Proposal for a Fragility-Based or 'Conditional' Precautionary Principle (Technical Summary)

By Rupert J. Read and Nassim N. Taleb

Problem: The precautionary principle — because of its vagueness and of appeals to the sensationalism of extreme situations — can seemingly be invoked to justify anything, mostly inaction (we don't know the unintended consequences), but also action (we will 'blow up' otherwise and so need to intervene). It has been criticized in the philosophy, economics, and risk management literature. Here we propose methods to distinguish between situations where it makes sense to invoke it and others.[1]

These situations are situations concave to "meta-model" or "metaprobability". We call them "fragile" to metamodel.

Summary of Proposed Solution: Whenever there is concavity to metamodel, or fragility, we deem the precautionary principle necessary to uphold.

Extension 1, Via Negativa: the removal of a stressor or a harmful substance (say smoking for the human body or pollution in the environment) reduces concavity to metamodel.

Extension 2, Asymmetry of "Evidence". The burden of the proof of absence of harm lies on the concave "fragile" side.

Heuristics: This approach generates fast-and-frugal (but rigorous) heuristics, which can be superseded by other heuristics.

Definition: Metamodel or metaprobability corresponds to taking an existing model f(X|p) with quantitative output from input variable X and parameter vector p, and perturbating each of the variables (jointly or separately) to gauge the effect on the output. If the effect is accelerating, it is deemed concave (in the presence of harm) and convex (when there are benefits).

Metamodel can also (and centrally) correspond to taking a model that uses probabilities and changing the probabilities —both methods are equivalent (by the transfer theorem).[2]

The key is that concavity to harm indicates fragility to both shocks and model error. These are situations of accelerating harm, easily detected mathematically, in the sense that the left-tail of the distribution swells in response to small changes of parameters.

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[1] In those situations where it makes sense to invoke it, of which (we imply in n.2, below) there are very many, it is, when understood aright, essentially immune to the criticisms standardly made of it, as we shall explain in detail in a future non-technical presentation.

[2] One can use a metamodel by taking a situation called "Knightian risk", and, by making probabilities subjected to a probability distribution, turn it into a situation of "uncertainty". But we transcend the classical distinction by considering that "risk" is only a degenerate (or Dirac) metaprobability. "Risk" in

[2] One can use a metamodel by taking a situation called "Knightian risk", and, by making probabilities subjected to a probability distribution, turn it into a situation of "uncertainty". But we transcend the classical distinction by considering that "risk" is only a degenerate (or Dirac) metaprobability. "Risk" in the standard sense only exists in situations where the metaprobability reduces to one. (Alternatively, our point here could be put in this way: "Risk" is a (relatively rare) sub-class of "uncertainty", and nothing more.)