

Journal of Contemporary European Research

Volume 17, Issue 2 (2021)

Research Article

Foundations of Regulatory Choice: Precaution, Innovation...and Nonviolence?

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Citation

Baldoli, R. and Radaelli, C. M. (2021). 'Foundations of Regulatory Choice: Precaution, Innovation...and Nonviolence?' in, *Journal of Contemporary European Research* 17 (2): 186-204. <https://doi.org/10.30950/jcer.v17i2.1177>

First published at: www.jcer.net

Abstract

Two foundations of regulatory choice, precaution and innovation, co-exist in the political system of the European Union (EU). At the conceptual level the two foundations are complementary, and are both endorsed by the EU institutions, albeit in different ways and with different legal status. In the real-life of EU policymaking processes, however, precaution and innovation often become the terrain of polarised views anchored to technocratic or populist positions that erode trust in EU governance. We propose a way forward to this state of play. Instead of seeing the two foundations as opposite, we explore their dyadic relationship. We show that a conversation between the two is possible via an original reformulation of precaution and innovation. The reconciliation of precaution and innovation, we argue, is effective only in a context of social trust about the reconciled definitions. We propose the analytical and normative framework of nonviolence as seal of social trust. Nonviolence can assist the EU and its citizens in the path towards innovation that is socially responsible, future-proof and accountable. It can enhance precaution as internalised commitment of decision-makers as well as scientific and social communities.

Keywords

European Union; Innovation; Nonviolence; Precaution; Regulation; Scientific Research

In the post-pandemic scenario, foundations of regulatory choice under conditions of uncertainty require a renewed social trust. Ideological polarisation around the foundational principles of regulation is not only detrimental to sound policymaking, but also to social trust in governance and institutions. This is the starting point that motivates our article: how can we foster innovation in the post-pandemic recovery strategy, whilst at the same time exercising precaution in the face of radical uncertainty? This is not just a choice between principles, no matter how that choice might be. The confrontation between precaution and innovation can lead to ideological positions on risk regulation identified with populist and technocratic dystopias of European Union (EU) governance. To see how this may happen, we start with the foundations and then move to the possible, although we shall argue by all means not inevitable, connections with populism and technocracy.

Regulation often includes a delicate balancing act between positive and negative effects in a context of uncertainty. Policymakers face the choice of allowing behaviour (such as commercialising a new product) where the costs ultimately outweigh the benefits (false negative) or prohibiting something where the benefits would ultimately outweigh the costs (false positive). The precautionary principle intervenes in these cases by stating that, under conditions of incomplete knowledge and scientific incompleteness, regulators should stick to high levels of protection and give priority to concerns for the possible negative effects on the environment and health. This principle is Treaty-based and as such has an important role in EU public policy. If anything, this role has been magnified by the Covid-19 pandemic. As foundation of regulatory choice, precaution is more likely to accept false positives than false negatives (Majone 2002).

Over the last ten years or so, innovation as foundation of regulatory choice has emerged in the context of a major effort of the EU institutions to support growth and, today, the post-pandemic recovery and resiliency plan, and more generally the ambitions of the European Commission to drive the European economies and societies towards sustainable innovation and an ecological transition (Commission 2019b; Commission 2019a).

There are at least two different ways to frame innovation as foundational regulatory principle. One is to argue that all proposals have to pass a robust evidence-based test on their short-term and dynamic effects on innovation. Another is to re-think the role of regulation more broadly, as lever for innovation. Thus, regulations should be flexible and allow experimentations that support innovation (European Commission 2016; Council of the EU 2020) encouraging the EU to adopt sandboxes and experimentation clauses. In both formulations, innovation as policy foundation for regulation would lead regulators to avoid false positives as much as possible. The implications are therefore the opposite of those of precaution.

Since both precaution and innovation do not play out in vacuum, but in the political system of the EU, the two principles can be edited, translated and adopted by political ideologies. In its populist adaptation, precaution resonates with the fear of abandoning identities and traditional ways of life, distrust in vaccines and science, and the ordinary people's frustration with choices made exclusively on the basis of technical reason (Majone 2011). Instead, the necessity to promote innovation in a context of uncertainty, and therefore accepting that not all innovations will invariably produce net benefits, resonates with the fear of supposedly blind faith in science and progress typical of technocracy.

Although the formulation in terms of false positives and false negatives is somewhat aseptic, the appropriation of the two principles by political ideologies is incendiary. The scene for a clash between populism and technocracy is set. There are several elements of this scene that, as we shall explain below, have to be detailed and qualified. But the central conceptual argument in this article is that there is a way to accommodate precaution and innovation by considering nonviolence. Admittedly, this is not the most obvious choice, hence we will invest time in showing what nonviolence brings to this debate. Basically, we will argue that nonviolence leads to a reformulation of the two foundations of regulatory

choice that is less adversarial and less likely to become hostage to the populism-versus-technocracy confrontation.

We make the following claims in support of the central argument. First, we argue that the relationship between precaution and innovation is dyadic. Since the EU needs both, it is worth exploring the relationship between the two rather than the conditions under which one foundation of regulatory choice annuls the other. Second, this relationship is grounded on evidence. This does not mean supporting the technocratic rhetoric of 'evidence-based policy' unconditionally. Instead, it means pointing to evidence-informed and value-balanced decisions in directing precaution and innovation towards a politically and socially acceptable reformulation. Third, once reformulated with the aid of nonviolence, precaution and innovation achieve complementarity.

Indeed, we will argue that the social element to seal the reconciliation between the two principles is nonviolence. Although nonviolence is a topic often left to philosophers, divinity studies and scholars of social movements, it also has regulatory qualities. These qualities, we submit, add to the credibility and social resilience of the reconciliation we are looking for. Nonviolence implies self-regulatory principles, moderation, and consideration of the consequences of our actions for 'the other' - other living beings, the future generations and life on the planet. It induces scientists to think harder and deeper about the implications of disruptive innovation. It delivers on precaution in policy choice as well as fostering the capacity of societies to resist unjust regulations. In the end, we argue. nonviolence regulates the dyadic relationship between precaution and innovation, adding original qualities to each foundation.

We still have to motivate the choice of casting our argument and claims in the language of 'regulation'. First, it is exactly in the field of regulation, more precisely risk regulation, that the relationship between precaution and regulation has been mostly discussed (Wiener, Rogers, Hammitt and Sand 2011; Vogel 2012). Second, the EU has been characterised as a 'regulatory state' (Majone 1996) and an international public administration (Trondal, 2016) with specialisation on regulation (European Risk Forum 2019). We adopt 'regulation' not in the legal sense of secondary legislation but as policy type (different from distributive, redistributive, constitutional types of policy) that defines the characteristics of a policymaking process and its politics (Majone 1996).

In terms of organisation of the article, we first present the coordinates of precaution and innovation as manifested in the positions of the EU institutions and think tanks. Next, we connect the two foundations to the main topics that motivate the special issue, showing the pathway from regulatory principles to political ideologies. In the following sections we present our constructive proposal to go beyond the juxtaposition between precaution and innovation, enter nonviolence and show the implications of our choice. We conclude by re-connecting our findings to the themes of the special issue.

THE PILLARS OF HERCULES

The EU's 'regulatory state' can play an important role in bringing about the paradigmatic change to the sustainable, green, digital EU that, according to the official deliberations of EU institutions, should emerge from the post-pandemic recovery. And yet, how exactly can innovation and precaution be articulated in specific regulatory policy choices is a question that has led to tension, exemplified by emergency politics (White 2020) as well as thick, often irreducible political conflict, stalemate, and escalation of trade controversies (Tosun 2013; Majone 2000; Daviter 2018).

But where do precaution and innovation sit exactly in the legal and policy framework of the EU? Here some references to Treaties and official documents help. Precaution is enshrined (yet not defined) in Article 191 of the Treaty on the Functioning of the European

Union (TFEU) of 2013. This Treaty article refers to the environment, but its use has been expanded to public health, safety and even financial regulation.¹ The 2000 EC Guidelines state that the precautionary principle:

applies where scientific evidence is insufficient, inconclusive or uncertain and preliminary scientific evaluation indicates that there are reasonable grounds for concern that the potentially dangerous effects on the environment, human, animal or plant health may be inconsistent with the high level of protection chosen for the Community. (European Commission 2000: 1)

In order to decide which kind of regulatory measure to take, for example a moratorium on the exploitation of a given technological innovation in food or medical research, decision-makers must meet the requirements of being proportional, non-discriminatory, consistent with comparable measures already in place. Their decision must be anchored to an examination of benefits and costs of action and inaction. Further, this decision ought to be subject to review, and must carry out responsibility for producing future scientific evidence (European Commission 2000: 3).

The EU defined precaution in the year 2000. Instead, the innovation principle is the new kid on the block in terms of foundations of regulatory choice. The innovation principle was firstly developed by a pro-business think tank, the European Risk Forum (ERF 2011) with the aim of anchoring regulatory choice to the paradigm of evidence-based policy, dynamic efficiency and growth. The principle is defined by ERF (2015:3) as: 'whenever the EU's institutions consider regulatory proposals, the impact on innovation should be fully assessed and addressed'.

Thus, the ERF points to a specific stage of the EU policy process where the principle should be deployed. This is the stage of policy formulation. In the EU, policy formulation is a prerogative of the European Commission, which adopts impact assessment as single template to appraise a large number of economic, social and environmental impacts of different stakeholders and the environment. In a strong formulation, one could even argue that when the principle applies, the regulatory options considered in impact assessment should do no harm to innovation. Or, if harm is done, this should be justified by higher, demonstrable, social benefits.

In the last few years, the innovation principle has made progress in the EU institutions. It was officially discussed and endorsed by the Council of Competitiveness Ministers (Council of the EU 2016) and embraced by the 2019 Finnish Presidency high-level conference on innovation (Taffoni 2020). On 27 February 2020 the Competitiveness Council adopted Conclusions endorsing the innovation principle (reiterating the 2016 EU Council Conclusion), calling on the Commission to further determine its use (Council of the EU 2020).

Although the European Commission is not unconditionally persuaded by the innovation principle (Taffoni 2020), it has been open to a softer formulation of innovation as political priority. In *Better Regulations for Innovation-Driven Investment* (European Commission 2016) the Commission describes how flexible rules can encourage innovation – the 'regulation as driver of innovation' perspective mentioned above. Always within the Commission, its in-house think tank, the European Political Strategy Centre (EPSC) (2016), developed the connection between regulation and innovation in a note on *Towards an Innovation Principle Endorsed by Better Regulation*. For the EPSC the innovation principle is 'a positive obligation to facilitate innovation' (European Political Strategy Centre 2016: 7). This stronger claim, the EPSC observes, is anchored to an understanding of innovation as legal principle.

The innovation principle presupposes the political decision to embrace innovation as fundamental litmus test for the analysis of policy options. As we said, it gets close to a principle of 'do no significant harm to innovation'. This may well be the case, but why

innovation and not gender, human rights or other principles? Why focusing on one dimension without considering the balance between EU values that define the societal, environmental and consumer dimensions of EU policy (Garnett, Van Calster and Reins 2018: 10-11)?

Precaution can then deliver balance in regulatory thinking. There is no space in this article to rehearse the story of the principle, its possible interpretations (Gollier and Treich 2003) and the controversial applications to EU regulation (Alemanno 2007). In an effort to gain on clarity, the EU institutions have sought to reduce ambivalence by enshrining regulatory foundations in the legal framework of the EU. This was already done for precaution. Following the EPSC, the same could be done for innovation. In the end, no matter how much clarity can be provided by legal definitions, the EU would erect two rigid bastions defining the perimeter of EU regulation. Rigid limits exist to limit discovery and progress, not to encourage them. A bit like the two gigantic rocks (the pillars of Hercules) faced by Ulysses in Gibraltar in the version narrated by Dante, *Inferno*, XXVI. In the *Divine Comedy*, Ulysses urges his fellow travellers to sail past the pillars to gain knowledge.

PRECAUTION VERSUS INNOVATION: POPULISM VERSUS TECHNOCRACY?

In real-world EU politics, precaution and innovation are pitched one against the other. The evidence on policy controversies shows that the political usage of the precautionary principle leads to ideological and legal battles that dent the reputation of the EU as political system where values are balanced and evidence is taken into proper consideration (Tosun 2013; Majone 2000; Garnett, Van Calster and Reins 2018).

Indeed, the key problem is the political usage of regulatory principles, not something inherently anti-empirical in either precaution or innovation. After all, as we have seen, it is a question of judging false positives and false negatives. Yet the EU is a spectacularly inefficient arena for these ideological battles, with the added contradiction that the battles are fought 'in the name of evidence-based policy', as shown by the case of biotech regulation narrated by Falk Daviter (2018). When the Council, in 2016, endorsed the innovation principle adding (in a footnote) 'The Council recalls the Precautionary Principle' without further elaboration, it did not do much to solve the contradictions and entanglement of the foundations of regulatory choice. Ambivalence thrives in controversies about seemingly scientific arguments (Bogner and Torgersen 2018), such as legal cases in which the precautionary principle has been used to prevent the import of food products (Millstone, van Zwanenberg, Marris, Levidow, et al. 2004) or a general camouflage of political struggles behind the polysemic veil of cost-benefit analysis and impact assessment (Fischer 1990).

This political struggle leads to non-logical consequences because means and ends are completely disconnected. Concerning the precautionary principle, we find occasions in which new evidence showing safety of a new process or technique are not considered, for example the 2018 European Court of Justice decision on Clustered Regularly Interspaced Short Palindromic Repeats (Callaway 2018). At the same time, this juxtaposition contributes to further develop an adversarial legalistic EU regulatory style (Kelemen 2006), as shown by the cases of glyphosate, bisphenol A and endocrine disrupters.

How do these policy controversies fuel the battleground between populism and technocracy on science? This tension ties in with the themes of this special issue: distrust in elected politicians and the conflict between regulatory choices grounded in reason or in the 'will of the people' (Weale 2018). Distrust in science of the type voiced by populist narratives may connect with an approach to ecological issues that considers all major innovations like William Blake's 'dark satanic mills', as well as a lack of appreciation of the difference between hazard and risk. Populism, in the sense of listening to the 'will of the people' as interpreted by the charismatic party leader, is a narrative leading to EU dis-

integration and a political ideology that contrasts with democracy (Weale 2018). We are aware of the debate on the meaning of both populism, as ideology (Mudde 2014), discursive frame (Laclau 2005), style of rhetoric (Norris and Inglehart 2019), or a political strategy (Weyland 2017), and technocracy (see Bickerton and Invernizzi Accetti 2021). Whatever definition we choose, both terms refer to a particular disposition or posture towards policymaking under condition of risk.

The link between precaution-innovation and populism-technocracy is nothing new (see Majone 2011, 2002). Indeed, policy controversies on risk decisions fall on a terrain already prone to public scepticism (Gaskell, Allum, Wagner, Kronberger, et al. 2004; Gaskell, Stares, Allansdottir, Allum, et al. 2010), along with fear of choices made by unaccountable experts and non-elected regulators (Dunlop and Radaelli 2020). This builds up on what is already a clear 'risk aversion of regulators' (Majone 2002:412), leading to the danger of a populist refusal to compare costs and expected benefits in the presence of health risks.

On the innovation side, fear of public hostile reactions often leads institutions to an even more technocratic mode of governance (Papadopoulos 2013), choosing to shed their decisions behind emergency politics mantras of necessity and exceptional circumstances (White 2020). For what concerns the EU, its priority to make regulation more flexible and innovation-friendly may lead Brussels to repeat some of Washington's misunderstandings and misapplications. With reference to the US experience, Christie Ford (2017: 122) recalls propositions about regulation for innovation that are innocuous in theory but not in practice. In practice, she continues, the naïve approach 'allowed itself, sometimes, to be limited to a *technocratic conversation* that could be exploited in practice by political figures who neither appreciated nor valued its deep structure' (Ford 2017: 122, our emphasis).

The public is left to either bluntly trust (rare) or distrust even more experts, EU bureaucrats and politicians, arguably preparing the ground for techno-populism (Bickerton and Invernizzi Accetti 2021) and ideas such as proposing a housewife with three kids, instead of a 'economics professor', as minister of finance, because of the former 'better grasp of financial issues' due to her knowledge of family's finance (Bickerton and Invernizzi Accetti 2018: 140). This environment is far from optimal for the smooth, socially responsible development of science carried out in lively scientific communities. Indeed, the prospect is to carry out research and explore its technological implications in a climate of legal disputes, public anger and continuous political exploitation of scientific work for partial or party interest, bringing further divisions to the communities themselves.

And here we are today with the regulatory responses to Covid-19 (Alemanno 2020) and their balancing acts between public health and the economy, and between using regulation for innovation (Taffoni 2020) or adopting a more precautionary approach to deliver on sustainability. The dilemma is how to foster responsible innovation whilst at the same time exercising precaution (Ford 2017; Von Schomberg and Hankins, 2019). The EU regulatory state is not just a technical entity – its political properties include extensive delegation to non-elected decision-makers in a web of multi-level regulatory executive order (Trondal 2010). Yet, technocracy, that is leaving the balancing act between innovation and precaution to the experts, is a shortcut that is not politically viable (Dunlop and Radaelli 2020).

Thus, the question is: how to foster innovation in the post-pandemic recovery strategy, whilst at the same time exercising precaution in the face of radical uncertainty, without falling into populism or technocracy? Here we offer a vision of reconciliation between precaution and innovation. Contradictions, ambivalence and polysemic confrontations about precaution and innovation are ubiquitous in political life. We are not saying that they will disappear because of what we propose. Actually, we argue in a way we should accept confrontations but in a less ideological conversation between precaution and innovation. The point is to move the pendulum from confrontation to conversation. To achieve that, we must explore the dyadic relationship between the two foundations. At the core of this

relationship lies evidence, and therefore our work of reconstruction and reformulation will start from this concept.

BRINGING PRECAUTION AND INNOVATION BACK TO EVIDENCE

We set out to explore whether a dyadic relationship exists. Recall that, as adjective, dyadic describes interaction between two terms, not their opposition. For us, dyadic refers to the content and quality of this connection. Evidence, we argue in this section, is a central property of this relationship.

This is no surprise. In fact, already in the 2000 Communication of the European Commission (as well as regulation 178/2002 article 6 on the European Food Safety Authority) the principle of precaution is anchored to a set of evidence-based and science-based requirements that are compatible with innovation. The EPSC note adds that precaution is 'of particular importance for innovation, because especially at an early stage of a new technique or approach, the possibility of risk often cannot be ruled out' (European Political Strategy Centre, 2016: 3).

Logically, there has to be at least a minimum of empirical evidence leading to the conclusion 'we do not know enough' and opt for precaution. Now enter the jurisprudence of the World Trade Organization: regulators cannot simply go for unqualified precaution, otherwise the precautionary principle is equivalent to protectionism and consequently sanctioned (Majone 2000). Precaution should be used with qualifications. These qualifications are balancing acts where precaution is in active conversation with other foundations of regulatory choice. Innovation, as shown above, is emerging as one of these foundations. Conversely, if we were to argue that precaution and innovation are incompatible, we would conclude that the regulatory foundations of EU public policy contain a formidable paradox, such as 'follow this rule but also the negation of that rule'. There ought to be some degree of coherence in how the EU designs its regulations. Consequently, it is the connection between the two principles that deserves our attention.

But how exactly can the two principles come together? We do not have the general answer to this question. Yet we can at least explore the implications of a reformulation of the principles. The history of policy controversies in the EU shows that precaution is used politically to regulate, ban, limit, and prohibit. It is the weapon of those who say 'no'.

How about changing the conceptual angle, and draw on precaution in novel ways, and see when it is precautionary not to ban? This opens up the peripheral vision to some other notions of precaution, attenuating its totemic value of 'saying no'. Here is one example. Precaution suggests saying 'yes' instead of prohibiting or limiting scientific research. To move precaution to the other side, towards 'no', there has to be evidence. A reformulated precautionary principle can therefore state a new default condition, that is, that *the EU should not limit or prohibit scientific research unless there is evidence showing that the costs to humans and the environment outweigh the benefits of freedom of research*. Evidence becomes the 'quality test' in this reformulation. 'No' is possible only if sufficient evidence is produced.

On the basis of our reformulation research on embryos, assisted reproduction, psychedelics and genetic editing of plants should not be prohibited or limited. Another limitation is about time. Over time, the precautionary decision can be reversed, should evidence about costs become more compelling. Further, our reformulation is not an algorithm. Although we presented it in terms of utilitarian benefit-cost analysis, advocacy actors and discourse coalitions will always argue that there is or there is not sufficient 'evidence', and even contest the notion of what evidence is and is not. Our reformulation aims to handle contradictions and polysemy (see Cino-Pagliarello Forthcoming on the diffusion of polysemic ideas in the EU), not to eliminate politics.

We build symmetry between our argument for precaution with an original proposition about innovation. The innovation principle, as we said, is not a test like the others. It has been pushed forward by the business community to prioritise innovation. The possible recognition in the Treaties (and in any case its possible legal usages) means that its proponents see innovation as foundational to regulatory choice. Here again we can change the default condition and reduce the rigidity of this principle with the following proposition: *The EU should prioritise the do no significant harm to innovation in the impact assessment of regulatory proposals only when there is evidence that the benefits of doing so outweigh the cost to humans and the environment.* Again, innovation as foundation follows the precautionary foundation. It highlights the importance of evidence in defining the dyadic relationship. Anchored in evidence, innovation can be *in conversation with* instead of *in opposition to* precaution.

Going back to the themes presented in the introduction to this special issue, the two reformulations make it less likely that populists and technocrats deploy principles as weapons. The dyadic relationship exists because both foundations of regulatory choice are brought within the dimension of evidence. They leave room for values by making the balancing act more transparent, without any false hope of eradicating different legitimate visions of risk. Precaution and innovation are no longer free-floating political demands. Instead, they are taken in front of the tribunal of evidence and given a fair hearing before a decision pro or against a regulatory intervention is made.

There is an important caveat. These reformulations of precaution and innovation cannot work alone, as free-standing justifications. Social certification is necessary to seal the reconciliation. As shown in previous studies on risk and scientific knowledge (Wynne 1992), scientific knowledge is an activity which does not simply require more and more evidence. It also includes a process of reflexive learning about nature and human limitations (Wynne 1992: 115). Thus, science and innovation cannot prosper in a society without a serious reflection on personal responsibility, social commitments and conventions. Social certification relates to the legitimacy that undergirds our reformulations of the default conditions for precaution and innovation.

To put it bluntly, it is fine to balance and connect precaution and innovation: but why should citizens buy into that? What are the terms of this social contract? Imagine offering renewed trust to scientific research and easing the trade-offs between innovation and precaution, re-configuring them as dyad: what do citizens get back in exchange?

In the past, the answer to this question seemed simple: education. Governments have tried to educate the public about innovation and science by following the so-called deficit model (Ziman 1991; Sturgis and Allum 2004) in which the lack of trust in science is attributed to ignorance. Today, we know that scientific education, teaching statistics and economics to journalists and other approaches have their very valuable role to play. But the reasons behind lack of trust, affecting at different level EU member states during the current pandemic (Aksoy, Eichengreen and Saka 2020), are much deeper than ignorance, and the paternalism implicit in the deficit model can only make things worse.

At the same time, the answer cannot be reduced to deontological codes or a problem of ethics and principles of 'transference' of scientific evidence into policymaking, even though the latter is valuable, for example the Brussels Declaration (Euroscientist 2017). Perhaps in the EU, like in the USA, people have lost faith in expertise (Nichols 2017). Or perhaps not given the Covid-19 pandemic has witnessed many calls for more recognition of scientific findings when taking decisions about risk. Be that as it may, it cannot be a question of faith as mentioning faith in a discussion about evidence, expertise and science is an oxymoron.

We suggest nonviolence as social certification seal of the reconciliation we presented above. The construction of shared responsibility and social trust, the special issue

introduction reminds us, calls for new pathways to legitimise EU policy by bridging the 'gulf between 'populist' and 'technocratic' systems of knowledge production' (Foster, Grzymalski and Brusenbauch Meislová 2021).

NONVIOLENCE AS SOCIAL CERTIFICATION SEAL

There is no space here to rehearse the concept of nonviolence and its history (Mantena 2012; Jahanbegloo 2014; Baldoli 2019). We take nonviolence as a framework of action that includes both a set of techniques and a normative perspective that emerges when the desire to harm is eradicated (see Baldoli and Radaelli 2019 on the application of this definition to the EU). In a nutshell, our argument is that with nonviolence responsibility is not left in the hands of parties, ministers or 'the bureaucrats of the Commission' (not even left only in the hands of the Members of the European Parliament). Instead, responsibility for the consequences of actions (including EU regulations) is shared by scientific communities, individual scientists and citizens. The system is accountable and regulated by social, not legal, norms. Nonviolence provides the brake and gas pedals, reducing the legitimacy deficit of EU policy by considering jointly precaution and innovation.

What is nonviolence to do with science and innovation? To begin with, Gandhian nonviolence has an anti-deterministic position on science and technology: 'the technological process is inherently a social process that is integrated into political, social and economic contexts' (Ninan 2009: 186). Science and technology are not autonomous and pre-designed systems of knowledge. When science is not integrated in society, the result is economic exploitation and social disintegration (Ninan 2009: 187). Thus, Gandhi's problem was *yantravād* (indiscriminate mechanisation), but, crucially, not industry. The problem for him was not to fall into economic modes of production and trade which undermined human dignity. Innovation has qualities that score high in terms of dignity and better life, especially if we consider both technological and social innovation (Edquist 2017).

Let us now unpack nonviolence into techniques and normative pathways. In its most basic form, nonviolence refers to a set of techniques of action short of violence, from boycott to marches, from vigils to the establishment of parallel institutions. This set constitutes a basic accountability platform for encounters, dialogues and evidence-based contestation between citizens and scientists. Nonviolence contains techniques which can be used by citizens in order to express dissent without falling into violence (Sharp 1973; Nepstad 2015; Ackerman and Kruegler 1994). These techniques are already adopted to overthrow dictators (Popovic 2015; Chenoweth and Stephan 2011), fighting corruption (Beyerle 2014), designing national defence (Sharp and Jenkins 1990; Burrowes 1996) and defending human rights (Zunes 2000).

If anchored to nonviolence, contestation (even extreme) of evidence should not be perceived as threat by the scientific community. We can envisage a pluralistic EU where constellations of actors debate issues such as 'my numbers are better than yours'; 'we can use different instruments or policies to achieve the same result'; 'your assessment does not consider the benefits arising to future generations'; and 'where does your belief that this regulation will work come from?'. Given that the EU has limited democratic legitimacy, this pluralistic dialogue should perform better than any top-down attempt to 'educate' 27 different national cultures from above.

There are many examples of nonviolent techniques used to intervene on scientific research when some divisive/contrasted aspects emerge. They range from campaigns against nuclear testing and animal testing to specific studies on how to react to research and distribution of electroshock weapons, which ceased to be ways to reduce violence and become weapons to hurt (Martin and Wright 2003).

Yet, nonviolent techniques can also be adopted by scientific communities and individual scientists. The absence of EU bans on scientific research, as described in our reformulation of the precautionary principle, bestows a good deal of personal responsibility on scientists, including the duty to take risks. Such freedom may both unleash the potential of science as a tool of resistance (Crandall 2019), and encourage a scientist to become a civil disobedient. This is the first step towards bringing out the reflective capacity of scientists, as they too are also parents, citizens and children (Wilsdon and Willis 2004).

Nonviolent techniques to dissent have already been discussed both for global emergencies, such as the Covid-19 pandemic (Baldoli and Radaelli Forthcoming), climate change (Lemons and Brown 2011: 91), and for the day-to-day work of engineers (Schlossberger 1995; Boisjoly 1995). In extreme cases, a scientist may feel a duty even to become whistle-blower, or to risk his life testing on himself/herself a gene therapy, lacking the approval of the Food and Drug Administration, as it happened in the USA to the microbiologist Brian Hanley. We did not find similar episodes for the EU, although there are episodes of civil disobedience to EU law in the name of freedom of scientific research: in 2019 Marco Cappato (former MEP) and Marco Perduca (former Italian MP) disobeyed in public against EU limits to genetic plant editing and asked to be prosecuted (Science for Democracy 2019).

IMPURE PRAXIS TOWARDS FREEDOM AND PLURALITY

A limitation, though, exists. The empowerment of civil society with effective techniques to disobey and disrupt would not automatically lead to a better and more resilient EU. Our scenario may produce an even more divided EU, pushing to the extreme the clash between innovation and precaution. Divisions in society may bring back violence at a certain point, leading to the destruction of public experiments of GMOs in Europe (Kuntz 2012) or the questionable tactics of the Animal Liberation Front. The reason being that, in this scenario, the different actors are empowered to say 'no', without any focus on the constructive programme to navigate innovation. Neither social trust nor policy legitimacy would emerge.

For this reason, we propose a further step into nonviolence as normative framework, which offers such a constructive programme. Normatively, nonviolence is a relational approach, a mode of human togetherness. This mode of human interaction centres on an opportunity that all human beings have: people have the power to withdraw consent (Atack 2012) and to move from a condition of passivity, fear, anger, contempt, to a condition of love and courage (Nagler 2014: 47-49).

The rejection of passivity and the stress on personal responsibility are grounded in an original understanding of the human condition, and in particular the acknowledgment that human (and also non-human) life is interrelated. Humans are united by their fragilities, which means by pain, constitutive fallibility, and ineluctable death (Baldoli 2020:472). The perception of a link between people's suffering, along with the acknowledgment of human finitude, creates a condition of 'unity in fragility', which is the base for a new relationship between the actors of society, for a new praxis.

Unity in fragility is obviously reminiscent of what we experienced during the acute stages of the Covid-19 pandemic (Baldoli and Radaelli Forthcoming). More pertinently perhaps, it is an appropriate concept to frame the relationship between science and sustainability as well as for an EU where crisis management has become the new normal. Besides, in the EU the balance between unity and diversity is central, given the heterogeneity of cultures, national traditions, and approaches to science.

The acknowledgment of unity in fragility opens a practical opportunity for the different players involved. When a person recognises the connection and interdependence with the

others, she can decide to deepen it. She can choose an act of openness. She can choose to prioritise shared needs and aims over personal gains in a power-relation framework. This choice creates (factually, in real life) a different reality, which transcends the material bounds. It produces value and enhances both personal responsibility and social trust.

Let us now look at an implication of unity in fragility. Anytime a social actor (be it a scientist, a citizen, a firm, or a decision-maker) does not exploit the practical opportunity to face together human fragility, there is closure. The opportunity to create and live a better reality is lost. Grievances, mistakes and pain increase. Nonviolent scholars claim that violence begets violence. This is the case of destruction of crops or corporate irresponsibility; scientists hiding or even cheating on their research and data, or simply withdrawing from public discussion on the basis of a supposedly superior truth; or certain communities of scientists discouraging or limiting the articulation and representation of certain discourses (Azoulay, Fons-Rosen and Graff Zivin 2015).

Another implication points to praxis, a practical framework towards a change of reality (Mantena 2012). Indeed, praxis is the moment in which theory and practice are generated, and not something that follows them. In other words, praxis is the endless effort of the creation of values and of better practices. This matches the very endeavour and motivation of science, while at the same time it has potential for the legitimacy of the relationship between scientific modes of knowledge production and the citizens.

This praxis is and will always be *impure*, because nonviolence as praxis acknowledges, and actually proceeds from, human fallibility. Yet, imperfection should not discourage us. Nonviolence offers a framework to move forward, towards what Gandhi would call *swaraj* and *sarvodaya* (Gandhi 1997) and Aldo Capitini *liberazione* (liberation) and *apertura* (openness) (Baldoli 2019). Hannah Arendt (1998) called these two qualities of praxis freedom and plurality. Freedom is neither mere freedom to choose, nor a reduction to a life of pleasure; it is exactly the opposite of reducing human action into a passive follower of necessity (Bernstein 1977: 146). An action is free when it has the 'capacity to start something new' (d'Entrèves 1994: 66), when it is an interruption and a development of both the biological necessity embedded within natural life, as well as of the historical necessity. Within nonviolence, freedom is both self-restraint and practice to enhance personal responsibility.

Nevertheless, freedom cannot be achieved without plurality, without the others. We are not the exclusive masters of our actions. It is only through the other's sight and judgment that our action becomes a meaningful activity, overcoming the automatism of the natural process. This is equal to a recognition of both the possibility and need for human beings to understand each other, a crucial recognition in a hyper-diverse system like the EU. This 'quality' of praxis is cultivated by nonviolence through both actions of openness towards the others (made of forgiveness, reconciliation, avoidance of humiliation) and new practices of empowerment of everybody (both participation and inclusion).

DISCUSSION AND CONCLUSIONS

Nonviolent techniques to withdraw consent, non-cooperate and persuade others in society are the first step. Their potential is to generate EU legitimate practices to express disagreement without the destruction of the social fabric. Civil disobedience provides a powerful way to protect all the actors involved (citizens, scientists, the scientific community, and even institutions and businesses) from harassment or influence of powerful private interests (Landman and Glantz 2009), governments and other institutions, fostering transparency and openness.

The second step arises out of the *normative* framework. Unity in fragility fosters self-restraint and personal responsibility of scientific research and the process of innovation.

Freedom is widened: from freedom from external interference in the scientific mode of knowledge production to freedom to take charge of social and political implications of a choice. There are already examples around the world of different forms in which actors take this responsibility, from scientists² to citizens,³ from politicians to business⁴. By fostering practices of openness to the other and the enhancement of the power of everyone, nonviolence adds legitimacy, social trust and accountability via engagement and dialogue. The opportunity to create legitimacy exists in the early stages of policymaking, for example by widening the peripheral vision of regulatory impact assessments (Bice 2020). Upstream engagement includes commitment to transparency, access, open data, and hybrid forums (Callon Lascoumes and Barthe 2009).

The result of the development of this praxis of freedom and plurality is the blossoming of social trust within and among communities. Indeed, businesses, scientists, communities of science and citizens use their properties, wealth, ideas, talents for the service of society. They become *trustees*, at the service of society. This makes the conventional, advocacy-driven versions of the precautionary and innovation principles redundant and oppressive.

At the same time, this praxis represents fertile ground for the further development and diffusion of evidence-informed practices, our condition for the reformulation of the precautionary and innovation principles. The normative framework we presented calls for a new relation between science and society where decisions are created by balancing values and utilising a rich evidentiary base. Interestingly, this combination of robust evidence and balanced values is the trajectory suggested by a recent report of the European Academies (SAPEA 2019).

We are conscious of our limitations. We have presented a vision and corroborated it with examples and illustrations. In the post-pandemic stage, there is demand for science and societal interest for new visions, but we have not tested our framework against surveys of scientists, business or interest groups. Our vision will require further research on different mechanisms of accountability as well as on the role of EU institutions in such a bottom-up scenario. With these limitations, we have suggested a way forward: in our re-formulation, the principle of precaution protects innovation and the principle of innovation protects against fear and distrust. The challenge ahead is not to convene a new EU-wide intergovernmental conference to carry out the work. The challenge for citizens, individual scientists, the scientific communities, policymakers and (why not?) those who fund frontier research (König 2015) is to work together and to reinterpret current practices of precaution and innovation in a novel praxis. The Covid-19 crisis is already showing cases in which innovation is led by the empowerment and encounter of the different societal actors, such as the creation of apps to trace the virus and citizen science experiments to gain a better understanding of it.⁵ The challenge ahead is to gather and improve such socially robust experiments and practices of responsible innovation to deal with new crises and emergencies without falling into technocratic temptations and populist anger.

ACKNOWLEDGEMENTS

We wish to gratefully acknowledge support from the UACES Nonviolence Network (<https://www.uaces.org/networks/european-nonviolence-network>). We are also grateful to our reviewers, Monika Brusenbauch Meislová, Jan Grzymiski and Russell Foster and to all our friends in the UACES Limits of Europe network for their comments on an early draft, support and encouragement. Lorenzo Allio, Takuya Onoda, Lorna Schrefler, Jale Tosun kindly shared their views on the manuscript at different stages. Many thanks to Christopher Huggins for the editorial check. The usual disclaimer applies.

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ENDNOTES

¹ The TFEU states that 'Union policy on the environment shall aim at a high level of protection taking into account the diversity of situations in the various regions of the Union. It shall be based on the precautionary principle and on the principles that preventive action should be taken, that environmental damage should as a priority be rectified at source and that the polluter should pay'.

² Helen Caldicott is a physicist and writer working on nuclear and environmental crisis and advocating for citizens involvement and actions. See: <http://www.helencaldicott.com/about/>. Another example is Piero Giorgi, a biologist and neuroscientist who works on the cultural reasons for violence, as well as on the links between science and nonviolence (Giorgi 2009; 2001).

³ One example is citizen science, which has been adopted in fields such as biology, geography, and epidemiology. On the conception of citizen science as resistance see Kullenberg (2015).

⁴ There is currently a lack of debates on the meaning of nonviolence for business, but on the economy broadly defined see Cante and Torres (2019) and Schumacher (1993).

⁵ See for instance the different projects on Covid-19 at <https://www.citizenscience.org/covid-19/> as well as the Coronareport at <https://www.spotteron.net/projekte/coronareport-app>.

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