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Philosophy and the Precautionary Principle. Science, Evidence, and Environmental Policy

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granted decision-making power proportional to the strength of their claims. Regarding (a), the UNFCCC procedural rules were actually never adopted, and the process has since been governed by a norm of consensus decision-making (understood as the absence of an expressed veto). This could be conceived of as granting each party equal decision-making power. Though, it seems to grant greater power to those who prefer the status quo. It is clear that Svoboda does not think consensus decision-making is required for SRM, but then how do we go about aggregating the parties' equal influence? If, rather, we understand the appeal to the UNFCCC to imply (b) that all UNFCCC parties should be included in the decision-making process and be included according the varying strengths of their claims, then it is still unclear what determines the strength of each claim. This means we are still in the dark regarding *how* those identified parties ought to be included. Though, in Svoboda's defense, I should say that determining the strength of claims to participation in SRM decision-making is no small task.

Setting the issue of procedural justice aside, I want to at least mention the lack of discussion on what some consider a highly relevant ethical concern with geoengineering: namely, the idea of *respect for nature*. Now, perhaps it is unfair to press an author not on something he wrote, but rather on something he didn't. But, for a book focusing on the ethics of climate engineering, our ethical obligations to non-human nature (should we have any) are surprisingly not discussed at much length. It could be argued that – even if SRM were deployed by a virtuous climate engineer in accordance with appropriate norms of procedural and distributive justice – intentionally manipulating the climate is simply not the kind of thing we humans should be engaged in. Whether such a claim seems compelling is another issue. But an analysis of such a claim would seem to fit well within a book on the ethics of climate engineering, and some might find its absence curious.

These minor points notwithstanding, I thoroughly recommend the book. The geoengineering literature has at times been plagued by rather exceptional claims (Heyward, 2015) both for and against the technologies, and Svoboda does well to steer clear of such claims. It's also evident that he is neither advocating for nor against SRM research or deployment, but is rather being guided by 'the force of the better argument' (Habermas, 1984). Given geoengineering's controversial nature, it's clear that not everyone will agree with the conclusions Svoboda reaches. But it is similarly clear that *The Ethics of Climate Engineering* is a well-written, well-argued, and much needed piece in the normative discussion taking place around geoengineering.

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Philosophy and the Precautionary Principle. Science, Evidence, and Environmental Policy, by Daniel Steel, Cambridge, Cambridge University Press, 2015, xv + 256 pp., $99.99 (hardback), ISBN 978-1-107-07816-1

Should we reduce cell phone emissions to prevent possible cancer, even though the causal link has not been demonstrated? Should an allegedly unsafe vaccine be removed from the market? Can a modest carbon tax be considered as a good solution to the climate change issue? To these and similar questions, a principle has gained a large recognition in international treaties for a couple of decades: the precautionary principle (hereafter PP). The general idea it puts forwards is that when an activity can lead to a catastrophe for human health or the environment, policy measures should be taken to prevent it even if the cause-and-effect relationship is not fully established scientifically.

There is little consensus among scholars or society more broadly on PP, and it has been the target of many attacks. Among others, it has been accused of being ill-defined, vacuous, incoherent, or of stifling discovery. The ambition of Daniel Steel's book is large: by reassessing the various controversies surrounding PP, it aims at defending an interpretation of PP that survives them. For this, Steel's approach is philosophical, in the sense that he is primarily concerned with fundamental challenges of conceptual nature. This does not mean that his philosophical prose is abstract: it is informed by the sciences and a large number of concrete cases are discussed.

The first three chapters of the book are concerned with the formulation and the unity of PP. Steel introduces the precautionary controversy in chapter one. According to the literature, the central dilemma faced by PP is whether it should be interpreted weakly or strongly. In the former case, PP is taken to mean that 'uncertainty does not justify inaction in the face of serious threats' (p. 3), but then seems vacuous or trivial. In the latter case, PP requires precaution 'in the face of any scientifically plausible and serious environmental hazard' (p. 3), but it then seems incoherent and irrational, 'because environmental regulations themselves come with some risk of harmful effects and hence PP often precludes the very steps it recommends' (p. 3). Steel aims at a subtle path between these two extremes. The broad lines of his position are presented on pp. 9–10. He views PP as embodying three core themes: a meta-principle, which places general restrictions on what kind of decision rules can be used; a 'tripod', which specifies a specific *version* of PP: a knowledge condition and a harm condition trigger a specific recommended precaution; finally, a proportionality requirement between the harm condition and the recommended precaution.

Chapter two focuses on answering in detail the above-mentioned dilemma. For that, Steel develops his proportionality requirement, and he argues that PP can be viewed as a decision rule that chooses between specific policies. A favored formulation of PP of his is: 'If a scientifically plausible mechanism exists whereby an activity can lead to a catastrophe, then that activity should be phased out or significantly restricted' (p. 28). A formalization of the 'tripod' is offered in an Appendix, with an important uniqueness theorem about suitable versions of PP. In chapter three, Steel takes up the oft made objection that there is no such thing as *one* PP but instead a bunch of precautionary ideas, and he argues for a unified view of PP. He discusses its link with other classical decision rules like maximin or minimax regret.

Chapter four is devoted to the central question of how PP can be justified. Steel develops a historical argument based on the case of environmental policy: there have been 'many cases of prolonged and ultimately costly delays in response to serious environmental problems, while rushes to unnecessary and seriously harmful environmental regulation are relatively rare.' (p. 69). This calls for a corrective 'to move policy making on environmental matters toward greater balance' (p. 70). Steel defends this idea with novel arguments, by

arguing for the soundness of the historical induction, and by showing in detail that converse cases of excessive precaution have been rare or not very harmful.

Chapter five specifies what is meant by 'scientific uncertainty' in the formulation of PP. Steel argues against the traditional view that PP only applies when the possible outcomes are known, but not their probabilities (which corresponds to traditional case of decision under uncertainty). He suggests that 'scientific uncertainty be understood as the lack of a model whose predictive validity for the task in question is empirically well confirmed' (p. 101), which is thus a matter a degree.

PP involves weighing the interests of people in the present against those in the future, since it involves deciding whether present people should take costly precautions to avoid the risk of catastrophic harms in the future. Thus, it raises specific ethical questions known under the heading of discounting future harms and benefits, that chapter six considers. Steel argues for resorting to sequential plans, that is, 'plans enacted in stages over an extended period of time' (p. 143), which can embody an intergenerational impartiality.

Chapters seven and eight make the link between PP and the classical science and values debate in philosophy. Should value judgments in relation to human health or the environment influence scientific inferences? According to the value-free ideal, social or ethical values should not influence the reasoning of scientists. In chapter seven, Steel argues that an epistemic reading of PP demands to reject this value-free ideal. Chapter eight presents a values-in-science standard to replace it, and considers the case of uncertainty factors used in toxicology. Chapter nine recaps the central features of Steel's proposal, and applies it to case-studies on climate change, bovine growth hormone, and chemical regulation.

Overall, Steel fulfills his promise by convincingly arguing for a subtle path for PP between the weak and strong horns of the classical dilemma. He manages to defend a unifying picture of PP that brings much light both to PP itself and to previous misunderstandings of it. The book discusses an impressive range of literature on PP, but also connects the debates with relevant philosophical literature in philosophy of science, ethics and epistemology. Steel's argumentation is clear and reads well. The readability is also enhanced by the fact that formal developments are put in a valuable Appendix.

Although the book addresses several classical issues surrounding PP, I have closed it with the feeling that some 'big questions' on PP are still open, and future work on them would be welcome. My deceived expectations bear on the general scope of PP and its relation with other decision rules – what makes PP special in the decision theory framework. First, I would have liked PP to be situated in a broader decision theory picture. For instance, Steel discusses the link between PP and some standard decision rules, but not the link between PP and risk aversion – yet, a common-sense view is that being precautionary is in line with refusing to take risk. In traditional decision theory, a risk averse agent will for instance prefer a sure loss of $1 to a 50% chance of a $1000 loss together with a 50% chance of a $1000 gain. If losing $1000 is considered a catastrophe that the possibility of gaining $1000 cannot compensate, then it seems that PP would side with risk aversion here (or with ambiguity aversion, or perhaps with still other aversion), or at least that PP would be a natural extension of some aversions to the case where the probabilities of outcomes are not known (or where no predictive model is available, in Steel's view). Moreover, his general analysis of PP is that it comes under various versions that can be gradual. For instance, a medium harm could recommend a small precaution, and a greater harm a greater precaution – this nuanced position is interesting as it goes against some rigid and caricatured conceptions of PP that are assumed here or there. So, I would have liked to see a general discussion about a possible continuity between PP and traditional decision rules – is it meaningful to say that there exist some 'natural extensions' of PP to the risk domain? If no, is not it a problem? Can there be conflicts on limiting cases, and if so what should be done?

Another problem has to do with the scope of PP. In the book, Steel uses a scope for his PP which is much larger than the one he actually provides justification for in chapter four. There, his historical induction applies to a version of PP which is (i) for catastrophes, (ii) with a knowledge condition at the level of a plausible mechanism, (iii) on the topics of human health and the environment, and (iv) at the policy level. Yet, in his interpretation of PP, (i) the harm condition is flexible and he explicitly refuses to endorse 'catastrophe' as the only right one (p. 221); (ii) he also refuses to 'adopt any fixed evidential [knowledge] standard' (p. 38) for PP; (iii) he applies PP to preemptive war (p. 10 and 39); and (iv) he discusses the case of taking the decision to ride a motorcycle sans helmet (p. 59–61), as a *personal* decision. Beyond these cases, I think that Steel's book lacks more generally an extended discussion of the maximum scope of PP. Can a historical justification be found for more general features than the ones considered by Steel? Or can another kind of justification be worked out? To begin with, it seems natural to extend condition (iii) as more fields may be concerned by the historical induction. Economics, to which PP has been sometimes applied, could be a good candidate. One might easily argue to enlarge condition (iv): for instance, if I know I usually overestimate my ability to drive safely, then a historical induction could justify me in applying a corrective like PP *at my individual level*. Enlarging conditions (i) and (ii) will have to involve value judgments and ethical considerations. If the scope of PP is enlarged very much, the worry may be that precaution requirements will become overwhelming. This reinforces the need to reflect on the place of PP within broader decision theory, as indicated above.

A limitation of the scope of the book has to be acknowledged: Steel's thesis on what PP prescribes remains quite general. Although Steel conceives of PP as a decision rule which should select one policy among several ones, he argues *in fine* for a general family of 'versions' of PP, with various harm and knowledge conditions, and recommended precautions. As a consequence, it should be clear that Steel's proposal does not amount to a ready-to-use decision rule that could be applied without discussion, and without value judgments.

Despite these criticisms, I think Dan Steel has offered a very convincing philosophical piece on PP, in which he clearly argues that PP can be offered a non-problematic interpretation that solves alleged dilemmas. Steel engages with an impressive range of literature and issues related to PP, and his book will be of interest for philosophers of science, environmentalists, decision theorists or lawyers concerned with fundamental issues. Scholars already working on PP will have to take stand with his engaging analyzes, and Steel's book can also be considered as the new reference to start philosophical work on PP.

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