieve the end result.

As to whether CAD files shall be protected as “databases” within the meaning of the Database Directive, it is suggested that most of the file’s constituent elements, including information about colour, texture and material, do not have an independent meaning when accessed separately one from the other, but make sense only when referenced to the 3D model. Some other elements, such as the thumbnail image of the design, might have an independent value instead, in line with the definition of “database”.

It is however unlikely that the archive of data, information and works within a CAD file would require substantial enough investment to be protected under the *sui generis* database right.

It is also doubtful whether the arrangement and selection of the CAD file's internal components could be eligible for traditional copyright protection, insofar as the structure of the file is predetermined by software and essentially dictated by technical considerations.

Originality of the work(s) contained in a CAD file largely depends on the manner in which the file has been created: by drawing the digital model from scratch with the assistance of software or by scanning a real world object.

If the design drawing is made completely from the beginning, most likely it will entail sufficient creative choices to satisfy the originality requirement for copyright purposes. If the object that the drawing represents is not within the copyright's reach, the drawing may nonetheless be capable of protection in its own right, if the designer has added some creative spark in elements such as lighting, shading, colours and perspective.

On the contrary, if a real world object is scanned, the resulting scan will not enjoy copyright protection, unless some original adjustment, modification or alteration is made to the digital representation of the object. In that regard, academic scholarship distinguishes between "representational" and "expressive" scans.

In applying the idea and expression dichotomy to CAD-based drawings, this research dissects the parts of the drawing that do not merge with the CAD file's function of printing the object. In this respect, the type of software that is used to create the digital design may considerably impact the merger inquiry. Solid modelling software, as distinguished from surface modelling software, requires the user to select among a set of pre-made shapes that could not be expressed differently to perform the same function.

Likewise, the design drawing contained in printable (STL or GCODE) files, as distinguished from the image contained in CAD models, much more resembles a technical drawing that lacks ornamental or artistic features and, therefore, may be wholly incidental to the underlying function of printing the object.

An additional remark that is made, when dealing with the copyright/design interface in chapter III, is that protection available under copyright law for works of applied art, which a CAD file may enable to print, varies considerably among different EU countries and between Europe and the U.S.

At present, EU Member States retain the discretion to determine the level of originality necessary for a work of applied art to attract copyright protection. Hence, in theory, a 3D-printed item that is a useful article (i.e. a shoe) may still attract copyright protection under the

French "unity of art" doctrine, unless it is entirely dictated by function, but may not have a sufficient artistic value for obtaining the same protection in Italy[1495].

According to one possible reading of recent case law from the CJEU, the requirement of originality under EU copyright law has now been harmonized with respect to all work categories, including applied art.

This, in turn, would mean that countries, such as Italy, that have traditionally employed a higher originality threshold for copyright subsistence in works of applied art should now change their law and adopt the uniform "author's own intellectual creation" standard for the whole subject matter of copyright[1496].

This eventuality bears particular significance in the context of 3DP, considering that online platforms offer several printable items belonging to the category of applied art – such as articles of fashion, accessories, jewellery, toys, and home products of small dimensions, such as cups, vases, candleholders, etc. – which are also better suited for customization.

National case law, however, is not consistent in considering the implications that harmonization of the originality requirement has for applied art. For instance, Italian courts continue to make reference to "artistic value" as part of the originality criterion, and the German Supreme Court, whilst lowering the level of originality required for applied art, purposively did not consider this major change as being imposed by the CJEU's jurisprudence, but rather justified it on a purely national basis.

By contrast, the Dutch Supreme Court took the opposite direction, specifying that the originality criterion has now been harmonized at EU level also with respect to works of applied art. That being the case, the preferable view, in the present writer's opinion, is that "originality" shall not overlap with the presence of some "room for creative freedom", but require, instead, that creative choices have actually been made throughout the whole creative process.

In practical terms, this reconstruction of copyright's originality would enable to distinguish between different forms of product customization, which may or may not involve sufficiently original choices.

In fact, even though some room for personal choices exists when users customize products, the way in which customization takes place might reveal that the whole creative process is not

[1495] Moreover, taking the example of an Italian shoe or bag unprotected in Italy, it will still be protected in France if it passes the French test of protectability, insofar as France has to grant national treatment to applied art from other EU countries.

[1496] As discussed in chapter III, amongst the questions referred to the CJEU in the *Coefemel* case is whether the "author's own intellectual creation" standard shall also apply to works of applied art. The preliminary reference is still pending.

creative at all, since it merely consists in the selection of expressive features among a set of predetermined options. Hence, a more careful inquiry into the way in which users do actually exercise personal preferences may lead to the finding that an act of customization does not involve any or just a minimum creative contribution on the part of the user.

In the U.S., while the CAD-based drawing portraying a useful article (i.e. a shoe) may be a copyrightable graphic work, protection would not extend to the useful article itself, once 3D-printed. Any copyright would be limited to the pictorial, graphic or sculptural features incorporated into the design of the useful article that are separable from the article's utilitarian aspects.

In analysing the much-awaited decision from the Supreme Court in *Varsity Brands*, this work stresses the considerable ambiguity that is left in relation to copyright protection of the overall form of an object. One possible interpretation of the Court's ruling is that the shape of an article, including a 3D-printed one, is not copyrightable, since it replicates the useful article itself or a part thereof.

As far as design protection is concerned, digitization of 3D products triggers the question of whether EU design rights are aimed at protecting the external appearance of physical products only. As discussed in chapter IV, this does not seem to be the case, given the possibility to protect graphic symbols, including digital icons, as Registered and Unregistered Community Designs.

This issue is particularly relevant to the extent that infringement of EU design rights seems to be tied to a physical dimension only. Consequently, the exclusive rights conferred by a design could prevent only unauthorized use of the design in relation to a physical product or corporeal moveable, but not also the act of making and sharing a CAD file incorporating the protected design.

For all such reasons, right owners might wish to protect the digital representation of a product in the first place (probably as a graphic symbol), in order to prevent it from being used without consent.

It is also maintained that, in principle, when a CAD file clearly reveals the outer appearance of a product, its publication on a website would be tantamount to a "disclosure" for considering questions of novelty and individual character. Hence, all later designs, including those designs that are incorporated in CAD files and not yet offered in tangible form, will have to produce a different overall impression on the informed user.

Possibly, a CAD file that does not show the product's appearance in detail – for instance, a CAD file made available in STL format – is not suitable for relevant disclosure. Moreover, the act of uploading a CAD file onto a website outside the EU might not be sufficient to trigger unregistered design protection.

In theory, the concept of "informed user" might need to be slightly revisited in the future. According to EU design law, the user should be "informed" about the end product, not as to technology that is used to produce the item. Having noted that, an argument can be made that users are becoming more familiar with design techniques, thanks to open source digital modelling software available on the Internet.

It might be the case that the same "users" who purchase certain products (either in physical or digital form) will become also "designers" of the same category of products. Conceptually this means that the category of "informed user" would much more resemble that of "person skilled in the art" in patent law, i.e. a person that does not ignore the specific methods and techniques of production.

In a similar vein to design law, the subject matter of patent claims has traditionally embraced *physical* objects, with the main exception of methods and processes, including process claims directed to patent software.

As noted in chapter V, as a consequence of digitization of physical things, inventors may have to direct their patent claims to the CAD-based representation of their patented products.

The ease of converting a CAD file into the corresponding physical item has led some U.S. commentators to suggest that a CAD file is almost interchangeable with the end product itself, offered to the same actual or potential customers[1497]. As CAD files are almost equally valuable than the corresponding physical products, they should enjoy equal protection to that already accorded to the claimed (tangible) invention.

For the time being, this academic proposal appears to be premature: many intermediate steps separate a digital file from the final printout, especially when dealing with technical products that are the subject matter of patents. At present a CAD file does not operate as a substitute for a physical good.

Any expansion of the patent claim to include CAD files may be justifiable to the extent that 3DP becomes a commonly used technology to fabricate patented products. A question would then arise as to whether the digital version of a product shall be considered as an article of (digital) manufacture or as patent software in a patent claim[1498].

[1497] *Inter alia*, Holbrook; Osborn (2015).

[1498] The issue of subject matter categorization is analysed with reference to U.S. patent law, because of the large body of American literature dealing with it. The principles underlying the considerations made thus far, however, would be valid also in the EU.

An argument can be made that the subject matter of patent law should be expanded so as to include "digital manufacture". One should always keep in mind that a CAD file is just a means for incorporating a (tangible) product. The object of protection is the invention contained in the file, not the file *qua* file.

Thus, if we want to extend protection to printable files, this should be dependent on whether the product embedded therein is likewise patent eligible. Hence, if the underlying invention is an article of manufacture, the fact that it is expressed in electronic form, as a set of CAD-based instructions, should not alter the subject matter category included in the claim. The shortcomings of protecting CAD files as patent software support this conclusion.

When dealing with trademark law in chapter VI, it is first noticed that the concept of "trademark use" necessary to activate trademark protection presupposes the use of a sign as an indicator of origin of the goods and services to which the sign is applied. Hence, some degree of uncertainty persists as to whether the use of a sign in relation to a digital file amounts to use in relation to a "good" or "service".

Possibly, CAD files could fall within the list of goods contained in class 9 of the Nice classification, which includes different types of downloadable files. If not, the Nice Agreement might need to be amended in the future to include "printable files" as an autonomous class of goods or services.

An alternative route delineated in this thesis is to consider a CAD file as a means of manifesting a physical product, rather than an autonomous good, for trademark purposes. That being the case, while it would not be possible to obtain protection in the first place, trademark owners could nonetheless rely on the double identity rule to prevent infringement caused by the use of their mark in relation to third-party CAD files.

Assuming that the CAD file is the relevant good, in relation to which protection is sought, another relevant issue addressed in chapter VI of this thesis is whether the inclusion of a sign in the file, i.e. onto the CAD model, signifies the origin of the file or the origin of the file's content.

Arguably, a sign that appears only on the digital model embedded in the file does not designate the file's provenience; at maximum, such a sign would enable to identify the author of the design drawing.

Hence, a trademark would need to appear on the file's heading and/or description, in order to designate its origin. It is also fair to argue that the use of a sign in the description accompanying the file, for the purposes of indicating the characteristics and intended purpose of the item to be printed, most likely will be purely descriptive, especially when the printable products are spare parts or accessories.

3. Conclusions Reached From the Side of *Infringement* of Different IPRs

As emphasized throughout this work, availability of 3D printers at consumer level, combined with the spreading of 3DP platforms that facilitate the sharing of CAD files and 3D-print objects on-demand, have provoked fierce debate about the potential for widespread infringement of all IPRs.

The promise of 3DP is that people will be able to print all sort of items protected by IPRs in the comfort of their homes or entrust an intermediary with the task of printing them.

At first glance, the potential piracy issues that 3D printing raises resemble the challenges faced by the music industry when fighting against P2P file-sharing platforms such as Napster and The Pirate Bay[1499]. Academic discussion has generated a whirlwind of hype predicting that 3DP "*will do for physical objects what MP3 files did for music and film*"[1500].

Following this line of reasoning, policy choices to be adopted, in order to provide an effective legal mechanism against piracy challenges in 3DP landscape, should build on the "lessons learned" thus far in the copyright arena.

According to the present writer, however, such a claim should not be made without the necessary precautions. The fact that digital-design-file-sharing is a *sui generis* phenomenon is something we need to keep in mind before extending the holdings from copyright P2P file-sharing cases. Otherwise, the risk of drawing superficial analogies is to end up in hasty generalization and ungrounded recommendations.

While it is certainly true that enforcement of IPRs is likely to become a complicated process, if the dissemination of infringing CAD files becomes a common practice among users, for the time being file-sharing is not a mass phenomenon in the 3DP context.

Likewise, although in theory 3DP may facilitate counterfeiting on a decentralized basis, in practice consumer-driven infringement is not a major threat yet. The reason for this lies in the lack of sophistication of home 3D printers and the substantial manufacturing costs – covering hardware, printing materials and electricity – that are still involved in printing things at home.

In addition, consumers need to have at their disposal a laboratory or empty room where to print and conduct post-production activities, another factor weighing against the spreading of this technology.

[1499] Nordberg; Schovsbo (2017), 340.
[1500] Holbrook; Osborn (2015).

Moreover, all phases in the production process, from digital design to post-production, require a certain degree of technical knowledge that ordinary people may lack. It thus seems that, at present, home 3DP is confined to a small category of people, namely DIYers and 3DP enthusiasts.

A more significant cause of concern for right owners might be the increased role that intermediaries play in the context of 3DP.

As opposed to individual consumers, intermediaries have the facilities and hardware necessary to print a wider range of products. Besides, intermediaries tend to include specific clauses in the licence agreements exempting them from liability in cases where users upload or download infringing material onto or from their platform. In addition, the law may provide a "safe harbour" as well[1501].

An important point to make is that most policy options appear to be premature and anecdotal at present. Home 3D printing is still in its infancy or inception phase. Any attempt to target intermediaries might soon prove superfluous, if consumers increasingly make use of scanners and domestic 3D printers, assuming that the costs go down, the manufacturing process becomes faster and the quality of end products improves.

Moreover, a legislative or judicial expansion of indirect infringement doctrines, aimed at stifling 3DP intermediaries' activity, requires careful examination of the impact that preventing certain uses of an emerging technology might have, in terms of unduly restricting competition and technological progress.

There is a danger of constructing a regulatory regime that will affect all intermediaries in an indiscriminate way, without proper regard for their potential contribution to society. The facilities and services that 3DP intermediaries offer vary to a great extent. Looking forward, some intermediaries might offer products or services that are beneficial and foster innovation.

Certain uses of 3DP, such as customization of products, might be of particular value not only for new entrants in the marketplace, but also for users and society and, therefore, should not be overly constrained. In this regard, it has been observed that overprotection of IPRs can be as detrimental as under-protection, in that it can seriously harm the interest of the alleged infringers.

Therefore, in considering the intersection between IPRs and 3DP, it is important to evaluate every proposal for change in a careful and balanced way. One should also be mindful of the legitimate interests of users and society at large.

[1501] See Articles 12-15 E-Commerce Directive and 17 U.S.C. § 512.

By the same token, one should accept as a starting point that “makers” adhere to the open source philosophy, and share their contributions be means of Creative Commons or equivalent licenses. Hence, an aggressive enforcement strategy that is aimed at achieving a high level protection of IPRs might be unwarranted.

It is also important to recognize that 3DP poses novel questions, especially because it cuts across various areas of law and involves all IPRs. Hence, it is necessary to conduct a more holistic and wide-ranging research, which goes beyond an evaluation of the impact that the technology has on each and individual IPR. At the same time, checks and balances are needed to envision a legal response to 3DP, which is attentive to the peculiar traits and specificities of different IPRs and the relative industries.

Furthermore, in order to find the best solution to a problem, the actual magnitude of the problem and of the urge to change the current setting should serve as informing and guiding principles. In other words, an exact and objective appraisal of the dimension and economic consequences of the problem should be made, before a proposal for legislative change is set out[1502]. Estimates about the share of counterfeit and pirated goods that 3DP will facilitate should be based on reliable and trustworthy data.

One should thus ask whether there is such an impelling need to find a strategy to tackle a number of challenges that 3DP might present to the enforcement of IPRs in a hypothetical future scenario, or whether action should be better off postponed to a later date.

Arguably, the impact that illegal sharing of printable files might have on different industries and society at large is not easily predictable at present. This phenomenon and the possible remedies to address it need to be assessed in the long run. In fact, the attractiveness of certain proposals may vanish in the near future. Measures already available to enforce IPRs might prove sufficiently adequate.

Having made such general remarks, it is important to recapitulate more in detail the conclusions reached with respect to the infringement analysis conducted in this work.

3.1. Direct Infringement

First and foremost, this research elaborates on the distinction between direct and indirect infringement of different IPRs (i.e. primary v secondary liability).

[1502] Dreier; Kur (2013), 436.

When dealing with *direct* infringement of copyright in chapter II, it is first observed that laypeople can now scan a three-dimensional object or download somebody else's CAD file from an online repository at little or no cost.

Significantly, if the scanned object is copyright protected, the scan will infringe the copyright owner's exclusive right of reproduction. Likewise, if the pre-existing digital design enjoys copyright protection, it cannot be downloaded lacking the owner's authorization.

The design contained in the file can be modified with the aid of open source computer programs that are meant to assist those users who are not particularly knowledgeable or technically skilled in digital design.

Much like laypeople have learnt how to edit and manipulate photographs, music or video-clips with the aid of software, users might increasingly engage in adapting and revising the appearance of a product.

The ability to manipulate pre-existing designs, and share the resulting creations over the Internet, might contribute to unleash a new wave of creativity. Follow-on artists can imprint digital designs with their own artistic vision and express their creative abilities in an original manner. Likewise, digital modelling techniques enable the personalization and customization of products, which may prove extremely beneficial for consumers.

It is plausible to imagine that some of these modified designs constitute derivative works or parodies, shielded by the freedom of expression. However, it is likewise possible that the type of alteration that is made to the original design does not add sufficiently creative authorship to enjoy copyright in its own right.

Not only have consumers gained new empowering tools in the design phase, but they have also acquired the ability to control the manufacturing phase, by printing products at home or close to the point of consumption, i.e. at a local 3DP hub.

The mere change of dimension, from a 2D digital design to a 3D printed item, amounts to copyright infringement, unless the final printout is an unprotected useful article.

A more difficult question is whether 3D-printing an item constitutes infringement of the exclusive right to reproduce the literary work contained in the file. The answer to this question varies depending on whether the 3D-printed object is a protected work of authorship.

If the object is protected by copyright, then the literary instructions to make it serve as an instrument of fixation of the work, in the same way as literary notation may serve to fix a choreographic work in a permanent and tangible medium. Hence, making the object by following the literary instructions contained in the file would amount to copyright infringement.

In the opposite scenario of a 3D-printed object that is not copyright protected, the coded instructions to build it do not serve as a medium of fixation of a (artistic) work, but may nonetheless attract (literary) copyright in their own right, provided that the conditions for protection are satisfied.

In such a case, making the object by following the instructions would not reproduce the original expression contained in the literary work (i.e. the creative choices made in the selection and arrangement of the lines of code).

Thereafter, this work assesses, in chapter IV and V respectively, whether the law on direct infringement of designs and patents adequately addresses, and provides effective remedies against, the unauthorized sharing of CAD files for protected products.

It appears that this phenomenon cannot be easily subsumed within the current substantive provisions on direct infringement of design and patent rights, which aim to specifically tackle unlawful activities in respect of *physical* products.

Hence, infringing activities that normally take place with respect to tangible items, such as making, offering for sale, using, or importing products would need to be adapted to the digital world.

Some argue that activities carried out in respect to CAD files alone shall give rise to primary liability, if the file enables to print a protected item. Hence, a strand in academic literature opines that the law against direct infringement shall expand to encompass the act of making a CAD file for a patented product or a protected design, as well as the act of using or distributing the file without the owner's consent[1503].

The rationale underlying this approach is that unauthorized CAD files are liable to appropriate the economic value of the invention or the design, since they can be converted into the corresponding product almost at a click of a button.

Moreover, the argument in favour of an expansion of direct infringement doctrines to digital uses of patents and designs is grounded on the difficulty in suing end users who 3D print objects in their homes or in 3DP hubs.

If tracking and suing end users is not practical, then right owners shall be in the position to allege that the individual who created, shared or downloaded a CAD file committed an act of direct infringement.

An expansion of liability – it is worth underlining once more – should not be divorced from reality, but reflect the actual need to provide an effective remedy against harmful conduct. In

[1503] Holbrook; Osborn (2015).

the absence of a real harm to right owners, excessive protection might prove detrimental and stifle innovation.

Therefore, depending on the pace of technological development, it might or might not be desirable to expand the direct infringement doctrine, in order to prevent the sharing of printable files.

Assuming that file-sharing will cause real damage to right owners, arguably an expansion of protection against the simple *creation* of a CAD file would nonetheless go too far: it does not seem reasonable to regard such a conduct as equal to the actual "making" of the physical product. One should consider that a CAD file could be made for various purposes, not necessarily to print the item.

Hence, the ensuing question is whether the *sharing* of CAD files for protected products shall be regarded as a form of exploitation of the IPR that calls for remuneration to right owners, irrespective of whether the physical products come to existence or not at a second stage.

Insofar as trademark infringement is concerned, it is observed, in chapter VI, that the traditional "double identity" rule and "likelihood of confusion" doctrine postulate the identity or similarity between the goods or services to which the earlier mark and the later sign are applied. This, in turn, leads us back to the puzzling categorization of CAD files as autonomous goods or services, or as means of representing a good.

Two different scenarios are portrayed. Assuming that CAD files fall within the class of goods 9, pursuant to the Nice classification, and that a trademark is registered for such class of goods, its unauthorized use by a third party in relation to another printable file falls under the double identity rule.

Recent case law from the CJEU suggests that, even when the later sign is not used as an indicator of trade origin of third-party goods, it may nonetheless infringe the owner's exclusive rights, provided that one of the functions of the mark is adversely affected, especially the essential function of indicating origin.

When ascertaining if the origin function is affected, the way in which the CAD file is displayed on the website, together with the manner in which the sign is used in relation to the printable file, may lead to a different outcome.

Some commentators maintain that indicia external to the file, such as the type of website on which the file is offered, the username of the uploader, as well as the presence or not of a disclaimer are all relevant factors in determining whether a link could be established between the trademark proprietor and the CAD file concerned. Similarly, whether the use of the sign is internal or external to the CAD file may likewise influence this sort of inquiry.

This work also points out that other functions of a trademark, such as the quality, advertisement and investment functions, may all be adversely affected by the practice of sharing CAD files bearing a registered trademark.

The second scenario under scrutiny relates to a mark that is registered for physical goods and is used by a third party in relation to CAD files, lacking the owner's consent. Such use of the earlier mark could be sanctioned, under the double identity rule, to the extent that the infringing good under consideration is the (physical) product embedded in the file, rather than the file *qua* file.

To the extent that a CAD file is just a means of manifesting a physical item, the goods under comparison for infringement purposes shall be the earlier product, for which the mark was registered, and the product that can be printed from the CAD file.

On the other hand, if the CAD file *qua* file is regarded as the allegedly infringing good, similarity with its physical counterpart may potentially be established on the ground of the file's intended purpose: a CAD file is the precursor of the final item, which enables the latter to come into existence. This outcome, however, seems rather odd.

Lacking identity or similarity between the goods, protection would be available only under the doctrine of "dilution", provided that the earlier mark is well known.

Hence, it appears that an expansion of traditional direct infringement doctrines to the reality of digitized goods is not automatic, but requires a careful and comprehensive evaluation of its beneficial and/or detrimental consequences for all stakeholders.

3.2. Indirect Infringement

Given the complexity of proving direct infringement by large amounts of individual users or sellers of 3D-printed articles, right holders might decide to address their enforcement efforts against "intermediaries" that provide 3D-printing related products and/or services. Hence, the alternative route of pursuing *indirect* infringement claims is scrutinized in this work, with respect to all IPRs.

In that regard, this contribution critically evaluates, in chapter IV, some policy options put forward in the field of EU design law, which are meant to prevent and/or combat counterfeiting by means of 3DP. One option for change, proposed by the EU Commission in its *Legal Review on Industrial Design Protection in Europe*, is to introduce a specific provision in the regulatory framework of design law, sanctioning indirect infringement of design rights, which is currently not regulated at EU level. In the EU Commission's view, such provision should mirror Article 30 CPC.

Yet, the substantial uncertainty as to whether the various elements of the infringement test under Article 30 CPC can be interpreted extensively to cover the sharing of CAD files weighs against the introduction of a specular provision in EU design law.

Policy makers have also observed that an intolerable expansion of consumer 3DP might substantially undermine the rationale underlying the exception to design infringement for acts done privately and for non-commercial purposes.

In fact, if consumers increasingly engage in printing products in their private premises, rather than being the passive recipients of goods, it might be that private and non-commercial uses will suddenly begin to interfere with the commercial strategy of right owners, creating a parallel channel for the exploitation of design rights.

Hence, the concern expressed in policy documents is that the line between what is private and what is commercial will progressively blur, in light of a decentralised reproduction of protected designs by millions of users.

Accordingly, the Legal Review proposes a redefinition and limitation of the private use exception by employing the language of the three-step test set out in the TRIPS Agreement. Nonetheless, this proposal entails the risk that the ambiguous language of the three-step test would cause additional confusion and lead to inconsistent judicial interpretation.

If the contours of the private use exception are not well defined, the probability of litigation increases and transaction costs get higher.

The other option for change would be to impose a levy on 3DP equipment, such as printers, scanners and filaments, in order to ensure that right holders receive a fair remuneration in exchange of consumers' acts of private copying.

The main drawbacks of such proposal are identified in, first, the possibility that Member States will not follow a common approach towards the devices to be levied and, second, the difficulty to predict the amount of copying undertaken by users themselves (i.e. by scanning and printing objects at home) and/or by entrusted intermediaries, and, consequently, the amount of levies required to adequately compensate right holders.

Also, the universe of right holders to compensate may be substantially vaster than right holders in the copyright context, and thus lead to the prospect of spreading the levies out too thinly across all the right holders.

Under EU patent law, the main question, addressed in chapter V, is whether and under what circumstances offering on a website a CAD file containing a patented product may be tantamount to an act of indirect infringement, pursuant to Article 30 CPC, i.e. a conduct that fulfils the conditions of providing the direct infringer with the means relating to an essential element of the invention for putting such invention into effect.

The first controversial point in that regard is whether the concept of "means", which has been interpreted by national courts as extending to software, may also encompass printable files. Secondly, there is quite some disagreement as to whether the CAD-based instructions to build a patented product must be included in the patent claim, in order to satisfy the requirement that the means must relate to an *essential* element of the invention.

Finally, whether a CAD file shall be regarded as a means that is objectively *suitable* for putting the invention into effect, and subjectively *intended* by the person supplied to achieve this purpose, is still far from settled.

It thus seems that the judiciary might be faced with interpretative quandaries concerning digital patent infringement. Arguably, the decision to expand secondary liability doctrines shall come within the competence of the legislator, whereas patent courts shall not be charged with such an arduous task.

The two U.S. doctrines of indirect patent infringement, namely contributory infringement and inducement, are also examined in detail, showing, in particular, the crucial role that the subjective element of knowledge plays.

Both induced and contributory infringements require that the alleged infringer has knowledge of the underlying patent and that infringement would result from his or her conduct.

Arguably, users and/or intermediaries that provide CAD files for download may lack the required knowledge of the patent claim, and ignore that the object that the file enables to print is patented.

Additional doubts concern the qualification of a CAD file as a "component" of a patented object, for the purposes of contributory infringement, especially when such file enables to print the whole product, not just a part thereof.

As for inducement, providing evidence of the indirect infringer's *intent* to induce infringement is also a cumbersome burden that hardly will be overcome in the context of digital patent infringement. As discussed, the accused infringer must appreciate the infringing nature of the induced acts and, by implication, have knowledge of the patent's existence. Furthermore, for induced infringement to occur, the distributor of the CAD file must take affirmative steps to encourage direct infringement.

Intermediaries that do not merely host infringing content on their websites, but carry out additional activities, such as promotional or informative campaigns, and/or fail to implement filtering tools or similar methods to combat infringement, most likely will be found liable as active inducers. Yet, what kind of persuasion is needed to commit “active” inducement remains unsettled at present.

When dealing with trademark law, in chapter VI, it is questioned whether 3DP platforms that are entrusted, on behalf of users, of the design, manufacture and distribution of 3D-printed objects shall be held (directly or indirectly) liable for trademark infringement, if the final printout bears an earlier trademark.

One may argue that intermediaries in charge of the whole production process in exchange for money shall be held *directly* liable for using, in the course of trade, a pre-existing mark, in relation to 3D-printed goods. By contrast, hosting websites that merely offer file-sharing services may be found liable as indirect infringers under national trademark law.

Yet, such platforms tend to secure themselves with explicit licence terms, exempting them from liability, in case the digital design and corresponding physical product infringe trademark rights.

To conclude, the current regulatory framework of different IPRs is not suited, in all respects, to address a new method of producing and distributing goods, conjured up by the expression “3DP”.

EU legislators should not leave the task of regulating the 3DP phenomenon to the judiciary. It is of utmost importance that policy makers discuss in detail any option for change at the earliest possible, acknowledging, on the one hand, the proprietary interests of right owners and, on the other, the needs of follow-on creators, the demands of users and the commercial interests of numerous start-ups that have just entered the market.

Even if certain aspects of IP law might need to be revised to fit in a new age of digital production and dissemination of all sorts of items, policy options must be elaborated on a vision that looks ahead, without predating technological development. We must look forward to ensure that effective legal rules reconcile with technological, cultural and economic progress.

Bibliography

Anderson, C. (2009), *The Longer Long Tail: Endless Choice Is Creating Unlimited Demand*, London: Random House Business Books.

Anderson, C. (2009b), *Free: The Future of Radical Price*, London: Random House Business Books.

Anderson, C. (2012), *Makers, The New Industrial Revolution*, New York: Crown Business.

Angelopoulos, C. (2012), *The Myth of European Term Harmonisation: 27 Public Domains for the 27 Member States*, International Review of Intellectual Property Competition Law, Vol. 43, No. 5, p. 567-594.

Antikainen, M.; Jongsma, D. (2017), *The Art of CAD: Copyrightability of Digital Designs Files*, in Ballardini et al., *3DP, Intellectual Property and Innovation – Insights from Law and Technology*, Amsterdam: Wolters Kluwer.

Aplin, T. (2009), *Subject Matter*, in *Research Handbook on the Future of EU Copyright*, edited by Estelle Derclaye, Research Handbooks in Intellectual Property, Cheltenham: Edward Elgar Publishing Ltd.

Aplin, T.; Davis, J. (2013), *Intellectual Property Law, Text, Cases and Materials*, 2nd ed., Oxford: OUP.

Bain, M. (2015), *Nike's COO Thinks we Could Soon 3D Print Nike Sneakers at Home*, Quartz, available at: https://qz.com/518073/nikes-coo-thinks-we-could-soon-3d-print-nike-sneakers-at-home/.

Ballardini, R. M.; Norrdgård, M.; Minssen, T. (2015), *Enforcing Patents in the Era of 3D Printing*, JIPL&P, Vol. 10, No. 11.

Ballardini, R. M.; Lindman, J.; Ituarte, I. F. (2016), *Co-creation, Commercialization and Intellectual Property – Challenges with 3D Printing*, EJLT, Vol. 7, No 3.

Ballardini, R.M.; Lee, N. (2017), *The Private And Non-Commercial Use Defence Revisited: The Case of 3D Printing Technologies*, in Ballardini et al., *3D Printing, Intellectual Property and Innovation – Insights from Law and Technology,* Amsterdam: Wolters Kluwer.

Barlow, J. P. (1996), *Declaration of Independence of Cyberspace*, available at: https://projects.eff.org/~barlow/Declaration-Final.html

Bayliss, C. J. (2014), *The Unitary Patent and Unified Patent Court: Potential Changes and Implications*, Mitchell Hamline School of Law, VOL. 5, Is. 2, Art. 3.

Bell, C. (2015), *3D Printing with Delta Printers*, 1st ed., Apress.

Bellia, M. (2016), *Comment on "Metalco" – "Top-Tier Design", Copyright Protection, and the Assessment of the "Artistic Value" Requirement Under Italian Law*, IIC – International Review of Intellectual Property and Competition Law, Vol. 47, Issue 7, pp. 875-881.

Benkler, Y. (2006), *The Wealth of Networks: How Social Production Transforms Markets and Freedom*, New Haven and London: Yale University Press.

Bensoussan, H. (2017), *Benefits of 3D Printing: Impossible Designs and Internal Channels,* Sculpteo blog, available at: https://www.sculpteo.com/blog/2017/01/18/3d-printing-benefits-impossible-designs-and-internal-channels/.

Bently, L.; Sherman, B. (2008), *Intellectual Property Law*, 3rd ed., Oxford: OUP.

Bently, L. (2012), *The Return of Industrial Copyright?*, European Intellectual Property Review 34: 654-672.

Bently, L; Sherman, B. (2014), *Intellectual Property Law*, 4th ed., Oxford: OUP.

Bertoni, A.; Montagnani, L. (2017), *Foodporn: Experience-Sharing Platforms and UGC: How to Make Copyright Fit for the Sharing Economy*, E.I.P.R. 2017, 39(7), 396-402.

Biggs, J. (2014), *MakerBot Responds To Critics Who Claim It Is Stealing Community IP*, Techcrunch blog, available at: http://techcrunch.com/2014/05/28/makerbot-responds-to-critics-who-claim-it-is-stealing-community-ip/

Blum, J.; Blair, S. (2017), *When is a Contribution Sufficient to Give Rise to Joint Authorship?* Kluweriplaw blog, available at: http://copyrightblog.kluweriplaw.com/2017/12/11/contribution-sufficient-give-rise-joint-authorship/.

Bolte, M. (2017), *Germany: Unfair Competition Remains Tough to Call for Design Cases*, World Trademark Review, available at: http://www.worldtrademarkreview.com/Magazine/Issue/67/Country-correspondents/Unfair-competition-remains-tough-to-call-for-design-cases.

Von Bomhard, V.; Geier, A. (2017), *Unregistered Trademarks in EU Trademark Law*, The Trademark Reporter, Vo. 107, No. 3

Bradshaw, S.; Bowyer, A.; Haufe, P. (2010), *The Intellectual Property Implications of Low-Cost 3D Printing*, Scripted, 7(1).

Brean, D. H. (2008), *Enough is Enough*: *Time to Eliminate Design Patents and Rely on More Appropriate Copyright and Trademark Protection for Product Designs*, 16 Tex. Intell. Prop. L.J. 325.

Brean, D. H. (2013), *Asserting patents to combat infringement via 3D printing: It's no "use".* Fordham Intellectual Property, Media & Entertainment Law Journal, Vol. 23, Is. 3, Art. 1.

Brean, D. H. (2015), *Patenting Physibles: A Fresh Perspective for Claiming 3D-Printable Products*, 55 Santa Clara Law Rev. 837.

Buccafusco, C.; Fromer J. C. (2017), *Fashion's Function in Intellectual Property Law,* Notre Dame Law Review, Vol. 93, available at: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2826201.

Caso, R.; Giovannella, F. (2014), *Balancing Copyright in the Digital Age: Comparative Perspectives,* Berlin: Springer.

Cass, W. (2017), *Rethinking Additive Manufacturing and Intellectual Property Protection,* in Ballardini et al., *3DP, Intellectual Property and Innovation – Insights from Law and Technology,* Amsterdam: Wolters Kluwer.

Chandler, D. C.; Salmi M. (2017), *Law and Technology of 3D Printing and Medical Devices,* in Ballardini et al., *3D Printing, Intellectual Property and Innovation – Insights from Law and Technology,* Amsterdam: Wolters Kluwer.

Chesbrough, H.; Bogers, M. (2014), *Explicating Open Innovation: Clarifying an Emerging Paradigm for Understanding Innovation,* Oxford: OUP.

Christie, A. F.; Wright, R. (2014) *A Comparative Analysis of the Three-Step Tests in International Treaties,* International Review of Intellectual Property and Competition Law.

Cook, T. (2013), *The Cumulative Protection of Designs in the European Union and the Role in such Protection of Copyright*, JIPR (18), pp. 83-87.

Cornish, W.; Llewelyn, D.; Aplin, T. (2007), *Intellectual Property: Patents, Copyright, Trade marks and Allied rights*, 7th ed., London: Sweet & Maxwell.

Cotropia, C. A. (2005), "*After-Arising" Technologies and Tailoring Patent Scope*, NYU Annual Survey of American Law, Vol. 61.

Daly, A.; Moilanen, J.; Lobato, R.; Allen, D. (2014), *Cultures of Sharing in 3D printing: What Can We Learn from the Licence Choices of Thingiverse Users?,* available at: http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2440027

Daly, A. (2016), *Socio-Legal Aspects of the 3D Printing Revolution*, Palgrave Macmillan.

Dagne, T. W.; Dubeau, C. (2016), *3D Printing and the Law: Are CAD Files Copyright-Protected*?, 28 IPJ 101.

Dama, S.; Chinmaye, A. (2016), *Printing a Revolution: The Challenges of 3D Printing on Copyright*, 84 Geo. Wash. L. Rev. Arguendo 68.

Dasari, H. (2013), *Assessing Copyright Protection and Infringement Issues Involved With 3D Printing and Scanning*, AIPLA Quarterly Journal, vol. 41, n. 2.

Derclaye, E. (2008), *The Legal Protection of Databases: A Comparative Analysis*, Cheltenham: Edward Elgar.

Derclaye, E. (2010), *Are Fashion Designers Better Protected in Continental Europe than in the United Kingdom? A Comparative Analysis of the Recent Case Law in France, Italy and the United Kingdom*, The Journal of World Intellectual Property, Vol. 13, no. 3.

Derclaye, E.; Leistner, M. (2011), *Intellectual Property Overlaps: A European Perspective,* Oxford: Hart Publishing.

Desai, D. R.; Magliocca, G. N. (2014), *Patents, Meet Napster: 3D Printing and the Digitization of Things*, The Georgetown Law Journal, Vol. 102:1691.

Di Cataldo, V. (2002) *From the European Patent to a Community Patent*, 8 Colum. J Eur. L. 19.

Dillon, S. (2014), *Infringement by Blueprint: Protecting Patent Rights in a World of Low-Cost 3D Printing*, 42 AIPLA Q. J 425.

Dimita, G. (2010), *Copyright and Shared Networking Technologies*, DPhil thesis, Queen Mary, University of London, available at: https://qmro.qmul.ac.uk/xmlui/bitstream/handle/123456789/1303/DIMITACopyrightAnd2010.pdf.

Dinwoodie, G. B. (2014), *Secondary Liability for Online Trademark Infringement: The International Landscape*, 37 Colum. J.L. & Arts 463 2013-2014.

Doherty, D. (2012), *Downloading Infringement: Patent Law as a Roadblock to the 3D Printing Revolution*, Harvard Journal of Law and Technology, Vol. 26, Num. 1.

Dolinsky, K. (2014), *CAD's Cradle: Untangling Copyrightability, Derivative Works, and Fair Use in 3D Printing*, Washington and Lee Law Review, 71(1).

Downes L. (2009), *The Laws of Disruption: Harnessing the New Forces that Govern Life and*
Business in the Digital Age, New York: Basic Books

Dratler, J; McJohn, S. (2006), *Intellectual Property Law: Commercial, Creative, and Industrial Porperty*, New York: Law Journal Press.

European Commission *Legal Review on Industrial Design Protection in Europe* (April 2016), under the contract with DG Internal Market, Industry, Entrepreneurship and SMEs, MARKTD2014/083/D.

Ebrahim, T. Y. (2016), *3D Printing: Digital Infringement and Digital Regulation*, Northwestern Journal of Technology and Intellectual Property, Vol. 14, Is. 1, Art. 2.

Elam, V. (2018), *Digital Single Market: a Long Way to Go*, IDP, Revista de Internet, Derecho Y Política, no. 26.

Elam, V. (2016a), CAD Files and European Design Law", JIPITEC – Journal of Intellectual Property Information Technology and E-Commerce Law, Is. 7(2), available at: https://www.jipitec.eu/issues/jipitec-7-2-2016/4439.

Elam, V. (2016b), *The Transfer of Computer-Aided Design Files in the Era of 3D Printing: Trademark Infringement Under the Current European Framework*, proceedings of the 12th International Conference on Internet, Law and Politics, Universitat Oberta de Catalunya:

“*Building a European Digital Space*.

Elam, V. (2018), *Tracing the Historical Roots of Collaborative Production: Emerging Challenges Posed by Three-Dimensional Printing*, proceedings of the 14th International Conference on Internet, Law and Politics, Universitat Oberta de Catalunya: *Collaborative Economy: Challenges & Opportunities*.

Europe Economics (2015), *The Economic Review of Industrial Designs in Europe*, a study commissioned by DG Internal Market and Services, MARKT/2013/064/D2/ST/OP.

Fabian (2017), *5 Mistakes to Avoid When Designing a 3D Model for 3D Printing*, i.materialise 3D Printing Blog, available at: https://i.materialise.com/blog/5-mistakes-to-avoid-when-designing-a-3d-model-for-3d-printing/.

Fabbio, P. (2015), *Contro una Tutela Autoriale “Facile” del Design. Considerazioni a Margine di una Recente Pronuncia della Cassazione Tedescs (Bundesgerichtshof, sent. 13 novembre 2013 – “Geburtstagszug”) e Brevi Note nel Diritto Italiano Vigente*, Rivista di Diritto Industriale, 45-70.

Finniss, G. (1964), *The Theory of “Unity of Art” and the Protection of Designs and Models in French Law*, 64 JPOS 615.

Finocchiaro, C. W. (2013), *Note, Personal Factory or Catalyst for Piracy, The Hype, Hysteria and Hard Realities of Consumer 3D Printing*, 31 Cardozo Arts & Ent. L.J. 473.

France, A. K. (2013), *Make: 3D Printing: The Essential Guide to 3D Printers*, Kindle Edition.

Galli, C.; Zama, A. (2014), *Stampa 3D, Una Rivoluzione che Cambierà il Mondo*, Bologna: Filodiritto Editore.

Gaubiac, Y. (1982), *La Théorie de l’Unité de l’Art,* 111 Revue Internationale Du Droit d’Auteur 2.

Gervais, D. (2012), *The Tangled Web of UGC: Making Copyright Sense of User-Generated Content*, Vanderbilt University Law School, Working Paper No 09-17.

Gervais, D. (2013), *The Derivative Right, or Why Copyright Law Protects Foxes Better than Hedgehogs*, Vanderbilt J. of Ent. And Tech. Law, vol. 15:4:785.

Gibb, A. (2015), *Building Open Source Hardware, DIY Manufacturing for Hackers and Makers*, Addison-Wesley Professional.

Gielen, C. (2014), *Substantial Value Rule: How it Came into Being and Why it Should be Abolished*, E.I.P.R., Is. 3 © Thomas Reuters (Professional) UK Limited and Contributors.

Gilbert, P. et al. (2016), *The Unified Patent Court and the Unitary Patent: Latest Developments*,
Practical Law, Thomson Reuters.

Ginsburg, J. (2000), Essay: *From Having Copies to Experiencing Works: the Development of an Access Right in U.S. Copyright Law*, in *U.S. Intellectual Property: Law and Policy*, Hugh Hansen editor, Cheltenham: Sweet & Maxwell.

Ginsburg, J. (2003), *The Concept of Authorship in Comparative Copyright Law*, 52 DePaul L. Rev. 1063.

Ginsburg, J. (2016), '*Courts Have Twisted Themselves into Knots': US Copyright Protection for Applied Art*. Columbia Journal of Law & the Arts, Forthcoming; Columbia Public Law Research Paper No. 14-526, available at https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2837728.

Ginsburg J. (2013), *Exceptional Authorship: The Role of Copyright Exceptions in Promoting Creativity*, Columbia Public Law & Legal Theory Working Papers, Paper 9205.

Ginsburg, J. (2018), '*Courts Have Twisted Themselves into Knots' (and the Twisted Knots Remain to Untangle): U.S. Copyright Protection for Applied Art after Star Athletica*, in *The*

Copyright/Design Interface, Past, Present and Future, edited by Estelle Derclaye, Cambridge: CUP.

Goldstein, P. (1970), *Copyright and the First Amendment*, 70 Colum. L. Rev. 983.

Goldstein P.; Hugenholtz B. (2013), *International Copyright: Principles, Law and Practice*, 3rd ed., New York: OUP.

Goldstein, P. (2017), *Goldstein on Copyright*, 3rd ed., Wolters Kluwer.

Grace, J. (2014), *The End of Post-Sale Confusion: How Consumer of 3D Printing Will Diminish the Function of Trademarks*, Harvard Law Journal of Law & Technology, No. 1.

Griffiths, A. (2013), *"4D-Printed" Shape-Changing Dress and Jewellery by Nervous System*, dezeen magazine, available at: *https://www.dezeen.com/2013/12/03/kinematics-4d-printed-shape-changing-jewellery-by-nervous-system/*

Griffiths, J. (2009), *The "Three-Step test" in European Copyright Law – Problems and Solutions*, I.P.Q. 428.

Griffiths, J. (2011), *Infopaq, BSA and the "Europeanisation" of United Kingdom Copyright Law*, Media & Arts Law Review, vol. 16.

Griffiths, J. (2013), *Dematerialization, Pragmatism and the European Copyright Revolution*, Oxford Journal of Legal Studies, Vol. 33, No. 4 (2013), pp. 767-790.

Grimmelmann, J. (2014), *Indistinguishable from Magic: A Wizard's Guide to Copyright and 3D Printing*, 71 Wash. & Lee L. Rev. 683.

Grunewald, S. (2016), *When eBay Sellers Try to Defend Their Illegal Sale of 3D Models from Thngiverse, Comedy Ensues*, available at: http://3dprint.com/120727/ebay-licensing-3d-models/.

Gupta, D.; Tarlock, M. (Farella Braun and Martel LLP) (2013), *3D Printing, Copyright Challenges, and the DMCA*, New Matter, Vol. 38, No. 3.

Hamari, J.; Sjoklint, M. (2016), *The Sharing Economy: Why People Participate in Collaborative Consumption, Journal of the Association for Information Science and Technology*, Journal of the Association for Information Science and Technology, Vol. 67, Is. 9.

Hamdi, K. (2015), *IP Law vs 3D Printing: the 5 Worst Examples*, Trinckle blog, available at: https://www.trinckle.com/blog/ip-vs-3dp/

Hartwig, H. (2014), *Germany: Conflict Between Design and Copyright Law*, World Intellectual Property Review, available at https://www.worldipreview.com/article/industrial-designs-in-germany-conflict-between-design-and-copyright-law.

He, K. (2017), *Regulating Terms and Conditions of Copyright Licences on the User-Generated Content 3D Printing Platform*, in Ballardini et al., *3DP, Intellectual Property and Innovation – Insights from Law and Technology*, Amsterdam: Wolters Kluwer.

Helberger, N. et al. (2009), *Legal Aspects of User Created Content*, available at SSRN: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=1499333.

Hoffmann, B.; Wiktorson, K., (2017), *Contributory Infringement in Europe – Before and After the UPC*, available at: http://www.managingip.com/Article/3727740/Contributory-infringement-in-Europebefore-and-after-the-UPC-sponsored.html

Holbrook, T. R. (2003), *Liability for the "Threat of a Sale": Assessing Patent Infringement for Offering to Sell an Invention and Implications for the On-Sale Patentability Bar and Other Forms of Infringement*, Santa Clara Law Review, Vol. 43, No 753.

Holbrook, T. R. (2006), *The Intent Element of Induced Infringement*, Santa Clara High Technology Law Journal, Vol. 22, Is. 3, Article 2.

Holbrook, T. R.; Osborn, L. (2015), *Digital Patent Infringement in an Era of 3D Printing*, University of California, Davis, Vol. 48: 1319.

Holbrook, T. R. (2016), *The Supreme Court's Quiet Revolution in Induced Patent Infringement*, 91 Notre Dame Law Review 1007.

Holder, N. (2006), *Indirect Patent Infringement – Latest Developments in Germany* EIPR, 28(9), 480-484.

Hugenholtz, B.; Senftleben, M.R.F. (2012), *Fair Use in Europe. In Search of Flexibilities*, Amsterdam Law School Legal Studies Research Paper No. 2012-39.

Hugenholtz, B. (2012a), *Works of Literature, Science and Art, in A Century of Dutch Copyright Law: Auteurswet 1912-2012*, Amsterdam: deLex.

Hugenholtz, B. (2016), *Something Completely Different: Europe's Sui Generis Database Right*, in *The Internet and the Emerging Importance of New Forms of Intellectual Property*, edited by Frankel and Gervais, The Netherlands: Kluwer Law International BV.

Hurst, N. (2013), *HBO Blocks 3-D Printed Game of Thrones iPhone Dock*, Wired Magazine, available at: https://www.wired.com/2013/02/got-hbo-cease-and-desist/

INTA 3D Printing Task Force (2017), *3D Printing: Key Legal Issues and Options for Change*, available at:
https://www.inta.org/Advocacy/Documents/2017/3D%20Printing%20Report%2027.09.2017.pdf.

Jasserand, C. (2011), *Creative Commons licences and design: Are the two compatible?*, JIPITEC 2.

Jones, H. R. (1990), *The Myth of the Idea/Expression Dichotomy in Copyright Law*, 10 Pace L. Rev. 551.

Kahn, A. E. (2018), *The Copyright/Design Interface in France*, in *The Copyright/Design Interface: Past, Present and Future*, edited by Estelle Derclaye, Cambridge: CUP.

Kaisi, A. (2014), *Finally a Single European Right for the EU? An Analysis of the Substantive Provisions of the European Patent With Unitary Effect*, EIPR, 36(3).

Katz, J. (2016), *Here's the Story Behind Katy Perry's Viral Left Shark,* billboard, available at: http://www.billboard.com/articles/news/6859524/katy-perry-left-shark-revealed-true-story-super-bowl/

Kenny, C. (2013), *How 3D Printing Will Impact Animation Off Screen*, The Animation Anomaly, available at: http://animationanomaly.com/2013/02/20/how-3d-printing-will-impact-animation-off-screen/.

Keyes, B. (2008), *Alive and Well: The (Still) Ongoing Debate Surrounding Conceptual Separability in American Copyright Law*, Ohio State Law Journal: Vol. 69, No. 1, 109-147.

Kitchin LJ; Floyd J; Arnold J; HHJ Birss QC (2012), "*Response to Consultation on Reform of the UK Designs Legal Framework*", available at: http://old.ipo.gov.uk/response-2012-designs-kitchin.pdf.

Knight, D. (2018), *The Wheels Come Off for Acacia*, available at: https://intellectualpropertyblog.fieldfisher.com/2018/the-wheels-come-off-for-acacia.

Kur, A.; Dreier, T. (2013), *European Intellectual Property Law: Text, Cases and Materials*, Cheltenham: Edward Elgar.

Latreille, A. (2009), *From Idea to Fixation: a View of Protected Works*, in *Research Handbooks in Intellectual Property Series*, edited by Estelle Derclaye, Cheltenham: Edward Elgar.

Lee, E. (2012), *Digital Originality*, Vanderbilt Journal of Entertainment & Technology Law, Vol. 14, No. 4.

Leistner, M. (2014), *Structural Aspects of Secondary (Provider) Liability in Europe*, JIPLP, vol. 9, No. 1.

Lemley, M. (1995), *Convergence in the Law of Software Copyright*, Berkley Technology Law Journal, Vol. 10. Is. 1, Art. 1.

Lemley, M. (1997), *The Economics of Improvement in Intellectual Property Law*, Texas Law Review, Vol. 75.

Lemley, M. (2014), *IP in a World Without Scarcity*, Stanford Public Law Working Paper No. 2413974.

Lessig, L. (2001), *The Future of Ideas, The Fate of the Commons in a Connected World*, New York: Random House

Li, P; Mellor, S.; Griffin, J; Waelde, C.; Hao, L; Everson, R. (2014), *Intellectual Property and 3D Printing: a Case Study on 3D Chocolate Printing*, JIPLP, Vol. 9, No. 4.

Lipson, H.; Kurman, M. (2013), *Fabricated: The New World of 3D Printing*, 1st ed., Indianapolis: Wiley.

Luepke, M. H. H. (2008), *Taking Unfair Advantage or Diluting a Famous Mark – A 20/20 Perspective on the Blurred Differences Between U.S. and E.U. Dilution Law*, The Trademark Reporter, vol. 98.

Macik, T. (2015), *Global Data Meets 3D Printing: The Quest for a Balanced and Globally Collaborative Solution to Prevent Patent Infringement in the Foreseeable 3D Printing Revolution*, Indiana Journal of Global Legal Studies, Vol. 22, Is. 1, Art. 9.

Madison, M. J. (2012), *The End of the Works as We Know It*, 19 J. Intell. Prop. L. 325 2011-2012.

Malaquias, P. (2014), *The 3D Printing Revolution: an Intellectual Property Analysis*, available at: http://papers.ssrn.com/sol3/Papers.cfm?abstract_id=2495416.

Manyika, J. Chui; M. Brown, B.; Bughin, J; Dobbs, R., Roxburgh, C.; Beyers, A. (2011), *Big Data: The Next Frontier for Innovation, Competition, and Productivity,* McKinsey Global Institute.

Margoni, T. (2013), *Not for Designers: On the Inadequacies of EU Design Law and How to Fix it*, JIPITEC 4(3).

Margoni, T. (2014), *The Digitisation of Cultural Heritage: Originality, Derivative Works and (Non) Original Photographs.* Available at SSRN: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2573104.

Margoni, T. (2016), *The Harmonisation of EU Copyright Law: The Originality Standard*, available at SSRN: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2802327.

Marzano, P. (2014), *An Ill Designed Protection for a Well Designed Product: Italy and its Copyright Protection of Industrial Design*, RIDA, Revue Internationale du Droit d'Auteur.

Masiyakurima, P. (2016), *Copyright in Works of Artistic Craftsmanship: An Analysis,* Oxford Journal of Legal Studies, Vol. 36, No. 3, 504-534.

Mazziotti, G. (2008), *EU Digital Copyright Law and the End-User*, Berlin: Springer.

McKenna, B. (2016), *3D-Printed Shoe Race: How Do Nike, Under Armour, and Adidas Stack up,* The Motley Fool, available at: https://www.fool.com/investing/general/2016/04/02/3d-printed-shoes-nike-underarmor-adidas-newbalance.aspx.

Mendis, D. (2014), "*The Clone Wars" – Episode 1: The Rise of 3D Printing and Its Implications for Intellectual Property Law – Learning Lessons from the Past?*, European Intellectual Property Review, Vol. 35, Is. 3, 155-169.

Mendis, D. (2014), *"Clone Wars" Episode II – the Next Generation: The Copyright Implications Relating to 3D Printing and Computer-Aided Design (CAD) Files*, Law, Innovation and Technology, 6:2, 265-281.

Mendis, D.; Secchi, D. (2015), *A Legal and Empirical Study of 3D Printing Online Platforms and an Analysis of User Behaviour*, Report Commissioned by the UK IPO, No 2015/41, Study I.

Mendis, D.; Reeves, P. (2015), *The Current Status and Impact of 3D Printing Within the Industrial Sector: An Analysis of Six Case Studies*, Report Commissioned by the UK IPO, No 2015/41, Study II.

Milchior, R. (January 12, 2015), *How to Prove If a Shoe is Protected by Copyright – and Who Owns It?*, JIPLP, available at http://jiplp.blogspot.it/2015/01/how-to-prove-if-shoe-is-protected-by.html.

Mimler, M. (2013), *3D Printing, the Internet and Patent Law – A History Repeating?*, La Rivista di Diritto Industriale, vol. 62, is. 6.

Minn, M. (2015), *Patenting in Europe: The Jurisdiction of the CJEU over European Patent Law*, Perspectives on Federalism, Vol. 7, Is. 2.

Moffat, V. (2013), *The Copyright/Patent Boundary*, 48 University of Denver Sturm College of Law, Legal Research Paper Series, Working Paper No. 13-29, available at: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2273840.

Negroponte N. (1996), *Being Digital*, London: Hodder and Stoughton.

Nordberg, A.; Schovsbo, J. (2017), *EU Design and 3D Printing: Finding the Right Balance in a New E-Ecosystem*, in Ballardini et al., *3DP, Intellectual Property and Innovation – Insights from Law and Technology*, Amsterdam: Wolters Kluwer.

Nimmer, M.; Nimmer, D. (1989), 3 *Nimmer on Copyright.*

Nordgård, M; Ballardini, R. M., Kasi, M. S. (2017), *Intellectual Property Rights in the Era of 3D Printing*, in Ballardini et al., *3D Printing, Intellectual Property and Innovation – Insights from Law and Technology*, Amsterdam: Wolters Kluwer.

Ohly, A. (2018), *The Case for Partial Cumulation in Germany*, *The Copyright/Design Interface, Past, Present and Future,* edited by Estelle Derclaye, Cambridge: CUP.

Ong, B. (2010), *Originality from Copying: Fitting Recreative Works into the Copyright Universe*, I.P.Q. 2010, 2, 165-191.

Osborn, L. (2014), *Of PhDs, Pirates, and the Public: Three-Dimensional Printing Technology and the Arts*, Texas A&M Law Review ISSN 10801-5449, Vol. 1.

Osborn, L. (2014b), *Ripple Effects in the Law: The Broadening Meaning of an "Offer to Sell" in Patent Law,* 17 Stanford Tech. L. Rev. 549.

Osborn, L. (2015), *Regulating Three-Dimensional Printing: The Converging Worlds of Bits and Atoms*, 51 San Diego L. Rev. 553.

Osborn, L. (2016), *Doctrinal Quandaries with 3D Printing and IP*, Summer 2016 American Bar Association's Intellectual Property Litigation Newsletter.

Osborn, L. (2016a), *3D printing and Intellectual Property*, in *Research Handbook on Digital Transformations*, Edited by Olleros and Zhegu, Edward Elgar.

Osborn, L. (2017), *The Limits of Creativity in Copyright: Digital Manufacturing Files and Lockout Codes*, Texas A&M University Journal of Property Law, Vo. 4, pp. 25-66.

Osborn, L. (2017a), *Trademark Boundaries and 3D Printing*, Akron Law Review, Vol. 50, No. 865.

Osborn, L. (2017b), *The Limits of Creativity in Copyright: Digital Manufacturing Files and Lockout Codes*, Texas A&M University Journal of Property Law, Vol. 4, pp. 25-66.

Oudersluys, B. (2018), *Following ClearCorrect: A Guideline for Regulating Digital Trade*, Berkley Technology Law Journal, Vol. 32, Is. 4, Article 15.

Owoeye, O; Adewale, M. (2016); *3D Printing and Patent Law a Balance of Rights and Obligations*, EIPR, vol. 38, no. 11.

Pang, W.; Burstall, R. (2012), *Sculpting an Effective Design Protection System*, JIPLP, Vol. 7, Is. 6.

Perlow, J. (2016), *The Patentability of Digital "Manufacturers" as 3D Printing Expands Into the 4D World*, Vand. J. Ent. & Tech. L., Vol. XIX:1:177.

Pihlajarinne, T. (2017), Non Traditional Trademark Infringement in the 3D Printing Context, in Ballardini et al., *3DP, Intellectual Property and Innovation – Insights from Law and Technology*, Amsterdam: Wolters Kluwer.

Pinckney, R. (2015), *Understanding the Transitional Provisions of the Agreement on the Unified Patent Court*, E.I.P.R. 268.

Pinz & Partners (2018), *An Update on the Unitary Patent*, available at: https://pintzandpartners.com/blog-1/2018/2/13/an-update-on-the-unitary-patent.

Phillips, J. (2015), *3D Printing and the Law: Three Recent Studies – and a Critical Review*, The IPKat, available at: http://ipkitten.blogspot.it/2015/05/3d-printing-and-law-three-recent_31.html.

Pila, J. (2008), *Works of Artistic Craftsmanship in the High Court of Australia: The Exception as Paradigm Copyright Work*, 36 Fed. L. Rev. 365.

Pila, J. (2010), *Copyright and Its Categories of Original Works*, Oxford Journal of Legal Studies, Vol. 30, No. 2, pp. 229-254.

Pila, J.; Torremans, P. (2016), *European Intellectual Property Law*, Oxford: OUP.

Pouillet, E. (1894), *Traité Théorique et Pratique de Propriété Littéraire et Artistique et du Droit de Représentation* and *Traité Théorique et Pratique des Dessins et Modèles*, 2nd ed., Marchal and Billard.

Poster, M. (1995), *The Second Media Age,* Cambridge: Polity.

Postman, N. (1992), *Technopoly: The Surrender of Culture to Technology,* New York: Knopf.

Quaedvlieg, A. (2009), *Overlap/Relationships Between Copyright and Other Intellectual Property Rights*, in *Research Handbook on the Future of EU Copyright*, edited by Estelle Derclaye, Cheltenham: Edward Elgar.

Quan, X. (2016), *Putting the Pieces Together: A Proposal For a Contributory Infringement Provision in Patent Law*, Chicago-Kent Journal of Intellectual Property, Vol. 15, Is. 2, Article 7.

Rahmatian, R. (2009), *Dealing With Rights in Copyright-Protected Works: Assignments and Licences,* in *Research Handbook on the Future of EU Copyright*, edited by Estelle Derclaye, Cheltenham: Edward Elgar.

Rahmatian, R. (2011), *Copyright and Creativity. The making of Property Rights in Creative Works*, Cheltenham: Edward Elgar.

Ranya T.; Striukova, L; Darlington, J. (2015), *Co-creation and User Innovation: The Role of Online 3D Printing Platforms,* Journal of Engineering and Technology Management 37, 90-102.

Redwook, B.; Schöffer, F.; Garret, B. (2017), *The 3D Printing Handbook, Technologies, Design and Applications,* 3D Hubs B.V., Amsterdam: The Netherlands.

Reichman, J. H. (1983), *Design Protection in Domestic and Foreign Copyright Law: From the Berne Revision of 1948 to the Copyright Act of 1976,* Duke Law Journal, Vol. 1983:1143, No. 6.

Reitinger, N. (2015), *CAD's Parallel to Technical Drawings: Copyright in the Fabricated World*, Journal of the Patent and Trademark Office Society, Vol. 97, No. 1.

Rendas, T. (2018), *Copyright Protection of Designs in the EU: How Many Originality Standards is Too Many?* JIPLP, Vol. 13(6).

Ricketson, S. (1999), *The Boundaries of Copyright: Its Proper Limitations and Exceptions: International Conventions and Treaties*, 1 Intellectual Property Quarterly 56-94.

Rickeston, S.; Ginsburg, J., (2006) *International Copyright and Neighbouring Rights: The Berne Convention and Beyond,* 2nd ed., Oxford: OUP.

Rickeston, S; Suthersanen, U. (2012), *The Design/Copyright Overlap: Is There a Resolution?,* in Wilkof, Basheer, *Overlapping Intellectual Property Rights*, Oxford: OUP.

Rideout, B. (2011), *Printing the Impossible Triangle: The Copyright Implications of Three-Dimensional Printing*, The Journal of Business, Entrepreneurship & the Law, vol. 5, is. 1.

Rifkin, J. (2014), *The Zero Marginal Cost Society: The Internet of Things, The Collaborative Commons, and the Eclipse of Capitalism*. Basingstoke/New York: Palgrave Macmillan.

Rimmer, M. (2017), *The Maker Movement: Copyright Law*, *Remix Culture and 3D Printing*, The University of Western Australia Law Review 51-84.

Rosati, E. (2013), *Originality in EU Copyright: Full Harmonisation Through Case Law*, Cheltenham: Edward Elgar.

Samuels, E. (1989), *The Idea-Expression Dichotomy in Copyright Law*, 56 Tenn. L. Rev. 321.

Samuelson, P. (1954), *The Pure Theory of Public Expenditure*, 36 Rev. Econ. & Stat.

Schroeder, J.E. (2008), *Brand Culture: Trade marks*, *Marketing and Consumption*, Trade Marks and Brands – an Interdisciplinary Critique, Lionel Bently *et al*. eds, Cambridge: CUP, 161-176.

Sedhom, R.V. (2015), *3D Printing and its Effect on the Fashion Industry: It's More Than Just About Intellectual Property*, 55 Santa Clara L. Rev. 865.

Sellens, M., (2018), *The Viability of the Unitary Patent Package After the UK's Ratification of the Agreement on a Unified Patent Court*, IIC, Vol. 49, Is. 2, pp. 136-152.

Shiller, D. (1997), *The Information Commodity: A Preliminary View*, in Jim Davis, Thomas Hirschl and Michael Stack (eds), *Cutting Edge: Technology, Information Capitalism and Social Revolution*, London: Verso.

Simon, M. (2013), *When Copyright Can Kill: How 3D Printers Are Breaking the Barriers Between "Intellectual" Property and the Physical World*, 3 Pace. Intell. Prop. Sports & Ent. L.F. 60.

Smith, D. (2015), *Can Unified Patent Court and National Laws of Infringement Diverge*? *An IPKat Dialogue*, available at: http://ipkitten.blogspot.it/2015/01/can-unified-patent-court-and-national.html.

Söderberg, J.; Daoud, A. (2012), *Atoms Want to be Free Too! Expanding the Critique of Intellectual Property*, TripleC Communications, Capitalism & Critique 10(1).

Solum L. B. (2008), *Models of Internet Governance,* University of Illinois, Public Law Research Paper, No. 07-25, available at: http://ssrn.com/abstract=1136825.

Sosa, F. (2015), *Politicalsculptor Retains Legal Representation and Responds to Katy Perry's Law Firm,* Political Sculptor blog, available at: http://politicalsculptor.blogspot.it/2015/02/politicalsculptor-retains-legal.html.

Spada, P.; Auteri, P.; Ghidini, G., *Industrial Design e Opera d'arte Applicata all'Industria (Dialogo tra Paolo Spada e Paolo Auteri Commentato da Gustavo Ghidini)* (2002), Riv. dir. civ., II.

Stamatoudi, I.; Torremans, P. (2014), *EU Copyright Law: A Commentary*, Cheltenham: Edward Elgar.

Suthersanen, U. (2010), *Design Law: European Union and United States of America*, 2nd ed., London: Sweet and Maxwell.

Synodinou, T. E. (2014), *Copyright Law: an Ancient History, a Contemporary Challenge*, in Research Handbook, Cheltenham: Edward Elgar.

Tapscott D., Williams A. (2008), *Wikinomics: How Mass Collaboration Changes Everything*,
London: Atlantic Books

The Economist (10 February 2011), *The Printed World*, available at: http://www.economist.com/node/18114221/.

Thompson, C. (2012), *Clive Thompson on 3-D Printing's Legal Morass*, Wired Magazine, available at: https://www.wired.com/2012/05/3-d-printing-patent-law/.

Thomson J. (2010), *Works of Artistic Craftsmanship: What is Happening in This "Formidable Area of Complexity"?,* EIPR, 32(3).

Torrone, P. (2013), *An Interview with MakerBot's Bre Pettis*, Makezine.com, available at: http://makezine.com/2013/12/03/stratasys-lawsuit-patents-and-more-an-interview-with-makerbots-bre-pettis/.

Tuomi, J.; Chekurov, S.; Partanen, J. (2017), *3D Printing History, Principles and Technologies*, in Ballardini et al., *3DP, Intellectual Property and Innovation – Insights from Law and Technology*, Amsterdam: Wolters Kluwer.

UK IPO (Revised March 2017), *Repeal of Section 52 of the Copyright, Designs and Patents Act 1988, Guidance for Affected Individuals, Organisations and Businesses*, available at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/585718/160408_guidance_s52_final_web_accessible.pdf

Urban, J. M., Karaganis, J., Schofield, B. (2017), *Notice and Takedown in Everyday Practice*, UC Berkley Public Law Research Paper No. 2755628.

Vallés, R. C. (2009), *The Requirement of Originality*, in *Research Handbook on the Future of EU Copyright*, edited by Estelle Derclaye, Cheltenham: Edward Elgar.

Van Caenegem, W. (2007), *Intellectual Property Law and Innovation*, Cambridge: CUP.

Van der Noll, R. et al. (2012), *Flexible Copyright, The Law and Economics of Introducing an Open Norm in the Netherlands*, SEO-report nr 2012-60.

Van Eechoud, M. (2012), *Along the Road to Uniformity – Diverse Readings of the Court of Justice Judgements on Copyright Work*, 3 JIPITEC.

Van Eechoud, M. (2014), *Adapting the Work*, in *The Work of Authorship*, edited by Mireille van Eechoud, Amsterdam: Amsterdam University Press.

Van Gompel, S.; Lavik, E. (2013), *Quality, merit, aesthetics and purpose: An inquiry into EU copyright law's eschewal of other criteria than originality,* RIDA, no 236, pp. 100-295.

Van Gompel, S. (2014), *Creativity, Autonomy and Personal Touch, A Critical Appraisal of the CJEU's Originality Test for Copyright*, in *The Work of Authorship*, edited by Mireille van Eechoud, Amsterdam: Amsterdam University Press.

Van Overwalle, G.; Reinout, L. (2017), *3D Printing and Patent Law a Disruptive Technology*, International Review of Intellectual Property and Competition Law, Vol. 48, Is. 5, pp. 504-537.

Victoria (2016), *Guide to CAD for CNC: What is G-code?*, Scan2CAD's blog, available: http://www.scan2cad.com/tips/guide-to-cad-for-cnc-what-is-g-code/.

Vitorino, A. (2013), *Recommendations Resulting from the Mediation on Private Copying and Reprography Levies*, available at: http://ec.europa.eu/internal_market/copyright/docs/levy_reform/130131_levies-vitorino-recommendations_en.pdf.

Von Bomhard V.; Geier, A. (2017), *Unregistered Trademarks in EU Trademark Law*, The Trademark Reporter, vol. 107(3).

Von Hippel, E.; von Krogh, G. (2003), *Open Source Software and the "Private-Collective" Innovation Model: Issues for Organization Science*, Organization Science, 14 (2), pp. 209-223.

Vuaghan, W. (2012), *Digital Modeling*, Berkley: New Riders.

Yanisky-Ravid, S; Kwan, K. (2017a), *3D Printing the Road Ahead: The Digitalization of Products when Public Safety Meets Intellectual Property Rights – a New Model*, Cardozo Law Review, Vol. 38, No. 3.

Yarksy, J. K. (2017), *Hastening Harmonization in European Union Patent Law Trough a Preliminary Reference Power*, Boston College International and Comparative Law Review, Vol. 40, Is. 1, Art. 7.

Waelde C. et al. (2016), *Contemporary Intellectual Property Law and Policy*, 4th ed., Oxford: OUP.

Wang, E. T. (2011), *The Line Between Copyright and the First Amendment and Why Its Vagueness May Further Free Speech Interests*, 13 U. PA. J. Const. L. 1471.

Wei, G. (2012), *Industrial Design Law in Singapore*, Singapore: Academy Publishing.

Weinberg, M. (2010), *It Will Be Awesome if They Don't Screw it Up: 3D Printing*, Public Knowledge, available at: https://www.publicknowledge.org/news-blog/blogs/it-will-be-awesome-if-they-dont-screw-it-up-3d-printing.

Weinberg, M. (2013), *What's the Deal with Copyright and 3D Printing*, available at https://www.publicknowledge.org/news-blog/blogs/whats-the-deal-with-copyright-and-3d-printing.

Weinberg M. (2013a), *Stratasys Sues Afinia: Ramifications for the Desktop 3D Printing Industry*, Make Magazine, available at: https://makezine.com/2013/11/27/stratasys-sues-afinia-ramifications-for-the-desktop-3d-printing-industry/.

Weinberg, M. (2015), *3 Steps for Licensing Your 3D Printed Stuff*, Washington: Public Knowledge.

Weinberg M. (2015a), *Why Katy Perry's Lawyers Just Jumped the Shark,* Make, Make Magazine, available at: http://makezine.com/2015/02/06/why-katy-perrys-lawyers-just-jumped-the-shark/.

Weinberg, M. (2016), *When 3D Printing and the Law Get Together, Will Crazy Things Happen?* Washington: Public Knowledge.

Weinberg (2017), *Copyright Implications of 3D Scanning*, in Ballardini et al., *3DP, Intellectual Property and Innovation – Insights from Law and Technology*, Amsterdam: Wolters Kluwer.

West, J.; Kuk, G. (2014), *Proprietary Benefits from Open Communities: How MakerBot Leveraged Thingiverse in 3D printing,* available at: SSRN http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2544970

Westkamp, G. (2007), *The Implementation of Directive 2001/29/EC in the Member States*, London: Queen Mary Intellectual Property Research Institute.

WIPO, Standing Committee on the Law of Trademarks, Industrial Designs and Geographical Indications, 9th session (11-15 November 2002), *Industrial Designs and Their Relation with Works of Applied Arts and Three-Dimensional Marks.*

WU, T. (2016), *An Introduction To the Law & Economics of Information*, Columbia Public Law Research Paper No. 14-399.