THE WISHFUL ANTICIPATOR

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ABSTRACT

Prophecy is a very old dream of mankind: the desire to know the future and, if possible, to twist the course of future events is overwhelming since cavemen and shamans and is still very much with us, from fortune tellers, astrologers and soothsayers to economic planners and science fiction novelists.

There are however many limits to anticipation, and subsequent action. They seem to be basically of two classes:

- those inherent to the deep nature of natural evolution of all kinds of situations
- those related to our own limitations as observing systems, i.e. as perceivers, learners, modellers and actors.

This papers presents a short overview of these topics

RÉSUMÉ

La prophétie est un très ancien rêve de l'humanité: le désir de connaître l'avenir et, si possible, d'en changer le cours, est irrésistible depuis l'homme des cavernes et les chamans et est toujours présent parmi nous, depuis les cartomanciennes, les devins et les astrologues jusqu'aux planificateurs en économie et auteurs de science fiction.

Il y a cependant de nombreuses limitations à l'anticipation et à l'action. Elles sont fondamentalement de deux espèces:

- celles inhérentes à la nature profonde de l'évolution naturelle de n'importe quelle situation
- Celles qui résultent de nos propres limitations comme observateurs, en relation avec nos capacités perceptives et d'apprentissage, et aussi comme constructeurs de modèles et acteurs.

Ce travail présente un survol rapide de ces divers aspects.

1. Ambiguous Future

Is future totally determined, or not at all, or only partly so?

And if only partly determined, does it mean that it is partly random, or that it can be changed by man ?

These queries are age old and so is the debate between those who share any of these opinions: soothsayers, shamans, prophets, astrologers or, more recently futurologists and planners.

To begin with, some prophecies or forecasts become verified... and others no. So, there is no experimental way to reach a definitive view on the matter. As a result,

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the debate remains inconclusive and is frequently re-enacted in some more or less new terms.

It should be observed that the course of events seems always determined... after the events. A more or less clear chain or causes and circumstances can most of the time be traced, explaining - a posteriori - how and why the fire started, or the President was murdered.

However, nobody is ever able to demonstrate that the mishap, or the drama could have been avoided. This has ever been a rich fodder for science fiction writers specializing in time paradoxes.

Moreover, determinism seems to act at different scales in different ways. There seems to exist a slow, but at the same time strong determinism at long term historic time spans. All the past empires have crumbled after a number of successful generations. For some reasons, an inopportune leadership fatigue and mental ineptness appears to be a very general feature in political systems after some decades or, at most, some centuries: Antique empires, Chinese dynasties, Western colonial empires and, quite recently Soviet Russia are characteristic examples. The same sequence of growth and decay also affects commercial and industrial companies, which very seldom last more than one century. Possibly, this is a result of some unperceived subtle changes - at times consequences of the very success of the system - or even in some cases, the pushover event could seem to be random.

However, nobody seem to be able to precisely predict if, why and when these destructive events are going to occur for such or such country or concern.

At the individual level, the French biologist P. VENDRYES established (1942) an interesting concept of autonomy, distinguishing in living systems an aptitude to "determine their own laws", by self regulation within limits. According to his view, the present is the crucial moment of decision. This means that at the present moment a choice is made, or a decision is taken, which selects one possibility, and only that one, excluding all other options.

Thus instant determinism marks, in some sense, a timely transition from indetermination to determination. This is in step, for example, with wave collapse in quantum mechanics.

For individuals, the conditions to such a selection is to possess information and resources sufficient to create the possibility of a choice between different options. This amounts to an adaptive regulation, i.e. already a cybernetic model. In this way, any present act closes... and opens roads to the future. This could explain why most of use believe in free will and in the consequent possibility of meaningful decision.

However, the inquisitive mind will obviously come up with a new question: "All right. But why did you select that decision, and no other?".

Another interesting line was introduced by the American futurologist R. AMARA. He observed that the close future is quite determined and thus very difficult to change, while situations in a distant future become less and less determined and consequently, more easy to influence. In other words, time itself is a resource. AMARA's principle is a unique salvation platform for planners and futurists or prospectivists alike! But again, why does the planner selects this or that decision ?

We are obviously in a conceptual morass, out of which we cannot escape merely by logical or philosophical arguments.

2. Some cybernetic and systemic angles

Could cybernetics and systemics give us a hand ?

Cybernetics introduced the notion of feedback, which is much more subtle that appears at first sight.

Natural physical feedbacks are kind of automatic. A diver, for example, will go back to the surface because of a buoyancy feedback resulting from Archimedes Principle. No specific goal therein!

Biological feedbacks are more ambiguous, as for example the regulation of respiration. This process must by necessity remain within some more or less specific limits, of biological character. This is achieved by a set of countervailing regulations through combined positive and negative feedbacks, adapted to the characteristics of the concerned living system. An example is the heartbeat regulation by a set of opposed nerves.

However, the engineer building a control is using a constructed feedback loop, which has some characteristics quite significant for our problem.

A control is operating a feedback in order to achieve some precisely defined goal. It has been erroneously said that in such a case, the future influences the present situation.

Of course, the goal is defined by the constructor of the control. It is his/her goal, here and now and this does not imply any time paradox.

However, the goal must be represented within the control mechanism, as for example in the case of a thermostat. Moreover, differences must constantly be monitored and measured. They must be used as trigger to produce the needed corrections (whose possibility is depending of the existence of specific resources, generally stored in the system). A command and an effector are also usually needed. The corrections are still fully determined through the potential of the mechanism. But there is something else in it: The aim assigned to the control is to adapt and readapt the system as many times as needed to variable external conditions in its environment. Such variations may well be determined in the environment by specific causes. But for the system they are random, at least within limits. Thanks to the control, the system acquires a modicum of autonomy ... and we are back to VENDRYES.

Another interesting line is that many sequences of natural phenomena are cyclical: sun spots, the rhythm of day and night, the seasons, the fluctuations of populations, economic activity, markets oscillations, etc...

Different cycles have been discovered, for example in economy: the Juglar, the Kuznets, the Kondratieff cycles.

But there is a serious problem: none of these cycles is perfectly regular. Most affect some types of events in different ways. Their interest for prospective and forecast would be enormous... if only we could understand and compute correctly their interactions. But this is awfully difficult.

It is well known, for example that an imprudent use of harmonic analysis applied to statistical data may show spurious cyclical regularities.

We could easily speak about the "dangers of cyclism".

A little arithmetical exercise throws however some interesting light on this problem.

Let us suppose the existence of 3 different interrelated cycles of respective periods 3, 6 and 12 (be it seconds, days, years or millenia). Being the respective periods commensurable, the 3 and 6 periods cycles will appear as regularly correlated with the 12 period cycle. The whole of it would have a good forecasting value.

Let us now imagine 3 different interrelated cycles whose periods should be prime numbers, let us say 3, 19 and 41 (again seconds, or days, etc...). A global coincidence between the three cycles would appear only at a period that would be the product of the 3 original periods, i.e. 2337. Such a long period would be very difficult to observe and the data meanwhile collected would for a long time appear as random.

Thus randomness can be apparent when a number of different cycles with incommensurable periods do combine.
This would be a practically unobservable complex deterministic process.

A curious example has been given by John CASTI.

He writes: "... high estimates for H (note: the HURST exponent), which measures a kind of "long term "memory effect" present in processes like sunspot fluctuations, river discharges and rainfall levels... provide strong support for the claim that the stock market is not a random walk, but rather is a fractal with trend-reinforcing behavior... in direct contradiction with the cherished Efficient Market Hypothesis which describes the market as a roulette wheel with no memory" (CASTI, 1994, p.254).

Different HURST exponents for various markets imply a cycle time (i.e. a "memory") that varies from 30 to 60 months
from Britain to Germany!

Obviously we have here a part-deterministic, part-random process whose general trend and intermediate scaled fluctuations correspond in time to different (fractal) levels of evaluation of various short, medium and long terms factors by traders and investors. So, the market is a quasi-system submitted to criticality rules.

It becomes clear that absolute determinism as well as absolute randomness are gross simplifications. This is in fact what everyday life teaches us.

3. Road to chaos, road from chaos

Our classical mathematics focuses our attention to functions, mostly in their linear guise or at least reducible to linearity.

However systemic processes are different, because they cannot be isolated from numerous interferences from other correlated processes. This situation is akin to POINCARÉ's 3-bodies problem which precisely ushered the first insights into chaos.

The general problem is compounded by the existence of various different and simultaneous initial conditions within the complex system. Moreover, the propagation of their effects within the system is not isochronous in a space-time which is itself not isotropic

In such dynamic action networks, determinism must by necessity be constantly broken and reconstructed. No system could survive without maintaining a sufficient degree of coherence, corresponding with its core identity. However neither could it survive if unable to adapt and re-adapt constantly.

So, while determinism may be locally reduced, it remains globally present and conditions the whole long term existence and processes of the system.

However, there are different kind of systems, more or less stable, more or less coherent: This is one great discovery of the last quarter of century, which spawned chaos and criticality theories, defining the specific characteristics of composite (or quasi-) systems, as different from strongly integrated ones.

Indeed, the road to chaos is not to be confused with a road to total indeterminism. A system, or a quasi-system, devoid of any degree of coherence should not remain a system at all and quickly become scattered into myriads of independent elements (death, in the case of living systems!)

There is also obviously a road from chaos.

Criticality points to some implicite order. P. BAK, C. TANG and K. WIESENFELD emphasize that quasi- (or composite) systems have "a specific temporal fingerprint, namely "flicker noise"... characterized by a wide range of time scales, a clear indication of some cooperative effect" (1988, p. 364). Cooperative should be taken here in its original meaning of operating in a more or less correlated way.

These authors add: "Flicker noise is in fact no noise but reflects the intrinsic dynamics of self-organized critical systems" and "Another signature of criticality is spatial self-similarity" (Ibid). This indicates that such systems, submitted to a power law, will show a fractalized structure, and the corresponding fractalized behavior.

It seems, for example, that tectonic plates movements may lead either to a succession of frequent small seismic movements, or to a catastrophic earthquake after a long "silent" build-up of stresses.

Determinism thus more or less randomized is not very useful for precise forecasting. But it becomes at least clear that the behavior of this type of systems is not totally random.

In stock markets, HURST's exponents express the same fractal scaling of the global behavior of a great number of agents who are not absolutely independent from one another.

Here too big crashes at very long time intervals are somehow correlated to the slow build-up of economic and psychological stresses. This does not make them precisely predictable, but

offers at least indications about a general trend and an approximate view of a global situation.

4. Limits to anticipation and planning

Very strongly deterministic processes are thus infrequent exceptions, possible only when some very basic initial condition is strongly dominant.

This is not the general case for systems composed of a great number of not highly organized elements. Rigorous deterministic forecasting is thus illusory or at least extremely difficult and insecure in ecology, meteorology,
economics (specially so markets) and politics.

And since forecasting is insecure, so is also necessarily planning.

Some more comments seem useful.

First, any forecast should be considered provisional for these types of systemic processes. And rigid planning should be replaced by a kind of open one, always potentially in need to be reconsidered according to circumstances (which may even result from endogenous critical variability).

Planning should be cybernetically reiterative: permanent monitoring is a sine qua non condition of reasonably safe control. Curiously, this is generally not applied to the systems that are the most unstable by their nature.

On the other hand, the pursuit of maximization is frequently contradictory with real optimization. The first goal should be to understand the conditions for dynamic stability of any considered system. The second one should be avoiding any action that could destroy such stability in an irreversible way. The third one should be maintaining the adaptability of the system, i.e. a sufficient leeway for fluctuations: today's good adaptation can be to morrow's ill adaptation.

Still more generally, we need still better models of many situations and systems which escape our traditional reference frames. The main research field in this area should probably be a wider exploration of the intricated relations between determinism and randomness.

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