

# Forecast and event control

## On what is and what cannot be possible

### Part I: Classical case

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#### **Abstract**

Consequences of the basic and most evident consistency requirement—that measured events cannot happen and not happen at the same time—are shortly reviewed. Particular emphasis is given to event forecast and event control. As a consequence, particular, very general bounds on the forecast and control of events within the known laws of physics result. These bounds are of a global, statistical nature and need not affect singular events or groups of events.

#### **Principle of self-consistency**

An irreducible, atomic physical phenomenon manifests itself as a click of some detector. There can either be a click or there can be no click. This yes-no scheme is experimental physics in-a-nutshell (at least according to a theoretician). From that kind of elementary observation, all of our physical evidence is accumulated.

Such irreversibly observed events (whatever the relevance or meaning of those terms are [1, 2, 3, 4]) are subject to the primary condition of *consistency* or *self-consistency*. *“Any particular irreversibly observed event either happens or does not happen, but it cannot both happen and not happen.”*

Indeed, so trivial seems the requirement of consistency that David Hilbert polemicised against “another author” with the following words [5], “...for me, the opinion that the [[physical]] facts and events themselves can be contradictory is a good example of thoughtlessness.”

Just as in mathematics, inconsistency, i.e., the coexistence of truth and falseness of propositions, is a fatal property of any physical theory. Nevertheless, in a certain very precise sense, quantum mechanics incorporates inconsistencies in a very subtle way, which assures overall consistency. For instance, a particle wave function or quantum state is said to “pass” a double slit through both slits at once, which is classically impossible. (Such considerations may, however, be considered as mere trickery quantum talk, devoid of any operational meaning.) Yet, neither a particle wave function nor quantum states are directly associable with any sort of irreversible observed event of physical reality. We shall come back to a particular quantum case in the second part of this investigation.

And just as in mathematics and in formal logic it can be argued that too strong capacities of intrinsic event forecast and intrinsic event control renders the system overall inconsistent. This fact may indeed be considered as one decisive feature in finite deterministic (“algorithmic”) models [6]. It manifests itself already in the early stages of Cantorian set theory: any claim that it is possible to enumerate the real numbers yields, via the diagonalization method, to an outright contradiction. The only consistent alternative is the acceptance that no such capacity of enumeration exists. Gödel’s incompleteness theorem [7] states that any formal system rich enough to include arithmetic and elementary logic could not be both consistent and complete. Turing’s theorem on the recursive unsolvability of the halting problem [8], as well as Chaitin’s  $\Omega$  numbers [9] are formalizations of related limitations in

formal logics, the computer sciences and mathematics.

In what follows we shall proceed along very similar lines. We shall first argue that any capacity of total forecast or event control—even in a totally deterministic environment—is contradicting the (idealistic) idea that decisions between alternatives are possible; stated differently: that there is free will. Then we shall proceed with possibilities of forecast and event control which are consistent both with free will and the known laws of physics.

It is also clear that some form of forecast and event control is evidently possible—indeed, that is one of the main achievements of contemporary natural science, and we make everyday use of it, say, by switching on the light. These capacities derived from the standard natural sciences are characterized by a high chance of reproducibility, and therefore do not depend on single events.

In what follows, we shall concentrate on very general bounds of capacities of forecast and event control; bounds which are imposed upon them by the requirement of consistency. These considerations should be fairly general and do not depend on any particular physical model. They are valid for all conceivable forms of physical theories; classical, quantum and forthcoming alike.

### **Strong forecasting**

Let us consider forecasting the future first. Even if physical phenomena occur deterministically and can be accounted for ("computed") on a higher level of abstraction, from within the system such a complete description may not be of much practical, operational use [10, 11].

Indeed, suppose there exists free will. Suppose further that an agent could predict *all* future events, without exceptions. We shall call this the *strong form of forecasting*. In this case, the agent could freely decide to counteract in such a way as to invalidate that prediction. Hence, in order to avoid inconsistencies and paradoxes, either free will has to be abandoned, or

it has to be accepted that complete prediction is impossible.

Another possibility would be to consider strong forms of forecasting which are, however, not utilized to alter the system. Effectively, this results in the abandonment of free will, amounting to an extrinsic, detached viewpoint. After all, what is knowledge and what is it good for if it cannot be applied and made to use?

It should be mentioned that the above argument is of an ancient type [12]. As has already been mentioned, it has been formalized recently in set theory, formal logic and recursive function theory, where it is called “diagonalization method.”

In doing this, we are inspired by the recent advances in the foundations of quantum (information) theory. There, due to complementarity and the impossibility to clone generic states, single events may have important meanings to some observers, although they make no sense at all to other observers. One example for this is quantum cryptography. Many of these events are stochastic and are postulated to satisfy all conceivable statistical laws (correlations are nonclassical, though). In such frameworks, high degrees of reproducibility cannot be guaranteed, although single events may carry valuable information, which can even be distilled and purified.

### **Strong event control**

A very similar argument holds for event control and the production of “miracles” [13]. Suppose there exists free will. Suppose further that an agent could entirely control the future. We shall call this the *strong form of event control*. Then this observer could freely decide to invalidate the laws of physics. In order to avoid a paradox, either free will or some physical laws would have to be abandoned, or it has to be accepted that complete event control is impossible.

## Weak forecast and event control

From what has already been said, it should be clear that it is reasonable to assume that *forecast and event control should be possible only if this capacity cannot be associated with any paradox or contradiction*.

Thus the requirement of consistency of the phenomena seems to impose rather stringent conditions on forecasting and event control. Similar ideas have already been discussed in the context of time paradoxes in relativity theory (cf. [14] and [15, p. 272], “*The only solutions to the laws of physics that can occur locally ... are those which are globally self-consistent*”).

There is, however, a possibility that the forecast and control of future events *is* conceivable for *singular* events within the statistical bounds. Such occurrences may be “singular miracles” which are well accountable within the known laws of physics. They will be called *weak forms of forecasting and event control*.

It may be argued that, in order to obey overall consistency, such a framework should not be extendable to any forms of strong forecast or event control, because, as has been argued before, this could either violate global consistency criteria or would make necessary a revision of the known laws of physics.

The relevant laws of statistics (e.g., all recursively enumerable ones) impose rather lax constraints especially on finite sequences and do not exclude local, singular, improbable events. For example, a binary sequence such as 11111111111111111111111111111111 is just as probable as the sequences 11100101110101000111000011010101 and 01010101010101010101010101010101 and its occurrence in a test is equally likely, although the “meaning” an observer could ascribe to it is rather different. These sequences may be embedded in and be part of much longer stochastic sequences. If short finite regular (or “meaningful”) sequences are padded into long irregular (“meaningless”) ones, those sequences become statistically indistinguishable for all practical purposes from the previous

sequences. Of course, the “meaning” of any such sequence may vary with different observers. Some of them may be able to decipher a sequence, others may not be capable of this capacity.

It is quite evident that per definition any finite regularity in an otherwise stochastic environment should exclude the type of high reproducibility which one has gotten used to in the natural sciences. Just on the contrary: single “meaningful” events which are hardly reproducible might indicate a new category of phenomena which is dual to the usual “lawful” and highly predictable ones.

Just as it is perfectly all right to consider the statement “This statement is true” to be true, it may be perfectly reasonable to speculate that certain events are forecasted and controlled within the domain of statistical laws. But in order to be within the statistical laws, any such method *needs not to be guaranteed* to work at all times.

To put it pointedly: it may be perfectly reasonable to become rich, say, by singular forecasts of the stock and future values or in horse races, but such an ability must necessarily be not extendible, irreproducible and secretive; at least to such an extend that no guarantee of an overall strategy and regularity can be derived from it.

The associated weak forms of forecasting and event control are thus beyond any global statistical significance. Their importance and meaning seems to lie mainly on a very subjective level of singular events. This comes close to one aspect of what Jung imagined as the principle of “synchronicity” [16], and is dual to the more reproducible forms one is usually accustomed to.

### **Against the odds**

This final paragraph reviews a couple of experiments which suggest themselves in the context of weak forecast and event control. All are based on the observation whether or not an agent is capable to forecast or control correctly future events such as, say, the tossing of a fair coin.

In the first run of the experiment, no consequence is derived from the agent's capacity despite the mere recording of the data.

The second run of the experiment is like the first run, but the *meaning* of the forecasts or controlled events are different. They are taken as outcomes of, say gambling, against other individuals (i) with or (ii) without similar capacities, or against (iii) an anonymous "mechanic" agent such as a casino or a stock exchange.

As a variant of this experiment, the partners or adversaries of the agent are informed about the agent's intentions.

In the third run of experiments, the experimenter attempts to counteract the agent's capacity. Let us assume the experimenter has total control over the event. If the agent predicts or attempts to bring about to happen a certain future event, the experimenter causes the event not to happen and so on.

It might be interesting to record just how much the agent's capacity is changed by the setup. Such an expectation might be defined from a dichotomic observable

$$e(A, i) = \begin{cases} +1 & \text{correct guess} \\ -1 & \text{incorrect guess} \end{cases}$$

where  $i$  stands for the  $i$ 'th experiment and  $A$  stands for the agent  $A$ . An expectation function can then be defined as usual by the average over  $N$  experiments; i.e.,

$$E(A) = \frac{1}{N} \sum_{i=1}^N e(A, i).$$

From the first to the second type of experiment it should become more and more unlikely that the agent operates correctly, since his performance is leveled against other agents with more or less the same capacities. The third type of experiment should produce a total anticorrelation. Formally, this should result in a decrease of  $E$  when compared to the first round of experiment.

Another, rather subtle, deviation from the probabilistic laws may be observed if *correlated* events are considered. Just as in the case of quantum entanglement, it may happen that individual components of correlated systems may behave totally at random exhibit more disorder than the system as a whole [17].

If once again one assumes two dichotomic observables  $e(A, i), e(B, i)$  of a correlated subsystem, then the correlation function

$$C(A, B) = \frac{1}{N} \sum_{i=1}^N e(A, i)e(B, i)$$

and the associated probabilities may give rise to violations of the Boole-Bell inequalities—Boole’s “*conditions of possible [[classical]] experience*” [18, 19, 20, 21] and may even exceed [22] the Tsirelson bounds [23, 24, 25] for “conditions of possible [[quantum]] experience.” There, the agent should concentrate on influencing the *coincidences* of the event rather than the single individual events. In such a case, the *individual* observables may behave perfectly random, while the associated *correlations* might be nonclassical and even stronger-than-quantum and might give rise to highly nonlocal phenomena. As long as the individual events cannot be controlled, this needs not even violate Einstein causality. (But even then, consistent scenarios remain [26].)

In summary it can be stated that, although total forecasting and event control are incompatible with free will, more subtle forms of these capacities remain conceivable even beyond the present laws of physics; at least as long as their effects upon the “fabric of phenomena” are consistent. These capacities are characterized by singular events and not on the reproducible patterns which are often encountered under the known laws of physics. Whether or not such capacities exist at all remains an open question. Nevertheless, despite the elusiveness of the phenomenology involved, it appears not unreasonable that the hypothesis might be testable, operationalizable and even put to use in certain contexts.



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