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The Precautionary Principle: A Dialectical Reconsideration

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ABSTRACT

This essay examines an overlooked element of the precautionary principle: a prudent assessment of the long-range or remote catastrophes possibly associated with technological development must include the catastrophes that may take place because of the absence of such technologies. In short, this brief essay attempts to turn the precautionary principle on its head by arguing that, (1) if the long-term survival of any life form is precarious, and if the survival of the current human population is particularly precarious, especially given contemporary urban population densities, and (2) if technological innovation and progress are necessary in order rapidly to adapt humans to meet environmental threats that would otherwise be catastrophic on a large scale (e.g., pandemics of highly lethal diseases), then (3) the development of biomedical technologies in many forms, but in particular including human germ-line genetic engineering, may be required by the precautionary principle, given the prospect of the obliteration of humans in the absence of such enhanced biotechnology. The precautionary principle thus properly understood requires an ethos that should generally support technological innovation, at least in particular areas of biotechnology.

Keywords: precautionary principle, public health, risk assessment, technological development

I. PRUDENT RISK-TAKING

The so-called precautionary principle raises a cluster of questions about how prudently to engage in risk-taking. All human activities involve risks. The development of new technologies is no exception. However, given a not-implausible account of the human situation, the unavailability of at least some biomedical technologies may itself count as a risk to continued human survival. This essay will examine an overlooked element of the precautionary

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principle: a prudent assessment of the long-range or remote catastrophes possibly associated with technological development must include the catastrophes that may take place because of the absence of such technologies. In short, this brief essay will attempt to turn the precautionary principle on its head by arguing that, (1) if the long-term survival of any life form is precarious, and if the survival of the current human population is particularly precarious, especially given contemporary urban population densities, and (2) if technological innovation and progress are necessary in order rapidly to adapt humans to meet environmental threats that would otherwise be catastrophic on a large scale (e.g., pandemics of highly lethal diseases), then (3) the development of biomedical technologies in many forms (some, such as human reproductive cloning or embryo research may be prohibited on moral grounds [Engelhardt, 2000]), but in particular including human germ-line genetic engineering, may be required by the precautionary principle, given the prospect of the obliteration of humans in the absence of such enhanced biotechnology. The precautionary principle thus properly understood requires an ethos that should generally support technological innovation, at least in particular areas of biotechnology.

II. PUTTING THE PRECAUTIONARY PRINCIPLE IN CONTEXT

There are a number of difficulties in making prudent assessments of risk. To begin with, intuitions vary widely about how to compare risks appropriately. There are some who regard a one-hour commercial flight with greater apprehension than a four-hour automobile journey to the same city. This is the case even though in general the risks are greater from the latter than the former. In part, this perception is grounded in the difference in psycho-social impact of learning about the death of 200 passengers in an airline crash versus learning of 200 automobile accidents in a year's time, each involving one fatality. The same number of people dying or being disabled at the same time usually has a more dramatic psycho-social impact than the same number being disabled or dying over a more extended period of time. So, too, were it the case that the number of individuals likely to be disabled or killed by nuclear power plant accidents were no greater than the number of persons likely to be disabled or killed by the generation of the same amount of electric power from the use of fossil fuels, the socially disruptive character of all of the deaths

happening at once appears to give this mass tragedy a weight greater than the sum of all the individual tragedies.[1] Intuitions that favor giving greater weight to concerns regarding airplane crashes and nuclear power plant accidents may contribute to the intuitions that are invoked to support the precautionary principle.[2]

In this essay, the precautionary principle is understood as the rule that one should never engage in a technological development or application unless it can be shown that this will not lead to large-scale disasters or catastrophes.[3] The possibility of a large-scale disaster or catastrophe is regarded as sufficient to prohibit the application of new technologies that offer considerable benefit to humans. In this sense, the precautionary principle is a variation of a principle of risk-aversiveness, so that one takes maximal regard of possible large-scale or catastrophic disasters, however remote and despite the benefits that might accrue from the technology. This understanding of the precautionary principle would constrain one to accept the likelihood of a number of deaths in order to avoid the remote possibility of even greater catastrophes.

For example, the precautionary principle has been invoked to prohibit the introduction of genetically modified organisms, until one can with a very high degree of certainty rule out the possibility of catastrophic outcomes. Those who embrace the precautionary principle would accept the starvation of millions in third-world countries who could be fed by genetically modified grains, rather than assume a very remote and very unlikely interruption of the ecological balance as a result of unexpected or unforeseen genetic effects as a result of genetically modified organisms.

Although the availability of genetically modified foodstuffs might aid the starving, this very important good would be seen to be outweighed by a possible, albeit unlikely, ecological catastrophe. New technologies are thus held to be guilty until proven innocent (Saunders, 2000). Marc Moreno who reports that according to a panel of food policy experts, the ban – on the basis of the precautionary principle – of genetically modified food (GM) has no scientific ground and causes starvation in the developing world (Moreno, 2002). In this vein, Goklany acknowledges that in order to meet food demands additional deforestation of millions of hectares will be required. In 1997, according to the Food and Agricultural Organization, it was estimated that already 1,510 million hectares were devoted to cropland and by 2050 an additional 1,600 million hectares of habitat land would be lost (FAO, 2000). He also notes that an annual increase of productivity of 2% (through the use of generically modified crops) would be translated into at least 422 million

hectares of cropland currently under plow that could be returned to nature or made available for habitat or other human uses, thus increasing environmental benefits (Goklany, 2001, pp. 30–32). He therefore concludes that, considering that the benefits related to the use of genetically modified crops outweigh the risks, biotechnology in agriculture can provide a means for addressing the problem of malnutrition around the globe without necessarily neglecting the environment. As he points out "the rewards of GM crops greatly outweigh their risks. Although it would be a mistake to go full steam ahead on GM crops, it would be a bigger mistake to stop them in their tracks. The wisest policy would be to go as fast as possible while keeping a sharp lookout, and staying on the track to improvements in human and environmental well-being" (Goklany, 2001, p. 56).[4] To proceed in this fashion would require reconsidering the implications of the precautionary principle as usually interpreted in order to take into account the potential damaging consequences of not promoting scientific and technological development.

Because of the difficulty of proving that new technologies will not involve unanticipated catastrophic outcomes, the precautionary principle if interpreted strictly, as shown from the example of policy responses regarding food from genetically modified crops, would seem to place an unjustifiable burden on all technological progress. It would not only appear to forbid anything but the most gradual introduction of most new technologies, but also give equal grounds for the suspension of technological interventions for which there has not been ample time to assess unforeseen risks.[5] For instance, one might hypothesize that a wide range of current pharmaceutical agents may carry with them unforeseen consequences for the development of senile dementia, etc. With a sufficiently active imagination one could bring much of contemporary biotechnology under suspicion without a ready ability to lift the cloud of uncertainty.

The concern to give proper weight to possible catastrophic outcomes is further augmented by discounting particular benefits, especially possible economic benefits. Among many of the proponents of the precautionary principles, there is a view either that it is improper to give any weight to economic benefits or that the importance of such benefits has been improperly inflated. Nancy Myers, for instance, claims that the World Trade Organization and the North American Free Trade Agreement "institutionalized . . . the ascendancy of commerce over environmental and public health concerns" and hence cost-benefit assessments, it is argued, dictate that products or technological innovations outweigh the costs of possible environmental harms (Myers, 2002, p. 214). If all consideration of economic benefits were removed from

cost-benefit calculations, a considerable burden would have been placed on the development of promising new technologies. This criticism of the weight to be given to economic benefits opens the larger issue of how to compare different genre of benefits and harms.

Finally, one must note that the precautionary principle is often interpreted so as to give equal if not greater weight to concerns with the environment in and of itself, not simply as harms to the environment may have indirect impacts on human welfare. Here the question is not simply of comparing benefits and harms, but the question of whose harms and benefits should be compared and in what way. That is, how is one to compare the possibility of harm to animals, ecosystems, and the environment with the possibility of harms and benefits to humans? This weighting of the environment, especially ecosystems in and of themselves, is noted by Alston Chase who asserts that the precautionary principle reflects concerns regarding benefits and harms that are biocentric[6] rather than humanistic or human-centered. As he puts it, ''biocentrism is the fundamental value conveyed in most treaties or protocols promoting the Precautionary Principle'' (Chase, 1997, p. 5). In these terms one can justify the starvation of millions of people for the sake of the well-being of the ecosystem.

The assessment of risks to the environment requires an account of how to compare harms and benefits to humans as well as to other living organisms and the environment generally. Such comparisons would require a complex account differentiating diverse benefits and harms as these have impact on humans, animals, ecosystems, and the environment in itself. Such rankings of goods and harms fall beyond a factual description of the consequences of particular technological interventions. It requires choosing one among a number of competing moral visions. This circumstance is stressed by Joe Thornton in his assessment of policies pertaining to environmental and health issues. He notes the obvious: the assessment of risk presupposes endorsing a particular vision that ranks harms and benefits with respect to interests in human versus environmental flourishing. In his volume, *Pandora's Poison: Chlorine, Health, and a New Environment Strategy*, he notes that ''I do not claim balance or objectivity, because these are neither appropriate nor possible in this kind of effort'' (Thornton, 2000, p. ix). Thornton recognizes the complex constitution of controversies involving a heavy political and moral overlay. To sort out such controversies, one needs to look with care at the geography of the different influences, as well as endorse a particular approach to weighting harms and benefits (Engelhardt & Caplan, 1987).

However one sorts out the proper assessment of harms and benefits, the cultural force of the precautionary principle would seem to place the burden of suspicion on technological innovation and progress, in that all innovative technological interventions carry with them an unassessable prospect of an unanticipated, large-scale, catastrophic side effect.[7] This conclusion would seem to follow, given intuitions that give a greater weight to possible significant catastrophic outcomes over equal but less catastrophic costs in human lives and suffering. This conclusion is further fortified by discounting economic benefits and adding a biocentric accent to the calculation of benefits and harms. All of this seems to lead to regarding the precautionary principle as hostile to biotechnological progress. This conclusion will now be brought into question.

III. THE NEED FOR RAPID RE-ADAPTATION OF HUMANS TO AN EVER-CHANGING AND OFTEN THREATENING ENVIRONMENT

Without addressing the issue of how to compare harms and benefits, one can bring into question the putative conclusion that the precautionary principle will under all circumstances place a burden against technological progress. The arguments developed below show that the precautionary principle, if properly understood, should support at least certain areas of biotechnological innovation, rather than constitute an impediment. In what follows, the focus is given to human welfare. With a few changes, the focus could be brought to bear on ecosystems as well. As developed, the argument does take into account concerns with the ecosystems insofar as they would constitute a threat to the long-range survival of the human species.

The long-range survival of humans depends on the capacity of humans to withstand threats from an environment often significantly hostile to the survival of humans, indeed, to the long-range survival of any species of organisms. Among those threatening elements are new viruses, new variations of old viruses, and bacteria that have become altered so as to be drug-resistant and/or toxic to humans in new ways. Similar threats to human survival can be envisaged in terms of viruses and other life forms that might threaten the human food supply and the environment. Given the network of rapid global travel, quarantine over any significant period of time is likely to be ineffective without a near total paralysis of international trade (see for instance the analysis of Bailey (2002) in relation to plant biotechnology). From Ebola and

AIDS to new forms of influenza and SARS, recent history has provided numerous possibilities for environmental confrontations that could lead to large-scale, indeed catastrophic, loss of human life.

The protean possibilities for future threats of a large-scale, indeed catastrophic magnitude, given a reasonable interpretation of the precautionary principle, would require the vigorous development of a biotechnology sufficient to produce not simply new antimicrobials and new vaccines, but able genetically to modify humans as well as the organisms that serve as foodstuffs for humans. Given the prospect of a catastrophic development of a hypervirulent microbe threatening either humans or their foodstuffs, the human ability both to kill such threatening microbes as well as rapidly to readapt humans and their foodstuffs to resist such threats would be obligatory under the precautionary principle. The precautionary principle should require vigorously supporting technological and scientific progress.[8]

This result is an important acknowledgement. There are two sides or dimensions of the precautionary principle. On the one hand, the precautionary principle requires considering the untoward consequences of new technological innovation. On the other hand, the precautionary principle requires considering the untoward consequences of not supporting technological innovation. In short, one must not only fear catastrophes that will flow from a technology, but also the catastrophes that will flow from its absence.

The question then is how to compare the two sides or dimensions of the precautionary principle. Which set of unforeseen, large-scale, and catastrophic consequences should be given greater weight and why? Possible catastrophes frame technology or frame its absence. To begin with, there are factual considerations. Given the recorded history of disastrous epidemics when communication among humans was less global than today, one might very well have grounds to tilt the balance in favor of giving greater weight to the unforeseen consequences likely to flow from the failure to accelerate biotechnological progress and encourage biotechnological innovation. Should such reflections on the history of the hostility of environments to organisms in general and to humans in particular be credible, then there would be a strong moral argument grounded in the precautionary principle in favor of sustaining a bias in favor of biotechnological progress and innovation. In this circumstance, the precautionary principle would need to be reinterpreted in order to be understood as substantively technology-friendly.

The greater the plausibility of bioenvironmental threats, the greater the obligation will be to encourage the development of an appreciation of

biomedicine and the biomedical technologies as core to the human enterprise. When the precautionary principle is combined with any moral vision that gives weight to obligations to future generations, then the biomedical technologies will be core to the human endeavor of ensuring the survival of the human species. In short, a more balanced appreciation of the precautionary principle should transform the principle from being central to an anti-technological ethos to a principle that when rightly understood is a cardinal foundation of an ethos supportive of biotechnological innovation. In addition, insofar as such innovation turns out as a fact of the matter to be enhanced by larger-than-usual profit-margins in the pharmaceutical and medical device industries, then one will wish to avoid forms of cost containment, tort liability, and tax policies that encumber profitability in this industry. In short, a more balanced consideration of the principle may shed important light on a broader range of risks associated with biotechnology, namely, those connected with a failure wholeheartedly to support it.

IV. THE ARGUMENT FROM IGNORANCE GOES BOTH WAYS

At the very least, this dialectical exploration of the precautionary principle shows its other side and excluded dimension, thus indicating one of the major difficulties involved with arguments from ignorance. Evenly applied, the precautionary principle invites us to give at least as much weight to the catastrophes we may face from not developing a certain technology as from developing the technology. Were one of the opinion that the historical record of devastating epidemics and other environmental changes was not sufficient to tip the balance vigorously in favor of technological innovation on the basis of the precautionary principle, then both appeals to ignorance would simply cancel each other out. In that case, the precautionary principle would be devoid of force.

It must be acknowledged that this analysis of the precautionary principle focuses on its application only in areas where it would bear on technologies whose unavailability could foreseeably lead to catastrophic human harms. Thus, there may be some (surely not these authors) who might be of the view that the precautionary principle should preclude the use of cell phones until the magnetic waves involved had been tested on primates for a sufficiently long period so as to assess the possibility of long-range adverse outcomes.

Were the precautionary principle to be employed to block the further use of cell phones, this concern might not be as easily outweighed by the health risks from the unavailability of cell phones.

This brief reflection leaves us with two conclusions, at least for some. First, a balanced appreciation of the precautionary principle leads to any unanticipated result: rather than setting cautionary blocks to biotechnological development, the principle should, given a number of plausible empirical assumptions, encourage biotechnological development. Second, if the factual assumptions necessary to tip the balance in favor of the precautionary principle as supporting biotechnological innovation are brought into question, then the default position will be to deprive the principle of any credible force, at least in a significant range of biotechnologies. Either the precautionary principle means something that most have not anticipated (i.e., it is technology-friendly), or, at least in many areas, it is rendered void by the possibility of contrary catastrophic possibilities.[9]

NOTES

1. For a critical appraisal of risk assessment with regard to nuclear power, see MacLean (1987).
2. The precautionary principle has roots in the German *Vorsorgeprinzip* ('foresight-planning'), which constitutes, according to Julian Morris, ''a founding principle of German environmental policy in the mid-1970s'' (Morris, 2000, p. 1). Morris, however, points out that in the United States the precautionary principle has implicitly been used since the 1950s, especially by political conservatives groups that opposed the fluoridation of water. The argument was two-fold: first it was argued that fluoride was used as rat poison and second this involuntary mass medication was ''a step on the road to socialism.'' (Morris, 2000, p. 2). In the 1960's, the same precautionary principle was implicitly used by left-wing activists to oppose nuclear power. Finally, in the 1970s social scientists referred to the principle in a more general framework. For an overview of the definition and origin of principle see Morris (2000, pp. 1–21).
3. The precautionary principle can be found under many forms in different treaties such as the Montreal Protocol, the Convention on Biological Diversity, the Helsinki Convention on Marine Protection in the Baltic, the Treaty on The Precautionary Principle by the European Union, the Biosafety Protocol and the Treaty on Persistent Organic Pollutants. One of its most influential statements is found in the Rio Declaration on Environment and Development (1992). Principle 15 requires that ''in order to protect the environment, the precautionary approach shall be widely applied by States according to their capabilities. Where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation.'' Available [On-line]: http://sedac.ciesin.org/pidb/texts/rio.declaration.1992.html

Another influential statement, The Wingspread Statement, which followed a gathering at Wingspread in 1998 (headquarters of the Johnson Foundation in Racine, Wisconsin), likewise presents a strong endorsement of the precautionary principle in public health and environment decision-making. It states ''while we realize that human activities may involve hazards, people must proceed more carefully than has been the case in recent history. Corporations, government entities, organizations, communities, scientists and other individuals must adopt a precautionary approach to all human endeavors. Therefore, it is necessary to implement the Precautionary Principle: When an activity raises threats of harm to human health or the environment, precautionary measures should be taken even if some cause and effect relationships are not fully established scientifically. In this context the proponent of an activity, rather than the public, should bear the burden of proof. The process of applying the Precautionary Principle must be open, informed and democratic and must include potentially affected parties. It must also involve an examination of the full range of alternatives, including no action.'' A full version of the Wingspread Statement is available on-line: http://www.sehn.org/state.html

4. For further details, see Goklany's chapter on ''The Risks and Rewards of Genetically Modified Crops'' (2001, pp. 29–56).
5. Risk assessment remains at the core of the discussions surrounding the precautionary principle. Some proponents of the principle, Peter Saunders and Mae-Wan Ho, for instance, argue that it is based on good science and therefore ''a compelling case for the application of the precautionary principle'' can be made that the precautionary principle can be used to protect the environment and human health (Saunders & Ho, 2003). Interestingly, however, in the first edition of the handbook on the precautionary principle written for the Science and Environmental Health Network, the authors acknowledge that ''risk assessment and other 'sound science' approaches to decision-making are highly reliant on policy and scientific assumptions, which are frequently unscientific or subjective'' (Tickner, Raffensperger, & Myers, p. 14). Chase likewise notes that the precautionary principle is unreliable as ''a means of making quantitative assessments of alternative courses of action'' and ''does not provide . . . a calculus by which to weigh and compare economic costs against ecologic benefits, or *vice versa*'' (Chase, 1997, p. 5).
6. Biocentrism involves ''The belief that . . . the Biosphere or ecosystem takes precedence over the well being of humanity'' (Chase, 1997, p. 5).
7. A good example of some of the values underlying support for the precautionary principle is found in a document issued in September 2001 by the Canadian government (Government of Canada, 2001). Although the document does not constitute an official position of the government (it is only a discussion paper), it reflects cultural assumptions concerning technological innovations and progress widespread in Canada. The document raises the question of the need for regulations at the national and international level, and it emphasizes risk management, especially in relation to new technologies (such as biotechnology, for instance). These two concerns characterize public suspicion of technological development while, at the same time, paradoxically, desiring the benefits of new technologies: ''Public opinion surveys show that Canadians want to reap the benefits of change (e.g., biotechnology), but they also want their governments to protect them from the risks. As a result, governments are often called upon to balance new or emerging risks and potential opportunities [technological innovations and progress], and to manage issues where there is significant scientific uncertainty. The decisions they make can have profound effects on societies, trade and economies'' (Government of Canada, 2001, p. 1). For a general assessment of the document see Lee and Barrett (2002).

8. Further reflections are needed with respect to the role of risk-taking in scientific progress. This issue goes beyond the scope of this short note. Space exploration illustrates the difficulty in evaluating the exact nature of proper risk assessment. Space exploration may at first blush appear to offer only ''limited'' benefits in biotechnology at the price of potential dangers for the people involved in it and the rest of the population (the risk of the crash of a space shuttle in inhabited areas is real, as the breaking apart of Columbia as shown). An application of the precautionary principle as usually understood, considering the calculus of risks and benefits, would simply stop any such undertakings.
9. For a critical assessment of the precautionary principle see Morris' *Rethinking Risk and the Precautionary Principle* (2000). The contributors to this volume address a variety of issues in relation to precautionary thinking and conclude that the principle has become an arbitrary imposition of regulations that are mostly counterproductive. In other words, the precautionary principle appears to be a rhetorical device unable to provide concrete guidance but with untoward consequences. As Chauncey Starr remarks ''the precautionary principle exists only as a rhetorical statement; it provides no useful input to decision making. Expert opinions should be sought, but be recognized as conservatively biased. The search for science-based guidance is commendable, but is rarely achievable'' (2003, p. 3).

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