



Nail in the Coffin

Elie Ayache, Author of the Black Swan

The best way to predict the Black Swan is to write it, claims **Elie Ayache**. In other words, to replicate it, to trade it, to exchange it. This is why his Black Swan is set against Taleb's, and in a way, written all over (against) it.

Ever since I read the two seemingly contradictory statements concerning *The Black Swan*, namely, that it was itself a Black Swan (in the publisher's words on the jacket flap) and that it wrote itself (in the author's in the prolog)¹, it appeared to me in a new light and I set out to reassess it from the point of view that was neither the publisher's nor the author's but truly my own. More specifically, because I wasn't the average reader, completely unprepared for *The Black Swan*, but was largely familiar with its themes from numerous, previous exchanges with Taleb, and because I wasn't, for all that, literally interchangeable with Taleb (if only for the reason, which will surface later in this article, that I wouldn't have written *The Black Swan* or ever thought it should be written but would have left it *literally* to write itself, or in other words, I would have left it forever deferred and highly improbable – for who else than Taleb could have really written it?), I undertook a rereading of *The Black Swan* with only one question in mind: “In what way, now that it is out, does it surprise me?”

Notice that I am exploring a realm here (the realm of the literary?) where “surprising” is not equated with “unexpected.” When somebody who knows you well surprises you with a gift, the gift needn't be the thing that you least expect. On the contrary, it may well be the object of your dreams, the gift that you *expect* the most. In a sense, the more desired and wanted and expected the object of the gift, the bigger your surprise. (Note that I am very careful not to say: “the greater your surprise,” for the literary distinction that I am making, in the domain of probability, between the *surprising* and the *unexpected*, has its correspondent, in metrical space, between *big* and *great*.) What I find even more intriguing is that, to add to the unusual phenomenon according to which the most expected is the most surprising, it takes somebody who knows you well, perhaps even the person who knows you best, to best surprise you when it comes to giving you what you expect the most.

Miracles share with gifts the property of being the most expected and, at the same time, the most surprising events. (Not to mention, in the case of the miracle, the peculiar brand of knowledge of the supreme giver.)

What is surprising is the gift, not the object given. “Just how did you know this was the thing I desired most?” asks the recipient in a burst of joy and thankfulness.

- Because I know you so well!
- Of course you do!

This tells us that no surprise will ever come, in the surprise gift, from collapsing the epistemological chain that is made up by the giver, the recipient, and the thing given. Since the first knows the second best and the second knows and expects the third most, by transitivity you could only get certainty of outcome and thus the total discounting of the surprise. In the literary domain (where “most surprising” is the other face of “most expected”), we are not in the business of fusing and compounding probabilities. On the contrary, the element of surprise lies in the *spacing* and the *timing* of the exchange. The surprise lies in the succession of the exclamation marks in the little dialog (or exchange) above and precisely in the silences and breaks between them. The surprise is not to be surveyed from above, by somebody who would conceptually and mechanically run the chain with no breaks (for that would converge to the one and only outcome), but it has to be lived through the written marks, through the precise words and their precise boundaries and their precise breaks: through their *risk*, we might say, which truly makes us feel, from the inside, that every word we reached marked the end of the world as we knew it at the time.

What is surprising is the staging of the gift: the world always relived as finite and the one and only desired possibility looking almost like a remote happening, perhaps even as an impossibility. This is why we organize ceremonies when we wish to surprise someone we know. Imagine,

instead, what I would call the *infinite* ceremony: that the giver and the recipient should be at all times telepathically wired to each other as well as to their bank account and to the Internet superstore and that the gift be made available and be given “the minute it wishes and it is known” (I am using the impersonal “it” here, as in: “it rains,” to emphasize the conflation of the chain of persons and things). To summarize, we may say that in the literary domain the surprise does not lie in knowledge and even less so in discounted expectation, but in the risk of writing.

My private “Black Swan”

In a way, Taleb has surprised me by giving me *The Black Swan* I expected most. For there to be a gift and a surprise, there must be a difference and an exchange. I couldn’t have given myself *The Black Swan* that I expected most (even though *The Black Swan* was, in a sense, already given to me, as I was acquainted with it and none of its themes came as a real surprise to me), for the reason that it takes two to make a gift and a giving, let alone an exchange. Not mentioning that I couldn’t have personally written *The Black Swan* or even imagined that something like it could ever be written: What could there be to record, indeed, on the subject of the extremely improbable and of its impact, beyond the fact that the event goes down in history and records itself by itself when it occurs, all the deeper and the more indelibly that it was precisely improbable and that it had a great impact?

I should thank Taleb for allowing this book – *The Black Swan* – to write itself; and it is only because *The Black Swan* is out now and because it is written that there could be material at all for my surprise. Recall that *The Black Swan* that I know best and am most acquainted with – the private *The Black Swan* I know so well that I could have written it myself – couldn’t have possibly surprised me *in thought* (not forgetting my intimate belief that it shouldn’t be written). In order to surprise me, it had to leave me and to differ from me; it had to leave my mind and assume the spaced and very different (almost strange) shape of the written material. In a way, our biggest surprise is when we come upon our own thoughts in a text that is not our own.

Like I said, the literary reverses the category of probability. True, a totally unexpected text may be thrilling, but what is more thrilling (and perhaps most thrilling) is that the material we are reading should fulfil us and correspond perfectly to what we want and what we expect – almost to the point of total coincidence – yet that the writing, this finite thread we are following word after word and spacing after spacing, should make it totally improbable and almost

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unimaginable, at every juncture, that such a thing should be written. This is why the greatest thinkers can make us the gift of the thoughts we expect most and understand best – our *own* thoughts – literally by writing them, by surprising us with the improbability, not of the thought, but of the written text. This is why Wittgenstein is able to write, in the preface of the *Tractatus*, that only the reader who has had similar thoughts can understand his book. This is why he is able to write an *impossible* book, surprising us all the more that what was once impossible for thought becomes possible in writing, even necessary.² This is why Pierre Menard is able to progress towards the only and, for this reason, most expected outcome of his writing process, Cervantes’ *Quixote*, without giving up the element of surprise and improbability at any point or any juncture.³

Pierre Menard’s trading room

Menard did not rewrite the *Quixote*; for then, there would have been no risk in his enterprise. He truly wrote it. This tells us that there could be risk, in writing, without there being probability, or even possibility. From the point of view of possibilities, there is none facing Menard except to end up writing the *Quixote*, which is another way of saying that he faces no possibility at all.

I express this by saying that *writing is a capacity, not a possibility*. What Menard has done, in the process of his writing, is probe a space of variation of a new kind; he has hollowed out a trading room, strictly independent of the space of possible alternatives to the *Quixote*. Only in the writing of future, unknown texts is capacity confused with possibility, for the thought is then that the writer could have equally written “another” text. The tradability and the element of improbability

in writing (what I have called the risk of writing) are then confused with the variability of the outcome *within the space of alternative outcomes*. In his endeavour of writing an existing text, Menard has managed, by contrast, to bring risk and probability apart again. Or rather, this is what Borges has managed to do, for Menard’s whole work and whole existence are, of course, totally incredible.

There is more to the *space* of trading/writing (I’ve called it a “room”) than just the collection of “preconceived” alternative texts. Consider that Menard was absolutely equipped with the algorithm of perfect replication of the *Quixote* (since the *Quixote* already existed), yet that he managed to trade it (I won’t say: “to change it,” for he didn’t, or: “to lose it then earn it back,” for he didn’t either – like I said, he just *wrote* it). The risk in trading/writing extends beyond probability. We can even define risk as that which *sways and trades*, after probability is done with and saturated. The market takes place – it starts – after the end of probability. It is the end that *can* start (the “can” of capacity, not of possibility).⁴

Probability, replication, context and beyond

Probability is always defined relatively to a given context, or collection of states of the world.⁵ By replicating the derivative in all possible states of the world, the derivative pricing model exhausts

probability and saturates the context. However, this is not yet trading. Trading the derivative is precisely what *happens next*. It is the putting in play of the parameter (or parameters) whose fixity was the guarantee of fixity of the context and of the corresponding dynamic replication. For instance, option trading is a volatility play and volatility is assumed to be fixed by the replication algorithm of Black-Scholes-Merton.

Note that derivatives were written *in order to trade* (not in order to conceal payoffs in a sealed envelope that would be opened only at expiry). Derivatives are the natural offspring of the market and they are the stuff the market is made of. (So, in a way, the market is also their produce: in fact, derivatives and the market are identical and not just hierarchically, or genetically, related.) Thus we see that trading (this process supposed to record a value, as of today and day after day, for the derivative that was once written and sentenced to have no value until a future date and unless a fraction of space) will never be the reiteration and the replication of the values that were initially planned for the derivative by the theoretical stochastic process and its prescribed dynamics.

The derivative valuation model is supposed to prescribe a value today, and everyday, from the values the derivative is supposed to receive in the intervening states of the world, and in this it may seem indeed that the model is giving back to the derivative the present value it was once denied on account of its derivative nature and of the instruction to pay off in a future that may never be present and in a state of the world that may never be realized. The irony, however, is that this making-present of the deferred value of the derivative has no other present to be imprinted against but the present of the market and the actuality of trading. Derivative valuation models are *intended for* derivative trading and pricing, despite what all the academics working and theorizing in the field may have to say about that. Yet we saw that the trading of the derivative, or in other words, its market, will by necessity take place and extend in this “improbable” space we have called the *trading room*, and which is by definition absent from the replication plan and from probability.

I propose that risk, or the market, is always posterior to context, possibility and probability. It always comes after probability, which is also a way of saying that context and probability are needed in the *first place*. Indeed, the market-maker wouldn't be pricing the derivatives and trading them were it not for the derivative valuation model and the dynamic replication algorithm which implicate him in the price process of the derivative.⁶ Some have proposed that risk is all *model risk*. This is certainly compatible with my proposition, even derivative on it. However, I think this attitude is reductive of risk, in the last instance. It tends to put the model at centre stage and to depict risk only negatively and derivatively relative to the model. By contrast, my proposition of risk exceeds the model and goes beyond it. It doesn't counter the model but requires it. Risk takes place *after* the model (and the context and the probability), and for this reason it cannot limit itself to the model, or be called “model risk.”

Capacity

Risk is the writing/trading thread that we keep pursuing despite the fact that the context has been saturated by replication. Or rather, the thread of derivative *writing* and *trading* (these two interchangeable sides of the destination of derivatives) is what the market is all about: the market as a writing process that is irreducible to a stochastic process; the market as a writing capacity that is irreducible to a writing possibility.

This is something I state of the market at large and not just of the derivatives market: what the market means in its *essence*. When you think of it, the story of the derivatives (or equivalently, the story of dynamic replication in *Pierre Menard*) has only helped us separate the context from what exceeds it and helped us distinguish between possibility and capacity. It put this distinction in all the greater relief that it was *necessary* both to have the context and to trade through it (i.e. to change it) in order to ascertain the writing and the risk of writing, both of which are alternative definitions of the market. If, in some fancy world, the destination of the derivatives (i.e. their writing and its risk) hadn't been bound up with the future and if it hadn't been altogether meaningless to speak of the market

except *for* the future, we could indeed have conceived of an extreme situation, like Pierre Menard's, where the risk of writing had really nothing to do with possibility and everything to do with capacity.

The distinction between possibility, as always defined relative to a fixed context, and capacity, as the capacity of changing the context and of trading the text beyond its perfect replication, can be made more accurate, in *Pierre Menard*, by saying that this extraordinary writer wasn't facing a single context or range of possibilities, one among which turned out to be the *Quixote*. A description like that would rather fit Cervantes, and this, by our lights, would imply that Cervantes did not in fact write the *Quixote* but created something which turned out to be the *Quixote*. It is interpreters, an extreme instance of whom is Pierre Menard, who face texts, not authors. Original authors face something else. For this reason, Borges' novel can be considered an extreme meditation on interpretation.⁷ What Menard was really facing is the *Quixote* as the one and only possibility (which is tantamount to saying he was facing a necessity), only his writing process was open to many, many *different contexts*.

The process of change of contexts

If we define “context” as *range of possibilities* and allow that different contexts may have some of their elements in common, then Borges has in fact described a strange individual who happened to worm his way inside a *process without possibilities but with many contexts*. This “worm-process” is, if you will, the set-theoretical intersection of all the contexts which admit the *Quixote* as one of their elements.

Now try to think what probability notion, if any, can be applied to a process like this. Later I will argue, as you might have guessed, that the market price process of derivatives, which is animated by “writers” the like of Menard who can trade and advance only insofar as they replicate the derivative that was once sealed and written, is such a process. *It is a process of change of contexts (a.k.a. recalibration) not of possibilities*. No probability can be applied to this process of change because probability can only choose among possibilities that fall within a single context.

Probability cannot be applied to Pierre Menard because the probability is one, in each one of the contexts his writing process has traversed, to yield the *Quixote* exactly. For this reason, Menard cannot be said to *pre-dict* the *Quixote*. An adaptation of the word is needed to describe his forward-advancing enterprise, worming its way in a future without possibilities (for there is no doubt that Menard faces his task as a future task and that it is risky). It is probably more suitable to say that Menard *pre-scribes* the *Quixote*.

Given the one and only possibility to which Menard has committed himself, what he is in fact trading is simply his own existence. This is always the case with writers who dedicate themselves to writing; however, Borges' novel is specifically revealing in this respect in that it doesn't even offer the writer the possibility of writing his own original text, for, otherwise, the choices and the sacrifices the writer would have to make would be confused with deliberations over the conception of the work and the future possible outcomes. What the fiction of Pierre Menard has achieved is isolate the risk in writing that is *in excess* of the risk of thinking, or simply, of the risk of living the life of an original writer.

The necessity of writing

What I have called "Menard's risk" is not the possibility of *not* writing the *Quixote*. His space of variation (his "trading room") is something else than chancing not to replicate the *Quixote* exactly. Again, think that derivative trading (the financial equivalent of Menard's business) is not the same as the possibility of *not* replicating the derivative, because dynamic replication is the historical trigger of derivative markets and is still their basic trading tool. That the derivative "may" end up not perfectly replicated (which is certainly the case, in reality) is strictly greater than a possibility or an eventuality, even greater than an empirical fact or the fact of blindness to the Black Swan (as Taleb would put it). It is something else. It is a necessity which is not bound up with possibilities offered to the derivatives market (as there would be no derivatives market altogether if derivatives were perfectly replicable).

It is not very easy to grasp the peculiar nature of this necessity because our vision of the future

is the hostage of epistemology and because this necessity, for all its directedness towards the market and towards the future, falls beyond epistemology. Even Taleb remains blocked in epistemology and talks of our inability to *predict* the Black Swan, and more generally, history, when Menard's analogy should make us suspect, on the contrary, that the market, or more generally, history, is not a matter of predicting or not predicting the Black Swan, but of *prescribing* it.

I called this "necessary possibility" (of trading away from their replication plan) the *destination* of the derivatives.⁸ To further single out this peculiar possibility, we can call it a "non-impossibility." For this is, indeed, what writing has offered Menard: the non-impossibility of living the life he lived and of producing the work he did, a non-impossibility that was irreducible to, and greater than, a plain possibility picked from a range of possibilities. It even offered Wittgenstein the most effective kind of counter-impossibility: that of *ending up writing* an impossible book. As for derivatives, they are at one with writing. They are written in order to trade, and trading is written all over them (they are fated to trade).

In all three cases, this possibility – or rather, capacity – lay in the excess that performative writing had over representation. Derivative writing/trading exceeds representation because representational thought hinges on fixed states of the world and derivatives markets can only grow at variance with the replication plan and its fixed underlying states of the world; they do so by the trader's performative stepping-in-and-then-out of the given context. Menard's enterprise exceeds representation because its representational content is plainly void (writing an existing text) and it totally revolves around Menard's performative commitment in writing (not its trivial result). Wittgenstein's *Tractatus* exceeds representation because it declares itself logically impossible (so it is even *less than* an existing text), and hence its true theme is the transformative experience that it impresses on its reader through his actual reading performance (not its subsequent narration, or recollection). As a result of the transformation, the reader ends up *having* the thoughts he must have in

order to understand the book, and this means that he *can only write it* (for why would he bother to read a book whose thoughts he already has?).

Writing the Black Swan

In my attempt at writing *The Black Swan* (or perhaps, as in *Pierre Menard*, at writing only the two chapters of the book which I desire most and which surprise me most), and for all the reasons that make its writing a necessity to me (for one thing, the fact that I already have its thoughts and cannot read it anymore, and for another, that I really want to take the risk of writing it *beyond* possibility and probability; and this means, by the same token, that I shall also be taking up the writing of risk – since it is the book of risk – and that I shall take *that* risk beyond probability), I shall, then, write it along the line of the *contexts*, not along the lines of probability, and following capacity, not possibility.

I shall take advantage of the identity, already noted by the publisher, between what the book is about, the Black Swan, and what the book itself is, a Black Swan, to propose that the risk in my writing *The Black Swan* (the risk I shall be pursuing by changing and chaining together, in Menard-like writing style, the different contexts that lead exactly to *The Black Swan* – or, shall I say, to the Black Swan?) will be identical with the risk in *The Black Swan* (and by this I mean the *topic of risk* making up the content of Taleb's book) and also, to some extent, with the risk inherent in the Black Swan.

I shall also propose, as you might have already sensed, that the process of writing the Black Swan, that is to say, the thread of writing/trading that takes place after the end of probability and the saturation of the context and qualifies, as such, as the risk of writing, is the best way of predicting the Black Swan, or rather (given that the category of knowledge and probability are altogether dismissed at this stage), of *prescribing* it, and in this I would be strictly following the author when he declares, from inside the writing process of *The Black Swan* (and not from the outside point of view of somebody who *expects* probability in matters of risk and still thinks of the Black Swan in probabilistic terms), that the Black Swan wrote itself.

Only through the writing/trading *performance* and not through the realizations of a theoretical stochastic process that is framed in representational thought, can the derivative writer/trader exceed the saturated context and move to the next – that is, he can trade – and for this reason, my unoriginal and derivative writing/trading of *The Black Swan* will exactly consist in removing from the book all remnants of representation and probability and in arguing that the Black Swan is not a highly improbable event, as Taleb claims, but simply a *case of change of context*. It is a revision of the whole range of possibilities, not just of the probability distribution overlying them.

It is no wonder, then, that writing/trading should be adapted to the Black Swan, since writing/trading is precisely the process of context change. And it is no wonder that the Black Swan should write *itself* and that we shouldn't need somebody like Taleb to write *about* it, since risk is another name for context change (or another name for the Black Swan) and writing is another name for the risk of writing (or another name for the process of context change).

Crossing again my meta-textual bridge, I shall thus attempt a writing of *The Black Swan* (or a prescribing of the Black Swan) where probability has not only been removed from the process of writing and of context change (as I will be converging towards the one and only possibility ... of *The Black Swan*) but from the content of the book itself. The real Black Swan, the Black Swan that is worth writing (not writing about) because it is worth the risk of writing (and is even equal to it), the Black Swan that is truly risky (and not completely expected as Taleb's book), is *The Black Swan* where the term "probability" has been completely eliminated, starting with its subtitle.

Finding the context in the Black Swan

I shall remove the term "highly improbable" from Taleb's subtitle (and keep the indisputable "impact") not only because his book is a certainty, even now a necessity, for my writing and no longer a remote possibility, but because this term, "highly improbable," has had me puzzled from the start, in the light of what Taleb has to say about its impact. (And Taleb has everything to

say about the impact – note that the subtitle of the book, supposed to unpack the Black Swan for us, is: *The Impact of the Highly Improbable*, not: *The Highly Improbable*. Also, Taleb makes it very clear, in the first of his series of endnotes on page 311, that his problem is not about the possibility of a Black Swan but about the impact.)

I feel puzzled because I can't help wondering: Does the event carry impact because it is highly improbable (and this would be fair enough) or does the impact lie in the event being less improbable than we had thought (hence Taleb's warning, and whole message)?

From the start and as early as the subtitle, there is this unsettlement about the *context* in which Taleb wishes to frame the impact of the Black Swan. Which is why, in my writing the Black Swan, I shall quickly move past, and dismiss, the two first attributes listed by Taleb: 1) that the Black Swan is an outlier and 2) that it carries an extreme impact, and find my true surprise in the last (where Taleb's gift to me truly lies), namely, 3) that what characterizes the Black Swan (and, to my mind, characterizes it alone) is that we "concoct explanations for its occurrence *after* the fact, making it explainable and predictable" (xviii).⁹ (*So it is an outlier*: fair enough; we should indeed expect highly improbable events to take place from time to time and I am not surprised that Taleb, or someone else, should write about them. *So it carries an extreme impact*: again, no surprise, here; the larger the impact, the smaller the probability. This is in fact not even contradictory with a Gaussian distribution over the variable measuring the magnitude of the impact. To be relevant at all, what Taleb must have in mind is actually the converse, namely, that the more inconceivable the event – and I add: *relative to the context prior to its occurrence* – the more extreme the impact – and I add: the major component, if not the entirety, of which resides precisely *in the unforeseeable, unprobabilizable, change of context* and in the jump of history into a whole new universe of possibilities. All of which brings me back to the one and only point I was trying to make all along and to which I have come again now, and that is that the Black Swan is the *non probability-bearing event of change of context*.)

In my interpretation of the Black Swan, or rather, in my writing of *The Black Swan* which is worth the risk of writing and even equal to it – and by this I mean that my writing shall proceed beyond probability to join the thread of change of contexts – I shall, therefore, *change the context* on Taleb and, instead of writing it from *the point of view of probability*, I shall write it from *the point of view of context* and argue that what is perceived by Taleb as a negative effect deserving only his irony, namely, that the Black Swan should only be predicted – and the fitting narrative only produced – *after the fact*, will appear, from my point of view, as a plain, even a positive, effect of the Black Swan, for the mere reason that the Black Swan is a *change of context* and that it is only relatively to a given context that we can make causal predictions at all.

To be fair, let me stress here that there is a continuous invitation, in *The Black Swan*, to look for the Black Swan outside the given context. Taleb talks of the *domain-specificity* of our reactions and whole mode of thinking and of their dependence on the "context in which the matter is presented" (53). He talks of "external uncertainty," of the "possibility of events straying from our mental projections": the now well-known "unknown unknown" (157). He specifically insists that "for an event to be a Black Swan, it does not just have to be rare, or just wild" (improbability and impact are not enough) but that "it has to be unexpected, has to lie *outside* our tunnel of possibilities" (213, my emphasis). As a matter of fact, he calls "Gray Swan" the extreme event that lacks this last property; and consequently, he recognizes that a revision of our probability distributions or even of our whole framework of randomness, such as Mandelbrot's fractals, if it makes the extreme event less improbable, "does nothing to solve the Black Swan problem, but only mitigates it" (262). What it manages to catch are just the Gray Swans, because something *conceivable* cannot be a Black Swan. (Here, finally, the hint that the Black Swan is, above all, an inconceivable event.)

Writing backwards

In the light of all this, my writing over against Taleb can be seen as just an attempt at completing what he says, or rather, at breaking with it completely by looking beyond probability and,

as you will see later, beyond representational knowledge altogether. Perhaps it aims at solving the Black Swan problem or at least at establishing the framework, *both philosophical and technological*, where it can be addressed. As the real Black Swan does not lie in the first two “conceivable” or tractable attributes on Taleb’s list (the high improbability, the extreme impact – see Taleb’s discussion on *hasard vs. fortuit* on page 272), this singles out the third, the backward narrative, as the decisive feature; hence my writing can alternatively be seen as the attempt to establish the meaning, and the significance, of the backward narrative. This meaning is structurally linked to the context-breaching nature of the Black Swan.

Since the context “of” the Black Swan is only available after it (and by “after it” I mean “following it in chronological order” and “following its style”), it is only normal that we should predict it after the fact. Once knowledge and probability have been dismissed as totally irrelevant to the process of writing/trading that I claim the market (as a species of history) and even history (as a whole) are made of, it won’t in the least bother us that backward-looking narratives should be worth a try, even worth the risk, and even carry risk. (It remains to be said, of course, why we need them.) Recall Menard’s enterprise of predicting, or prescribing, an existing and totally past text. Recall that there was risk and surprise (and in this sense, potentiality and room for trading) in Menard’s enterprise, and that this special brand of “future” had nothing to do with knowledge or representation and everything to do with writing and performativity.

In *Pierre Menard*, I have argued, the insertion in history and the event of appropriation (for Pierre Menard must have experimented, in his writing process, a series of appropriating events which really made the writing be his own, and what’s even better, the writing of the *Quixote*!) were shown to be independent of the future (in the sense of ordinary, infinite, metaphysical time), for they just followed the thread of the writing of an existing text.

Reinterpretive events and the narrative imperative

I will leave for later the fundamental issues we seem to have reached here, indicating that Taleb may not have found the right level of critique to address 1) the impact, both probabilistic and metric, of the Black Swan: he should address this context-changing event with a *meta-contextual predictive tool*, not just with the term “unpredictable” and certainly not “highly improbable,” or 2) the philosophy of time and temporality: he should address it from the finitude of the situated being-in-the-world, what Heidegger calls *Da-sein* or being-there, whereby “Time originates in the future, but the future necessarily draws on the past, and together, the future and past open the present”¹⁰, not from the *infinite* point of view of metaphysical time where history is just a succes-

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sion of unconnected “nows,” some of which beget unexpected events and make history and some of which fade out in a whisper, or 3) the philosophy of the event: he should address the event hermeneutically, not empirically, especially if it is of the extreme, context-changing kind, because events that matter enough to redefine history are what Richard Polt calls *reinterpretive events*.

These are events, writes Polt, which “affect how beings are *revealed* to the actor ... They open and close our ways of being-in-the-world, and hence our ways of access to beings as a whole ... They cannot be understood in terms of other levels of event, because such understanding is carried out by beings like us, whose interpretations bear the marks of many reinterpretive events ... They are turning points in the development of the hermeneutic ‘as’ ... They are *crises*, moments that decide the course of a life and its meaning ... They are emergencies in which meaning emerges. For this reason, they are unpredictable; the former order of meanings cannot account for them.”¹¹

More importantly, Polt says that “reinterpretive events can happen only for being-there – an entity whose own being is a ‘at issue’ for it and who works out its being by existing as someone *within* a world, thus interpreting itself and its surroundings” (my emphasis).¹² This tells us that Black Swans should be addressed from inside the thread of history and the process of writing/trading, not from Taleb’s infinite and indefinite point of view.

I will, thus, leave for later my main objection against Taleb’s “narrative fallacy” and that is that the narrative that we concoct after the event is *not* meant to explain the event or to make it more predictable, like Taleb says. Since the event has already occurred and is of the singular kind, this posterior narrative can by no means help us predict it again or predict similar events. Rather, the

narrative is our *interpretation* of the event. And we need this interpretation, not for the sake of the past event itself, or the sake of “similar” future events, but simply for the sake of our future, that is to say, of our time and our existence.

Again, the grounds of all this are found in Heidegger. According to Heidegger’s *Being and Time*, being is hermeneutical because its question can only be posed by the “entity” which can *understand* being, and understand it from out of its situated finitude and being-in-the-world: from out of its being-there. This being-there, or *Da-sein*, Heidegger does not equate with the human being (although the two will turn out to be coincident after time-space itself emerges as a consequence of the “happening of being in the site of being-there”), nor does he equate this fundamental ontology with anthropology. Being-there is just the “there” of being, the site of its happening, and in his later work, *Contributions to Philosophy*, Heidegger moves beyond the question of the understanding of being to the question of its happening.¹³ Being is no longer hermeneutical, in the

later Heidegger, but becomes an *appropriating event*. No longer to be retrieved by hermeneutical phenomenology but by a philosophy of the event, what Polt calls a *philosophy of possibility*.

And what is appropriation?

“Appropriation is the event in which the being of beings is given,” answers Polt. “Every gift affects the future, in that it begins a new relationship or perpetuates an old one.¹⁴ But the gift of being opens a whole realm of possibilities.”¹⁵ Understanding is also a projection of possibilities, writes Polt.¹⁶ And this is why, whether it hinges on the understanding of being-there or on the event of appropriation which occurs in the site of being-there, this philosophy of possibility, this “leap into the unknown” (Polt calls it a “risk”¹⁷, in which the truth of being ultimately lies, *cannot be independent from the past*. “Being-there and appropriation are futural,” writes Polt, “because every way of understanding must be.” However, this understanding must retrieve the past. “What makes a possibility original is not its independence from the past, but how deeply it retrieves the past.”¹⁸

Because of the reinterpreted nature of the appropriating event and of the gift of being as a projection of possibilities, and because of the finitude of primordial time (of which infinite, metaphysical time is only derivative), it is, therefore, a requirement that the interpretation of a past, history-changing event should be a constitutive part of our present, even of our *future*: not of our metaphysical future, but of what I have called the *risk of writing/trading*. Such an inaugural event, Polt calls an *inception*. “Inception is unique, a one-time event. It does not reproduce anything, nor can it be reproduced. But it does not stand alone, a solitary monument in the past that bears no relation to us; instead, it reaches forward and seizes us, calling on us to seize it in return.”¹⁹

Poetry and “The Black Swan”

So what Pierre Menard is doing is basically *interpreting* the *Quixote* (like a musical score) and this why his task and his outlook are truly futural, even though, in his highly unusual case, Menard’s metaphysical future is reduced to the *Quixote* as only possibility and his “narrative” predicts only the past. Pierre Menard is not so much after the *Quixote* as he is after his own thread of

appropriating events, in other words, his own being. His existence and his whole work take place in a different ontological domain than the one in which the *Quixote* already exists or Taleb’s Black Swan readily takes place. A different sort of existential quantification (and qualification) should, therefore, apply to them.

Menard’s work is truly poetic. Its value doesn’t reside in its propositional content (for this is hopelessly equal to the *Quixote*) but in its *poietic* drive. *Poiesis* means “to make” in ancient Greek. The Wikipedia defines it as a word that “was first a verb, an action that transforms and continues the world. Neither technical production nor creation in the romantic sense, *poietic* work reconciles thought with matter and time, and man with the world.” “Whereas propositional language always addresses beings *about* which it speaks, *poietic* saying *brings being forth* in the saying,” writes Daniela Vallega-Neu.²⁰ So it is not what Menard writes that matters, but *how* he writes it: the performativity of the writing, not its result. “Poetic moments are singular, non reproducible,” writes Polt. “But this should not be confused with ‘creativity’ or ‘originality’ in the sense of mere novelty.” To illustrate the point, Polt then proceeds to cite exactly the case of Pierre Menard! “Each genuine appropriation is a unique event,” he concludes, “even if it follows an established pattern, such as a musical score.”²¹

Similarly, the trader’s work is poetic. Since it is essentially *of* the future, it will always bring about novel possibilities, unlike Pierre Menard. But what it *brings forth* – the trading room – is a performative capacity that is singular and non reproducible to the extent that the trading individual is so himself and that he has to *be-there* in order that the market may *be*. Consider, by contrast, Taleb’s world, which seems to be given once and for all in its randomness and where the alphabet is just a device “to store information and reproduce it” (30), where a narrative serves the only purpose of reducing dimensionality, and where a novel, a story, a myth, or a tale, all have the same function: to “spare us from the complexity of the world and shield us from its randomness” (69-70)! Now consider again Menard’s work, in which the narrative doesn’t reduce anything at all, quite the contrary!

I am not sure that we write poems in order to reduce the dimensionality of the world, or that we even set them against the “random background” that Taleb wishes to recognize as only background and reality. But then, Taleb has not mentioned poetry in his list of narratives: intuition of an altogether different ontology, perhaps? (Poetry, especially by Hölderlin, was essential in Heidegger’s later thought of being as an event of appropriation.)

Saying: “The king died, and then the queen died of grief,” instead of: “The king died, and then the queen died,” is, to Taleb, an effective way of making us remember the two deaths. By adding information, it in fact reduces the dimension of history. Narrative is a human device and has no bearing on the real world, he says. I say: What world? In mine, the narrative has in fact opened many dimensions. For, I want to be that beloved king!

Postponing history

I will postpone until later the philosophical rift separating me from Taleb, namely, that the question of our insertion in history (or in the market – for those among us who are absorbed in this peculiar sub-species of history) and of our dealing with its Black Swans is, to me, primarily a matter of *ontology*, even of the fundamental kind, whereas it is all epistemology to him, perhaps even naturalized. In a typical moment, Taleb writes: “I know that history is going to be dominated by an improbable event, I just don’t know what that event will be” (154). I wonder: Is this typical Taleb or typical Yogi Berra? The way to insufflate substance in this statement is to say that this is simply how history happens and what history *is*. Simply *define* history as the series of Black Swans and drop the “I know” and the “I don’t know.” Ontology, instead of epistemology. What’s more, the “is” of your “history is” will not be empty. In fundamental ontology and its reinterpreted events, history *is* to the extent that *Da-sein* is-in-the-world and is-in-history.

I will postpone until later my major disagreement with Taleb, namely, that the question of history (or of the market) is too great and too overwhelming a phenomenon not to claim us completely and require our being-there as the

only site out of which it can be posed. It is too great, in any case, to fall under Taleb's hasty metaphysical reductionism and to be identified with a mere output that would be available to his inspection, as if from outside. (Taleb speaks of "the script that produces events" or of "the generator of history" (8). He speaks of the "generator of the world" (268), of the "generator of reality" (270), of the "model which runs the world" (267) and, in other places, of "that big machine that generates events" (12). Even truths are "generated by mechanisms," according to him (20). "The true explanation is unique," he writes, "whether or not it is within our reach" (72).)

For now, I will content myself with what is, to my eyes, the biggest surprise of *The Black Swan* (Taleb's true gift to me) and that is the realization that, if the Black Swan is indeed understood as a context-changing event, then it is truly mine: I have already covered it; I have already written it!²²

Incompatible contexts

It is in Taleb's chapter on the *ludic fallacy* that I was struck by the illumination that the Black Swan is, in fact, a *non probability-bearing event of change of context*. Of the three different sources of Black Swans that Taleb describes in his book: 1) the Black Swan that is inherent in our genes and in our evolutionary blindness to extreme events (I have always disliked naturalized epistemology), 2) the Black Swan, or rather, Gray Swan that is the result of mistaking the Gaussian probability distribution of Mediocristan for what should be, "in reality," the scalable laws of Extremistan (I will come to that in my next column) and 3) the Black Swan that cannot possibly be predicted because it falls beyond knowledge and probability (that is to say, it falls beyond the given context), I thus retain the third as the philosophical one (therefore worthy of my attention). The other two are either merely anthropological or disappointingly metaphysical.

Taleb cites the example of a casino in Las Vegas whose real risks turned out to be incommensurate with what could be anticipated, knowing that the business was a casino (129). "The four largest losses incurred or narrowly avoided by the casino," he notes, "fell completely outside their sophisticated models." They were triggered by 1) the loss of an irreplaceable per-

former in their main show after he was maimed by a tiger he considered to be his partner, 2) the attempt to dynamite the casino by a disgruntled contractor, 3) a tax violation, almost causing the casino to lose its gambling license, and 4) the kidnapping of the casino owner's daughter, causing him to dip into the casino coffers to secure the ransom. These Black Swans, Taleb observes, "swamp the on-model risks by a factor of close to 1,000 to 1."

In my opinion, these Black Swans are not, technically speaking, outliers. They simply are not part of the universe of possibilities initially envisioned by the casino. Each belongs to a different context, utterly foreign to gambling. Taleb himself recognizes they initially belonged *outside the casino's building*.

After a thousand days of feeding, confidence in a bright future is at its highest in the turkey's mind, until something unexpected happens on the Wednesday before Thanksgiving

Surely enough, the casino's management will from now on provision for losses that might be triggered by kidnapping, by tax negligence, by dynamite or by a tiger's appetite, and by this I mean that the corresponding state of the world, exotic as it may be, will be added to the existing list of states of the world. However, the key notion here is the *incompatibility of contexts prior to the experiment*, not the enumeration of utterly heterogeneous objects and items, which is always a possibility *after the fact* or may be, at best, the projection of a playful and erudite imagination.

Borges (yes, him again) is known for his capacity (yes, capacity) of producing improbable enumerations, the most famous of which occur in *The Aleph*. His "Chinese encyclopaedia" has fascinated many a thinker and Michel Foucault opens *The Order of Things* with a dip into it.²³ Taleb must have had in mind incommensurable enumerations of this sort when he spoke of the narrative

as a means of reducing their dimensionality (71), and he typically cites Borges at this juncture ("Funes, the Memorious"). As a matter of fact, Borges' style must have altogether interpenetrated Taleb's as his short novel "Yevgenia's Black Swan" definitely resonates with Borgesian tones to my ear.

Two contexts are said to be incompatible when they cannot be fused together and are not commutative. What this means is that the results of an experiment involving them can massively differ depending on the order in which you bring the two contexts to bear. Had the casino "experimented" with the context of dynamite or tigers (and I mean the whole context, not the isolated fact that was just their outcome) before experimenting with the con-

text of casinos, chances are it would have taken up the business of demolition contracting or wild animal breeding instead of gambling, possibly with a jackpot machine inserted in one corner of the cafeteria for the entertainment of employees and visitors.

Compare the turkey example, also cited by Taleb (40). The story goes like this: After a thousand days of feeding, confidence in a bright future is at its highest in the turkey's mind, until something unexpected happens on the Wednesday before Thanksgiving. My observation is that the context of feeding the turkey and that of wringing its neck are not so incompatible. It is all a matter of food, after all! Taleb can rightly talk of a sudden revision of belief, in the turkey's case, instead of a complete change of context, because the wringing of the neck definitely belongs to the turkey's context, only the turkey stupidly assigns to it zero probability. For all practical (and episte-

mological) purposes, it is indeed as if it wasn't there. But the turkey could have believed otherwise and, as a matter of fact, Taleb examines the alternative shrewd turkey which would consider the feeding as a confirmation of the danger of being turned into supper (188).

Incompatibility of contexts, by contrast, invalidates such counterfactual reasoning. It is a much more severe predicament, because it is impossible to *even begin* to group the possibilities belonging to the two contexts in the same universe of possibilities, and this is irrespective of the probabilities they would get. For instance, Taleb need not lament our ingratitude towards the invisible hero of 9/11 who manages to avoid the disaster by imposing continuously locked bullet-proof doors in every cockpit on September 10, 2001 (xxiii) because this thought experiment is counterfactually invalid. States of the world after 9/11 are incompatible with states of the world before, and the zero probability that the disaster gets in Taleb's heroic scenario is simply not defined because it cannot exist before its own context, which is 9/11. "Hero," like all the names history dispenses, seems to be a contextual notion.

When contexts are commutative they can be subsumed under a larger context which is simply their set-theoretical union, and both the experiment and the language reporting it can be set against this global context. Or rather, language can *forget* about the context and how it may affect the facts of the experiment or its objects and speak of the objects and their revealed properties *as if they were independent of the context and thus intrinsically determined*.

Commutative contexts are more routinely encountered than non-commutative ones and, as a matter of fact, the different languages that we human beings speak (even French) are *non-contextual*. This means that the context drops out of our ordinary speech and that we tend to attach different attributes to the same given object as if they were specific to it.

Knowledge as prediction

This is a very deep observation.

In the last resort, language is but a "hierarchy of anticipations concerning the unity of the range

of possibilities."²⁴ Words are intimately linked with predictions because when we utter a word, we expect something to *hold* or to appear to us in the same shape as before, not mentioning that we expect to be understood by others. (Note how deeper than the problem of induction this is.) Embedded in this shared logico-linguistic framework are, at a deeper level still, *invariants* that are extracted from the Heraclitean flux by the operation of what Michel Bitbol calls "schemes of reciprocity."²⁵ These schemes "enable *anticipation* of what will occur and rely on methods for *reproducing* situations, such as: moving an object and then putting it back at its original place, rotating an object until its initial profile is recovered, etc." This capacity of "freeing ourselves as much as possible from the irreversible aspects of any concrete situation" is what we call *knowledge*. Objects of knowledge are the formerly extracted invariants which we then organize in such a way as to be able to refer to them and to ascribe properties to them. They are presupposed in speech, and used to suggest predictions.²⁶

Knowledge itself, therefore, is but one big prediction or anticipation. Not just that part of our knowledge which specifically regards the future and contemplates predictions about future outcomes, but our entire, *present* knowledge, together with its presuppositions and all that it has to say about the entities in the world and their properties. Our everyday non-contextual language is not, therefore, a safe dwelling but a permanent-betting house. We keep "making the bet," everyday, that the different "experimental" contexts and their corresponding languages will come out unified over again.²⁷ This, of course, opens the possibility of losing the bet one day: the Black Swan of all Black Swans.

True empiricism

Until this happens, this gives us a glimpse of what true empiricism should be. Empiricism should be the way to *generalize* knowledge, not to defeat it and dismiss it altogether. True empiricism does not occur when we dismiss our theories and categories and objects and properties (what Taleb calls the "Platonic forms"), but when we recognize that those reified entities are, *as a matter of fact*, only specific to a special variety of

knowledge pervading our non-contextual way of speech: representational knowledge. What a broader, relational view of knowledge would teach us reciprocally is that the objects of knowledge are, *as a matter of fact*, always relative to context and are not permanent, autonomous objects. When we *abstract* our knowledge (as the evolved species we eventually are) beyond its representational variety, the two characteristics that remain are *invariance* and *predictability*. (Causality drops out, for instance.)

Taleb too defines knowledge as our ingrained tendency to ascribe patterns to the Heraclitean flux. "Perception of causation," he writes, "has a biological foundation" (68). "We need context," he writes a little bit further (132). But, wait a second! His use of the term "context" is different from mine. To him, "context" just means "concrete and tangible context." The complete sentence reads: "Alas, we are not manufactured [...] to understand abstract matters – we need context." As uncertainty and randomness are intangible notions (the logical empiricists would have called them "metaphysical"), their classification follows suit in Taleb's metaphysics. "They are abstractions," he writes. Hence, the "context" that we humans need in Taleb's theory of knowledge is different from the one we need in mine. In my view of knowledge, context is needed (or rather, *re-called*, summoned back) when we *abstract* knowledge beyond the autonomous and permanent objects of everyday language. This is when we understand that our everyday, representational knowledge is in fact a continuous bet on the success of de-contextualization and that anticipation and prediction are *constitutive* of knowledge (of all our knowledge, and not just the section concerned with the future).

Accordingly, Taleb's "prediction" is different from mine. His "prediction" is *solely* concerned with the future. ("Prediction ... is the real test of our understanding of the world," he writes (133).) His "probability" is an object *for* knowledge, not the *other face* of knowledge.²⁸ (This is why he is so worried about our knowledge of the right probability distributions.) He fails to see that the objectivity of knowledge (or the dynamics of objectification), without which there would be no language, no truth, and no world, can carry over and be

generalized to the meta-contextual level (where objects and properties are no longer independent of their contexts of manifestation) provided the essential ingredients of objectivity, invariance and predictability, are appropriately generalized.

Prediction (or even, in the case of Quantum Mechanics to be discussed in my next column, essential indeterminism) will then prevail over *description* as the only kind of epistemological intercourse with those generalized, context-dependent objects.

In Taleb's view, putting things into (concrete) context, or the narrative, is only a device for reducing the dimensionality of (our memory of)

the past, hence for inducing false beliefs about the dimensionality of the future. While context, in my view, is the step we require in our ascent towards the predominance of *prediction* as the only name of (generalized) knowledge, it is something that should be withdrawn, in Taleb's, lest we infer the *wrong* predictions. Accordingly, Taleb's empiricism consists in withdrawing the patterns and the contexts altogether. His "abstraction" consists in falling head down into "randomness": what he calls "reality" and even the "truth." Underlying Taleb's Black Swan is, like I said, a staunch commitment to metaphysical realism.

I was right to say that *context* was the Black Swan awaiting all of Taleb's Black Swan business. My *Black Swan* (the book with no probability and only context) is his Black Swan. Wait until I show you that the way to write, and to ride, my *Black Swan* lies in the derivatives markets: literally in Taleb's own past and debut, in the place he expects the least!

In the next issue, Elie Ayache will argue that the writing/trading of derivatives, or the derivatives market, is the way to write the Black Swan and not to just write about it.

ENDNOTES

1. Or maybe the two statements aren't contradictory but perfectly consistent with each other: If *The Black Swan* is itself a Black Swan then it doesn't need anybody and it is only fair that it should speak for itself, even write itself. But then, we could equally argue that it doesn't need to introduce itself to us any more or any better than by just striking us, when its time comes, as the Black Swan that it is. Even less so does it need to write itself ahead of time and commit itself to the written form.
2. Cf. Eli Friedlander, *Signs of Sense: Reading Wittgenstein's Tractatus* (Cambridge, Massachusetts and London, England: Harvard University Press, 2001) and Elie Ayache, *L'écriture postérieure* (Paris: Editions Complicités, 2006).
3. Pierre Menard is a fictional character created by Jorge Luis Borges in the novel "Pierre Menard, Author of the *Quixote*" (*Fictions* 1944). Menard is a twentieth-century Frenchman who has dedicated his life to writing two chapters of *Don Quixote* – not a modern adaptation, but the *Quixote* itself, using exactly the same (Spanish) words Cervantes has used. Menard's book has a completely different meaning than the original *Quixote* and, according to Borges, is in fact far more profound.
4. For the distinction between capacity and possibility, see Elie Ayache, "Why 13 Can Only Succeed to 11, or, the End of Probability," *Wilmott* July 2006: 30-38.
5. An illuminating account of probability being always conditional on the context of its definition and of our tendency to forget to check this "hidden condition" can be found in Espen Haug, "Hidden Conditions and Coin Flip Blow Ups," *Wilmott* March 2005: 74-76
6. Cf. Elie Ayache, "The Next Question Concerning Technology: Part I: The Significance of Dynamic Replication," *Wilmott* March 2007: 32-38.
7. See my book-length treatment of interpretation and posterior writing, *L'écriture postérieure* (Paris: Editions Complicités, 2006).
8. Cf. Elie Ayache, "The Next Question Concerning Technology:

Part II: A World Inverted," *Wilmott* May 2007: 42-48.

9. Numerals, either roman or Arabic, inside brackets refer to the pagination of *The Black Swan* in its first edition by Random House, New York, 2007. Note that Taleb retains only the two first attributes, the highly improbable and the impact, for the book cover. Does that imply that he reserves the third, the retro-narrative, for the book itself? As a matter of fact, is *The Black Swan* itself anything else than a narrative Taleb has concocted after the fact of the Black Swan? Only it says "no" when the other narratives say "yes": a sort of set-theoretical complement of the positive narratives and, for this reason, no more penetrant of the heart of the Black Swan than they are? To be fair, let us note, however, that the author himself recognizes that his book is just a story (xxvii). I sometimes wonder whether the Black Swan itself (even non-italicized) is not in fact just a narrative: Try to think of a Black Swan event without *narrating* the story that goes more or less like this: "Somebody, somewhere, was living peacefully (and perhaps, unknowingly) when, *suddenly*, ..."
10. Cf. Richard Polt, *The Emergency of Being: On Heidegger's Contributions to Philosophy*, (Ithaca and London: Cornell University Press, 2006): 223, cf. Martin Heidegger, *Being and Time*, Joan Stambaugh (trans.), (New York: State University of New York Press, 1996): 302-303.
11. Cf. Richard Polt, op. cit., pp. 78-79.
12. Cf. Richard Polt, op. cit., p. 79, and Martin Heidegger, op. cit. pp., 2-3, 7-8.
13. Cf. Richard Polt, op. cit., p. 50 and Martin Heidegger, *Contributions to Philosophy (From Enowning)*, Parvis Emad and Kenneth Maly (trans.), (Bloomington: Indiana University Press, 1999).
14. And so, Taleb's gift affects my future and perpetuates an old relationship with the author of *The Black Swan*. (By far, the most gratifying surprise *The Black Swan* has in store for me is what Taleb writes about our friendship in the "Acknowledgments" section.)
15. Richard Polt, op. cit., p. 116.

16. Richard Polt, op. cit., p. 223.
17. Richard Polt, op. cit., p. 216.
18. Richard Polt, op. cit., p. 223.
19. Richard Polt, op. cit., p. 117.
20. Daniela Vallega-Neu, "Poietic Saying," in: *Companion to Heidegger's Contributions to Philosophy* (Bloomington & Indianapolis: Indiana University Press, 2001): 67.
21. Richard Polt, op. cit., p. 118.
22. Cf. Elie Ayache, "Probability as the Other Face of Knowledge," *Wilmott* March 2005: 28-32.
23. This is the encyclopaedia in which it is written that animals are divided into: (a) belonging to the Emperor, (b) embalmed, (c) tame, (d) sucking pigs, (e) sirens, (f) fabulous, (g) stray dogs, (h) included in the present classification, (i) frenzied, (j) innumerable, (k) drawn with a very fine camelhair brush, (l) *et cetera*, (m) having just broken the water pitcher, (n) that from a long way off look like flies. "In the wonderment of this taxonomy," writes Foucault, "the thing we apprehend in one great leap, the thing that, by means of the fable, is demonstrated as the exotic charm of another system of thought, is the limitation of our own, the stark impossibility of thinking that."
24. Cf. Michel Bitbol, "Non-Representationalist Theories of Knowledge and Quantum Mechanics," op. cit.
25. Cf. Michel Bitbol, *Ibid*.
26. This already hints that prediction is what we really need, not "knowledge" which is only a special means. "Prediction is the real test of our understanding of the world," writes Taleb (133). From there, two possibilities suggest themselves: either knowledge is generalized into a general theory of prediction (see the opening of my next column) or an all-out alternative to knowledge is pursued (see the conclusion of my next column).
27. Cf. Michel Bitbol, *Mécanique quantique: Une introduction philosophique*, (Paris: Flammarion, 1996): 46.
28. Cf. Elie Ayache, "Probability as the Other Face of Knowledge," op. cit.