Rational Choice before the Apocalypse

Jean-Pierre Dupuy

Ecole Polytechnique, Paris
& Stanford University
jpdupuy@stanford.edu

A linguistic prefatory note

The German word "*bestimmt*" is fundamentally underdetermined.(1) It can mean "*festgelegt*," that is, "determined," "resolute"; or it can mean "*gewiß*," "certain," "sure"; or it can mean "*genau*," "precise," "specified," "explicit." When Werner Heisenberg chose to call his famous principle the "*Unbestimmtheitsrelation*," it was a stroke of genius: thanks to the indeterminacy of the German terminology, he did not have to choose which interpretation of quantum physics was better: uncertainty or indeterminacy. The difference is essential, however: uncertainty refers to the *epistemic* domain, that is, our knowledge about the system under observation, whereas indeterminacy refers to the *ontological* domain, that is, things as they are. In French and in English, we are not so lucky and we do have to choose. Most often, Heisenberg's principle is called the "Principle of Uncertainty," rather than the "Principle of Indeterminacy." My own interpretation of quantum theory would lead me to prefer the latter, but that is not the question. We are not here to talk about quantum theory but about human affairs.

1. Facing up to catastrophe

My topic is the *indeterminacy* regarding the survival of humankind. With the advent of the atomic bomb, humankind became potentially the maker of its own demise. In a recent stunning book, England's Astronomer Royal, Sir Martin Rees, who, incidentally, occupies Newton's chair at Cambridge University, forecasts that the odds are no better than fifty-fifty that humankind will survive to the end of the twenty-first century. The title of the book is explicit, and the subtitle even more: *Our Final Hour. A Scientist's Warning: How Terror, Error, and Environmental Disaster Threaten Humankind's Future in this Century–on Earth and Beyond(2)*. Sir Martin warns us: "Our increasingly interconnected world is vulnerable to new risks, 'bio' or 'cyber,' terror or error. The dangers from twenty-first century technology could be graver and more intractable than the threat of nuclear devastation that we faced for decades. And human-induced pressures on the global environment may engender higher risks than the age-old hazards of earthquakes, eruptions and asteroid impacts." Sir Martin is by no means isolated in his warning. Already in 2000, someone who is anything but an irresponsible leftist, Bill Joy, one of the most brilliant American computer scientists, wrote a

celebrated and much commented upon paper titled “Why the future doesn’t need us. Our most powerful 21st-century technologies–robotics, genetic engineering, and nanotech–are threatening to make humans an endangered species.”(3)

Even if one is less pessimistic than those two major scientists, it remains true that our way of life is in the long run irremediably doomed. One would be hard-pressed to imagine how it could last more than another half-century. Many of us will no longer be here, but our children will. If we care about them, it is high time that we open our eyes to what awaits them. There are three main reasons for this prognosis.

Firstly, the time when we could exploit cheap fossil fuels will soon be over, given that energy needs on a world scale are going to grow very fast if countries as populous as China, India, and Brazil follow us down the same development path. It is hard to see by what means or on what grounds we could stop them.

Secondly, the regions of the world where these resources are concentrated happen to be among the hottest on the planet from a geopolitical standpoint: the Middle East and the former Muslim republics of the ex-Soviet Union. Once these first two factors are widely recognized, no doubt quite late, that is to say too late, the world will be gripped by panic and prices will skyrocket, exacerbating the crisis tremendously.

The third reason is surely the most serious. Not a week goes by without a new symptom of climatic change confirming what all the experts now agree to be the case: global warming is real, it is essentially due to human activity, and its effects will be much more severe than what we imagined only yesterday. The experts realize that the objectives of the Kyoto protocol, trampled underfoot by mighty America, are laughable compared to what should be done to stem the rise in the atmospheric concentration of carbon dioxide: cut global emissions in half, when actually it is forecast that these emissions will continue to increase at least until 2030 given the inertia of the system. The indispensable condition for success is to keep the developing countries from following our own model for growth. If we, the industrialized countries, do not abandon it ourselves, our message does not have the slightest chance of being heard. America is guilty not so much for its part in polluting the planet as for its refusal to make a minimal gesture in this direction. At least, in their cynicism, the Americans are playing it straight: they have no intention of giving up their way of life, which they identify with the fundamental value of freedom. The hypocrisy of the European governments, in this regard, is hard to stomach: they promise to respect Kyoto, but they carefully avoid informing their citizenries that this is but a tiny first step and that further progress can be made only at the cost of an upheaval in their entire manner of doing and being.

Scientistic optimism encourages us to be patient. Soon, it whispers, the engineers will find a way to overcome the obstacles blocking our path. Nothing is less certain. One shudders to

learn that not one scenario drawn up by the relevant agencies includes a realistic solution for reaching the years 2040-2050. In the long run, a scientific and technological revolution is brewing: that of nanotechnologies, based on the manipulation of matter atom by atom. It is likely that they will be able to get around many of the obstacles now standing in our way, in particular by making it possible to harness solar energy, but it is no less likely that they will create new risks which the technologists themselves deem "phenomenal."

Thus we find ourselves with our backs to the wall. We need to say what is more important to us: our ethical imperative of equality, which leads to principles of universalization, or our mode of development. Either the privileged part of the planet isolates itself, which increasingly means that it protects itself with shields of all sorts against the aggressions that the resentment of those left behind will render ever crueler and more abominable; or else another type of relationship to the world, to nature, to things and beings, must be invented, one capable of being universalized on a humanity-wide scale.

None of what I have just said is uncertain. The experts know it. But they do not consider it their role to address the public directly. They do not want to be responsible for creating panic.(4) They consequently have limited themselves to informing successive governments. In vain. The political class, generally unschooled in scientific and technical matters, and in any case constitutionally shortsighted both in time (a few years at most) and space (the boundaries of national sovereignty), has nothing to say on the subject.

If a way out is to be found, it is obviously at the political level. However, we will remain bogged down in the same old political ruts if we do not radically alter our ethics first. In his fundamental work,*The Imperative of Responsibility*(5), German philosopher Hans Jonas cogently explained why we need a new ethics to rule our relation to the future in the "technological age." This "Ethics of the Future" [*Ethik* für *die Zukunft*]–meaning not a future ethics, but an ethics *for* the future, for the sake of the future, meaning that the future must become the major object of our concern–starts from a philosophical aporia. Given the magnitude of the possible consequences of our technological choices, it is an absolute obligation for us to try and anticipate those consequences, assess them, and ground our choices on this assessment. Couched in philosophical parlance, this is tantamount to saying that when the stakes are high, we cannot afford not to choose consequentialism(6), rather than a form of deontology(7), as our guiding moral doctrine. However, the very same reasons that make consequentialism compelling, and therefore oblige us to anticipate the future, make it impossible for us to do so. Unleashing complex processes is a very perilous activity that both demands foreknowledge and prohibits it. Now, one of the very few unassailably universal ethical principles is that *ought* implies *can*. There is no obligation to do that which one can not do. However, in the technological age, we do have an ardent obligation that we cannot fulfill: anticipating the future. That is the ethical aporia.

Is there a way out? Jonas's credo, which I share, is that there is no ethics without

metaphysics. Only a radical change in metaphysics can allow us to escape from the ethical aporia. The major stumbling block of our current, implicit metaphysics of temporality turns out to be our conception of the *future as unreal*. From our belief in free will–we might act otherwise–we derive the conclusion that the future is *not real*, in the philosophical sense: "future contingents," that is, propositions about actions taken by a free agent in the future, such as, "John will pay back his debt tomorrow," are held to have no truth value. They are neither true nor false. If the future is not real, it is not something that we can have cognizance of. If the future is not real, it is not something that projects its shadow onto the present. Even when we know that a catastrophe is about to happen, we do not believe it: we do not believe what we know. If the future is not real, there is nothing in it that we should fear, or hope for.

The derivation from free will to the unreality of the future is a sheer logical fallacy, although it would require some hard philosophical work to prove it(8). Here I will content myself with exhibiting the sketch of an alternative metaphysics in which free will combines with a particularly hard version of the reality of the future.

2. The serious deficiencies of the "precautionary principle"

But we have the "precautionary principle." All the fears of our age seem to have found shelter in one word: precaution. Yet the conceptual underpinnings of the notion of precaution are extremely fragile, as I shall now undertake to demonstrate.

Let us recall the definition of the precautionary principle formulated in the Maastricht treaty: "The absence of certainties, given the current state of scientific and technological knowledge, must not delay the adoption of effective and proportionate preventive measures aimed at forestalling a risk of grave and irreversible damage to the environment at an economically acceptable cost." This text is torn between the logic of economic calculation and the awareness that the context of decision-making has radically changed. On one side, the familiar and reassuring notions of effectiveness, commensurability and reasonable cost; on the other, the emphasis on the uncertain state of knowledge and the gravity and irreversibility of damage. It would be all too easy to point out that if uncertainty prevails, no one can say what would be a measure proportionate (by what coefficient?) to a damage that is unknown, and of which one therefore cannot say if it will be grave or irreversible; nor can anyone evaluate what adequate prevention would cost; nor say, supposing that this cost turns out to be "unacceptable," how one should go about choosing between the health of the economy and the prevention of the catastrophe. Rather than belabor these points, I will present three fundamental reasons why the notion of precaution is an ersatz good idea that belongs in cold storage. I will try at the same time to understand why the need was felt, one fine day, to saddle the familiar notion of prevention with an upstart sidekick, precaution. Why is it that in the present situation of risks and threats, prevention is no longer enough?

2.1 The first serious deficiency which hamstrings the notion of precaution is that it does not properly gauge *the type of uncertainty* with which we are confronted at present.

The French official report on the precautionary principle(9) introduces what initially appears to be an interesting distinction between two types of risks: “known” risks and “potential” risks. It is on this distinction that the difference between prevention and precaution is made to rest: precaution would be to potential risks what prevention is to known risks.

A closer look at the report in question reveals 1) that the expression “potential risk” is poorly chosen, and that what it designates is not a risk waiting to be realized, but a hypothetical risk, one that is only a matter of conjecture; 2) that the distinction between known risks and hypothetical risks (the term I will adopt here) corresponds to an old standby of economic thought, the distinction that John Maynard Keynes and Frank Knight independently proposed in 1921 between risk and uncertainty. A risk can in principle be quantified in terms of objective probabilities based on observable frequencies; when such quantification is not possible, one enters the realm of uncertainty.

The problem is that economic thought and the decision theory underlying it were destined to abandon this distinction as of the 1950s in the wake of the exploit successfully performed by Leonard Savage with the introduction of the concept of subjective probability and the corresponding philosophy of choice under conditions of uncertainty: Bayesianism. In Savage’s axiomatics, probabilities no longer correspond to any sort of regularity found in nature, but simply to the coherence displayed by a given agent’s choices. In philosophical language, every uncertainty is treated as an *epistemic* uncertainty, meaning an uncertainty associated with the agent’s state of knowledge. It is easy to see that the introduction of subjective probabilities erases the distinction between uncertainty and risk, between the risk of risk and risk, between precaution and prevention. If a probability is unknown, a probability distribution is assigned to it “subjectively.” Then the probabilities are composed following the standard computation rules. No difference remains from the case where objective probabilities are available from the outset. Uncertainty owing to lack of knowledge is brought down to the same plane as intrinsic uncertainty due to the random nature of the event under consideration. A risk economist and an insurance theorist do not see and cannot see any essential difference between prevention and precaution and, indeed, reduce the latter to the former. In truth, one observes that applications of the “precautionary principle” generally boil down to little more than a glorified version of “cost-benefit” analysis.

Against the prevailing economism, I believe it is urgent to safeguard the idea that all is not epistemic uncertainty. One could, however, argue from a philosophical standpoint that such is really the case. The fall of a die is what supplied most of our languages with the words for chance or accident. Now, the fall of a die is a physical phenomenon which is viewed today as

a low-stability deterministic system, sensitive to initial conditions, and therefore unpredictable–a "deterministic chaos," in current parlance. But an omniscient being–the God whose existence Laplace did not judge it necessary to postulate–would be able to predict on which side the die is going to fall. Could one not then say that what is uncertain for us, but not for this mathematician-God, is uncertain only because of lack of knowledge on our part? And therefore that this uncertainty, too, is epistemic and subjective?

The correct conclusion is a different one. If a random occurrence is unpredictable for us, this is not because of a lack of knowledge that could be overcome by more extensive research; it is because only an infinite calculator could predict a future which, given our finiteness, we will forever be unable to anticipate. Our finiteness obviously cannot be placed on the same level as the state of our knowledge. The former is an unalterable aspect of the human condition; the latter, a contingent fact, which could at any moment be different from what it is. We are therefore right to treat the random event's uncertainty *for us* as an objective uncertainty, even though this uncertainty would vanish for an infinite observer. Now, our situation with respect to new threats is also one of objective, and not epistemic, uncertainty. The novel feature this time is that we are not dealing with a random occurrence, for each of the catastrophes that hover threateningly over our future must be treated as a singular event. Neither random, nor epistemically uncertain, the type of "risk" that we are confronting is a monster from the standpoint of classic distinctions. Indeed, it merits a special treatment, which the precautionary principle is incapable of giving it.

Three arguments seem to me to justify the assertion that the uncertainty, here, is not epistemic, but anchored in the objectivity of the relationship binding us to phenomena.

The first argument has to do with the complexity of ecosystems. This complexity gives them an extraordinary robustness, but also, paradoxically, a high vulnerability. They can hold their own against all sorts of aggressions and find ways of adapting to maintain their stability. This is only true up to a certain point, however. Beyond certain critical thresholds, they veer over abruptly into something different, in the fashion of phase changes of matter, collapsing completely or else forming other types of systems that can have properties highly undesirable for people. In mathematics, such discontinuities or *tipping points* are called *catastrophes.* This sudden loss of resilience gives ecosystems a particularity that no engineer could transpose into an artificial system without being immediately fired from his job: the alarm signals go off only when it is too late. As long as the thresholds remain distant, ecosystems may be manhandled with impunity. In this case, cost-benefit analysis appears useless, or bound to produce a result known in advance, since there seems to be nothing to weigh down the cost-side of the scales. That is why humanity was able to blithely ignore, for centuries, the impact of its mode of development on the environment. But as the critical thresholds grow near, cost-benefit analysis becomes meaningless. At that point it is imperative not to cross them at any cost. Useless or meaningless, we see that for reasons having to do, not with a temporary insufficiency of our knowledge, but with objective,

structural properties of ecosystems, economic calculation is of precious little help.

The second argument concerns systems created by humans, let us say technical systems, which can interact with ecosystems to form systems of a hybrid nature. Technical systems display properties quite different from those of ecosystems. This is a consequence of the important role that positive feedback loops play in them. Small fluctuations early in the life of a system can end up being amplified, giving it a direction that is perfectly contingent and perhaps catastrophic but which, from the inside, assumes the lineaments of fate. This type of dynamic or history is obviously impossible to foresee. In this case as well, the lack of knowledge does not result from a state of things that could be changed, but from a structural property. The non-predictability is fundamental.

Uncertainty about the future is equally fundamental for a third reason, logical this time. Any prediction regarding a future state of things that depends on future knowledge is impossible, for the simple reason that to anticipate this knowledge would be to render it present and would dislodge it from its niche in the future. The most striking illustration is the impossibility of foreseeing when a financial bubble will burst. This incapacity is not due to a shortcoming of economic analysis, but to the very nature of the speculative phenomenon. Logic is responsible for the incapacity, and not the insufficient state of knowledge or information. If the collapse of the speculative bubble or, more generally, the onset of a financial crisis were anticipated, the event would occur at the very moment that it was anticipated and not at the predicted date. Any prediction on the subject would invalidate itself at the very moment it was made public.

When the precautionary principle states that the “absence of certainties, given the current state of scientific and technical knowledge, must not delay, etc.,” it is clear that it places itself from the outset within the framework of epistemic uncertainty. The presupposition is that we know we are in a situation of uncertainty. It is an axiom of epistemic logic that if I do not know p, then I know that I do not know p. Yet, as soon as we depart from this framework, we must entertain the possibility that we do not know that we do not know something. An analogous situation obtains in the realm of perception with the blind spot, that area of the retina not served by the optic nerve. At the very center of our field of vision, we do not see, but our brain behaves in such a way that we do not see that we do not see. In cases where the uncertainty is such that it entails that the uncertainty itself is uncertain, it is impossible to know whether or not the conditions for the application of the precautionary principle have been met. If we apply the principle to itself, it will invalidate itself before our eyes.

Moreover, “given the current state of scientific and technical knowledge” implies that a scientific research effort could overcome the uncertainty in question, whose existence is viewed as purely contingent. It is a safe bet that a “precautionary policy” will inevitably include the edict that research efforts must be pursued–as if the gap between what is known

and what needs to be known could be filled by a supplementary effort on the part of the knowing subject. But it is not uncommon to encounter cases in which the progress of knowledge comports an increase in uncertainty for the decision-maker, something which is inconceivable within the framework of epistemic uncertainty. Sometimes, to learn more is to discover hidden complexities that make us realize that the mastery we thought we had over phenomena was in part illusory.

2.2. The second serious deficiency of the precautionary principle is that, unable to depart from the normativity proper to the calculus of probabilities, it fails to capture what constitutes *the essence of ethical normativity concerning choice in a situation of uncertainty.*

I am referring to the concept of "moral luck" in moral philosophy. I will introduce it with the help of two contrasting thought experiments. In the first, one must reach into an urn containing an indefinite number of balls and pull one out at random. Two thirds of the balls are black and only one third are white. The idea is to bet on the color of the ball before seeing it. Obviously, one should bet on black. And if one pulls out another ball (after replacing the first one into the urn) one should bet on black again. In fact, one should *always* bet on black, even though one foresees that one out of three times on average this will be an incorrect guess. Suppose that a white ball comes out, so that one discovers that the guess was incorrect. Does this *a posteriori* discovery justify a retrospective change of mind about the rationality of the bet that one made? No, of course not; one was right to choose black, even if the next ball to come out happened to be white. Where probabilities are concerned, the information as it becomes available can have no conceivable retroactive impact on one's judgment regarding the rationality of a past decision made in the face of an uncertain or risky future. This is a limitation of probabilistic judgment that has no equivalent in the case of moral judgment.

A man spends the evening at a cocktail party. Fully aware that he has drunk more than is wise, he nevertheless decides to drive his car home. It is raining, the road is wet, the light turns red, and he slams on the brakes, but a little too late: after briefly skidding, the car comes to a halt *just past* the pedestrian crosswalk. Two scenarios are possible: Either there was nobody in the crosswalk, and the man has escaped with no more than a retrospective fright. Or else the man ran over and killed a child. The judgment of the law, of course, but above all that of morality, will not be the same in both cases. Here is a variant: The man was sober when he drove his car. He has nothing for which to reproach himself. But there is a child whom he runs over and kills, or else there is not. Once more, the unpredictable outcome will have a retroactive impact on the way the man's conduct is judged by others and also by the man himself.

Here is a more complex example devised by the British philosopher Bernard Williams,(10) which I will simplify considerably. A painter–we'll call him "Gauguin" for the sake of

convenience–decides to leave his wife and children and take off for Tahiti in order to live a different life which, he hopes, will allow him to paint the masterpieces that it is his ambition to create. Is he right to do so? Is it moral to do so? Williams defends with great subtlety the thesis that any possible justification of his action can only be retrospective. Only the success or failure of his venture will make it possible for us–and him–to cast judgment. Yet whether Gauguin becomes a painter of genius or not is in part a matter of luck–the luck of being able to become what one hopes to be. When Gauguin makes his painful decision, he cannot know what, as the saying goes, the future holds in store for him. To say that he is making a bet would be incredibly reductive. With its appearance of paradox, the concept of "moral luck" provides just what was missing in the means at our disposal for describing what is at stake in this type of decision made under conditions of uncertainty.

Like Bernard Williams' Gauguin, but on an entirely different scale, humanity taken as a collective subject has made a choice in the development of its potential capabilities which brings it under the jurisdiction of moral luck. It may be that its choice will lead to great and irreversible catastrophes; it may be that it will find the means to avert them, to get around them, or to get past them. No one can tell which way it will go. The judgment can only be retrospective. However, it is possible to anticipate, not the judgment itself, but the fact that it must depend on what will be known once the "veil of ignorance" cloaking the future is lifted. Thus, there is still time to insure that our descendants will never be able to say *"too late!"*–a too late that would mean that they find themselves in a situation where no human life worthy of the name is possible.

2.3. The most important reason that leads us to reject the precautionary principle is still to come. It is that, by placing the emphasis on scientific *uncertainty*, it utterly misconstrues the nature of the obstacle that keeps us from acting in the face of catastrophe. The obstacle is not uncertainty, scientific or otherwise; the obstacle is *the impossibility of believing that the worst is going to occur*.

Let us pose the simple question as to what the practice of those who govern us was before the idea of precaution arose. Did they institute policies of *prevention,* the kind of prevention with respect to which precaution is supposed to innovate? Not at all. They simply waited for the catastrophe to occur before taking action–as if its coming into existence constituted the sole factual basis on which it could be legitimately foreseen, too late of course.

Even when it is known that it is going to take place, a catastrophe is not credible: that is the principal obstacle. On the basis of numerous examples, an English researcher identified what he called an "inverse principle of risk evaluation": the propensity of a community to recognize the existence of a risk seems to be determined by the extent to which it thinks that solutions exist. To call into question what we have learned to view as progress would have such phenomenal repercussions that we do not believe we are facing catastrophe. There is no uncertainty here, or very little. It is at most an alibi.

In addition to psychology, the question of future catastrophe brings into play a whole metaphysics of temporality. The world experienced the tragedy of September 11, 2001 less as the introduction into reality of something senseless, and therefore impossible, than as the sudden transformation of an impossibility into a possibility. The worst horror has now become possible, one sometimes heard it said. If it *has become* possible, then it was not possible before. And yet, common sense objects, if it happened, then it must have *been* possible.

Henri Bergson describes what he felt on August 4, 1914, when he learned that Germany had declared war on France: "In spite of my shock, and my belief that a war would be a catastrophe even in the case of victory, I felt . . . a kind of admiration for the ease with which the shift from the abstract to the concrete had taken place: who would have thought that so awe-inspiring an eventuality could make its entrance into the real with so little fuss? This impression of simplicity outweighed everything." Now, this uncanny familiarity contrasted sharply with the feelings that prevailed *before* the catastrophe. War then appeared to Bergson "*at one and the same time* as probable and as impossible: a complex and contradictory idea, which persisted right up to the fateful date."

In reality, Bergson deftly untangles this apparent contradiction. The explanation comes when he reflects on the work of art: "I believe it will ultimately be thought obvious that the artist *creates the possible at the same time as the real* when he brings his work into being," he writes. One hesitates to extend this reflection to the work of destruction. And yet, it is also possible to say of the terrorists that they created the possible at the same time as the real.

Catastrophes are characterized by this temporality that is in some sense inverted. As an event bursting forth out of nothing, the catastrophe becomes possible only by "possibilizing" itself (to speak in the manner of Sartre who, on this point, learned the lesson of his teacher Bergson well). And that is precisely the source of our problem. For if one is to prevent a catastrophe, one needs to believe in its possibility *before* it occurs. If, on the other hand, one succeeds in preventing it, its non-realization maintains it in the realm of the impossible, and as a result, the prevention efforts will appear useless in retrospect.

3. Towards an enlightened form of doomsaying

3.1. Motivation

The terrible thing about a catastrophe is that not only does one not *believe* it will occur even though one has every reason to *know* it will occur, but once it *has* occurred it seems to be part of the normal order of things. Its very reality renders it banal. It had not been deemed possible before it materialized, and here it is, integrated without further ado into the "ontological furniture" of the world, to speak in the jargon of philosophers. Less than a

month after the collapse of the World Trade Center, the American authorities had to remind their fellow citizens of the extreme gravity of the event so that the desire for justice and revenge would not slacken. The twentieth century is there to demonstrate that the worst abominations can be absorbed into common awareness with no particular difficulty. The reasonable and calm calculations of risk managers are further proof of humanity's astonishing capacity to resign itself to the intolerable. They are the most conspicuous symptom of that unrealistic approach that consists in dealing with "risks" by isolating them from the general context to which they belong.

It is this spontaneous metaphysics of the temporality of catastrophes that is the chief obstacle to the definition of a form of prudence adapted to our time. This is what I strove to show in my book *Pour un catastrophisme éclairé,*(11) while at the same time proposing a solution founded on an antidote to that same metaphysics. The idea is to project oneself into the future and look back at our present and evaluate it from there. This temporal *loop* between future and past I call the metaphysics of *projected time*. As we shall see, it makes sense only if one accepts that the future is not only real but also fixed. The possible exists only in present and future actuality, and this actuality is itself a necessity(12). More precisely, before the catastrophe occurs, it can *not* occur; it is in occurring that it begins to have always been necessary, and therefore, that the non-catastrophe, which was possible, begins to have always been impossible. The metaphysics that I proposed as the basis for a prudence adapted to the temporality of catastrophes consists in *projecting oneself* into the time following the catastrophe, and in retrospectively seeing in the latter an event *at once necessary and improbable.* It is at this stage that the fundamental concept of indeterminacy enters the picture. The (im)probability of a necessary event is no longer the measure of an ignorance that might have some chance of being only provisional (*uncertainty*). It is an element of reality, a reality that is not entirely determinate (*indeterminacy*).

These ideas are difficult, and one may ask whether it is worth the trouble to wend one's way through such constructions. It is my contention that the chief obstacle to our waking up to the threats weighing on the future of humanity is of a conceptual nature. As Albert Einstein once said, we have acquired the means of destroying ourselves and the planet, but we have not changed our ways of thinking.

3.2 Foundations of a metaphysics adapted to the temporality of catastrophes

The paradox of "enlightened doomsaying" presents itself as follows. To make the prospect of a catastrophe credible, one must increase the ontological force of its inscription in the future. But to do this with too much success would be to lose sight of the goal, which is precisely to raise awareness and spur action so that the catastrophe *does not take place.* A classic figure from literature and philosophy, the killer judge, exemplifies this paradox. The killer judge "neutralizes" (murders) the criminals of whom it is written that they will commit a crime, but the consequence of the neutralization in question is precisely that the crime

will not be committed![(13)](#) Intuitively speaking, it would seem that the paradox derives from the failure of the past prediction and the future event to come together in a closed loop. But the very idea of such a loop makes no sense in our ordinary metaphysics, as the metaphysical structure of prevention shows. Prevention consists in taking action to insure that an unwanted possibility is relegated to the ontological realm of non-actualized possibilities. The catastrophe, even though it does not take place, retains the status of a possibility, not in the sense that it would still be possible for it to take place, but in the sense that it will forever remain true that it could have taken place. When one announces, *in order to avert it,* that a catastrophe is coming, this announcement does not possess the status of a *prediction,* in the strict sense of the term: it does not claim to say what the future will be, but only what it would have been had one failed to take preventive measures. There is no need for any loop to close here: the announced future does not have to coincide with the actual future, the forecast does not have to come true, for the announced or forecast "future" is not in fact the future at all, but a possible world that is and will remain not actual.[(14)](#) This schema is familiar to us because it corresponds to our "ordinary" metaphysics, in which time bifurcates into a series of successive branches, the actual world constituting one path among these. I have dubbed this metaphysics of temporality "occurring time"; it is structured like a decision tree:

Occurring time

All my efforts have been devoted to showing the coherence of an alternative metaphysics of temporality, one adapted to the obstacle that the non-credible character of catastrophes represents. I have dubbed this alternative "projected time," and it takes the form of a loop, in which past and future reciprocally determine each other:

Projected time

In projected time, the future is taken to be fixed, which means that any event that is not part of the present or the future is an impossible event. It immediately follows that in projected time, prudence can never take the form of prevention. Once again, prevention assumes that the undesirable event that one prevents is an unrealized possibility. The event must be possible for us to have a reason to act; but if our action is effective, it will not take place. This is unthinkable within the framework of projected time.

To foretell the future in projected time, it is necessary to seek the loop's fixed point, where an expectation (on the part of the past with regard to the future) and a causal production (of the future by the past) coincide. The predictor, knowing that his prediction is going to produce causal effects in the world, must take account of this fact if he wants the future to

confirm what he foretold. Traditionally, which is to say in a world dominated by religion, this is the role of the prophet, and especially that of the biblical prophet.(15) He is an extraordinary individual, often eccentric, who does not go unnoticed. His prophecies have an effect on the world and the course of events for these purely human and social reasons, but also because those who listen to them believe that the word of the prophet is the word of Yahveh and that this word, which cannot be heard directly, has the power of making the very thing it announces come to pass. We would say today that the prophet's word has a *performative* power: by saying things, it brings them into existence. Now, the prophet knows that. One might be tempted to conclude that the prophet has the power of a revolutionary: he speaks so that things will change in the direction he intends to give them. This would be to forget the fatalist aspect of prophecy: it describes the events to come as they are written on the great scroll of history, immutable and ineluctable. Revolutionary prophecy has preserved this highly paradoxical mix of fatalism and voluntarism that characterizes biblical prophecy. Marxism is the most striking illustration of this.

However, I am speaking of prophecy, here, in a purely secular and technical sense. The prophet is the one who, more prosaically, seeks out the *fixed point* of the problem, *the point where voluntarism achieves the very thing that fatality dictates*. The prophecy includes itself in its own discourse; it sees itself realizing what it announces as destiny. In this sense, prophets are legion in our modern democratic societies, founded on science and technology. The experience of projected time is facilitated, encouraged, organized, not to say imposed by numerous features of our institutions. All around us, more or less authoritative voices are heard that proclaim what the more or less near future will be: the next day's traffic on the freeway, the result of the upcoming elections, the rates of inflation and growth for the coming year, the changing levels of greenhouse gases, etc. The *futurists* and sundry other prognosticators, whose appellation lacks the grandeur of the prophet's, know full well, as do we, that this future they announce to us as if it were written in the stars is a future of our own making. We do not rebel against what could pass for a metaphysical scandal (except, on occasion, in the voting booth). It is the coherence of this mode of coordination with regard to the future that I have endeavored to bring out.

The French planning system as it was once conceived by Pierre Massé constitutes the best example I know of what it means to foretell the future in projected time. Roger Guesnerie succinctly captures the spirit of this approach to planning when he writes that it "aimed to obtain through consultations and research an image of the future sufficiently optimistic to be desirable and sufficiently credible to trigger the actions that would bring about its own realization."(16) It is easy to see that this definition can make sense only within the metaphysics of projected time, whose characteristic loop between past and future it describes perfectly. Here coordination is achieved on the basis of an *image* of the future capable of insuring a closed loop between the causal production of the future and the self-fulfilling expectation of it.

The paradox of the doomsayer's solution to the problem posed by the threats hanging over humanity's future is now in place. It is a matter of achieving coordination on the basis of a negative project taking the form of a fixed future *which one does not want.* One might try to transpose Guesnerie's definition into the following terms: "to obtain through scientific futurology and a meditation on human goals an image of the future sufficiently catastrophic to be repulsive and sufficiently credible to trigger the actions that would block its realization"–but this formulation would fail to take account of an essential element. Such an enterprise would seem to be hobbled from the outset by a prohibitive defect: self-contradiction. If one succeeds in avoiding the undesirable future, how can one say that coordination was achieved by fixing one's sights on that same future? The paradox is unresolved.

In order to spell out what my solution to this paradox was, it would be necessary to enter into the technical details of a metaphysical development, and this is not the place to do so.(17) I will content myself with conveying a fleeting idea of the schema on which my solution is based. Everything turns on a form of *indeterminacy* whose nature and structure defy the traditional categories of uncertainty that we discussed in the second part of this essay.

The problem is to see what type of fixed point is capable of insuring the closure of the loop that links the future to the past in projected time. We know that the catastrophe cannot be this fixed point: the signals it would send back toward the past would trigger actions that would keep the catastrophic future from being realized. If the deterrent effect of the catastrophe worked perfectly, it would be self-obliterating. For the signals from the future to reach the past without triggering the very thing that would obliterate their source, there must subsist, inscribed in the future, an *imperfection in the closure of the loop.* I proposed above a transposition of Roger Guesnerie's definition of the one-time ambition of the French planning system, in order to suggest what could serve as a maxim for a rational form of doomsaying. I added that as soon as it was enunciated, this maxim collapsed into self-refutation. Now we can see how it could be amended so as to save it from this undesirable fate. The new formulation would be: "to obtain . . . an image of the future sufficiently catastrophic to be repulsive and sufficiently credible to trigger the actions that would block its realization, *barring an accident.*"

One may want to quantify the probability of this accident. Let us say that it is an epsilon, ε, by definition weak or very weak. The foregoing explanation can then be summed up very concisely: it is because there is a probability ε that the deterrence will not work that it works with a probability 1-ε. What might look like a tautology (it would obviously be one in the metaphysics of occurring time) is absolutely not one here, since the preceding proposition is not true for ε = 0. The discontinuity at ε = 0 suggests that something like an indeterminacy principle is at work here. The probabilities ε and 1-ε behave like probabilities in quantum mechanics. The fixed point must be conceived as the *superposition* of two states,

one being the accidental and preordained occurrence of the catastrophe, the other its non-occurrence.

The fact that the deterrence will not work with a strictly positive probability ε is what allows for the inscription of the catastrophe in the future, and it is this inscription that makes the deterrence effective, *with a margin of error* ε. Note that it would be quite incorrect to say that it is the *possibility* of the error, with the probability ε, that saves the effectiveness of the deterrence–as if the error and the absence of error constituted two paths branching out from a fork in the road. There are no branching paths in projected time. The error is not merely possible, it is actual: it is inscribed in time, rather like a slip of the pen. The future is written but it is partially indeterminate. It includes the catastrophe but as an accident. As the most metaphysicians of all poets, Jorge Luis Borges, once wrote: "the future is inevitable, but it may not occur."

In other words, the very thing that threatens us may be our only salvation.

Notes

1. This article was originally a paper presented at the *Rational Choice Theory and the Humanities* Conference, Stanford University, April 29-30, 2005. (back)

2. Basic Books, New York, 2003. (back)

3. *Wired*, April 2000. Bill Joy is the inventor of the Java program, the language of the Internet. (back)

4. Cf. Jean-Pierre Dupuy, *La Panique*, Paris, Les Empêcheurs de Penser en Rond/Seuil, 2003. (back)

5. Hans Jonas, *The Imperative of Responsibility. In Search of an Ethics for the Technological Age*, University of Chicago Press, 1985. (back)

6. Consequentialism as a moral doctrine has it that what counts in evaluating an action is its consequences for all individuals concerned. (back)

7. A deontological doctrine evaluates the rightness of an action in terms of its conformity to a norm or a rule, such as the Kantian categorical imperative. (back)

8. See my *Pour un catastrophisme éclairé*, Paris, Seuil, 2002. See also Jean-Pierre Dupuy, "Philosophical Foundations of a New Concept of Equilibrium in the Social Sciences: Projected Equilibrium,"*Philosophical Studies*, 100, 2000, p. 323-345; Jean-Pierre Dupuy, "Two temporalities, two rationalities: a new look at Newcomb's paradox," in P. Bourgine et B. Walliser (eds.), *Economics and Cognitive Science*, Pergamon, 1992, p. 191-220; Jean-

Pierre Dupuy, “Common knowledge, common sense,” *Theory and Decision*, 27, 1989, p. 37-62. Jean-Pierre Dupuy (ed.), *Self-deception and Paradoxes of Rationality*, C.S.L.I. Publications, Stanford University, 1998. (back)

9. *Le Principe de précaution, Report to the Prime Minister*, Paris, Éditions Odile Jacob, 2000. (back)

10. Bernard Williams, *Moral Luck*, Cambridge, Cambridge University Press, 1981. (back)

11. Op. cit. (back)

12. In order to flesh out the metaphysics of projected time I have had to provide a novel solution to one of the oldest problems in metaphysics: Diodorus’s Master Argument. See Jules Vuillemin,*Necessity or Contingency. The Master Argument*, CSLI Publications, Stanford University, 1996. (back)

13. Here we are thinking of Voltaire’s Zadig. The American science fiction writer Philip K. Dick produced a subtle variation on the theme in his story “Minority Report.” Spielberg’s movie is not up to the same standard, alas. (back)

14. For an illustration, one may think of those traffic warnings whose purpose is precisely to steer motorists away from routes that are otherwise expected to be clogged with too many motorists.(back)

15. To his misfortune and above all that of his compatriots, the ancient prophet (such as the Trojans Laocoon and Cassandra) was not heeded; his words were scattered by the wind. (back)

16. Roger Guesnerie, *L’Économie de marché*, Paris, Flammarion, “Dominos,” 1996. The phrasing reflects the spirit of rational expectations. (back)

17. I will take the liberty of referring the interested reader to the bibliography provided in footnote 159 of *Pour un catastrophisme éclairé*. (back)