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Is Chance a Phenomenon?

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Abstract

An event is determinist when it is predictable; an event is stochastic when it's occurrence is unpredictable (from the Greek stokhastikos: conjectural). In the everyday language, determinism and chance are frequently considered as phenomena and as the causes of phenomena. Expressions such as "by chance" and "at random", are common examples of an alleged phenomenology.

Keywords: *Chance; Determinism; Time; Space*

Introduction

The occurrence of a determinist event is a certainty. For example, the trajectory followed by the Earth around the Sun is a determist event because the position of the Earth is predictable. Therefore, the mathematical modeling of the event is determinist.

A stochastic event is unpredictable; even when the event is probable, this is without certainty. The mathematical models that describe stochastic events are probabilistic. For example, with one dice, each face has one possibility out of six. A more accurate forecast is impossible.

These issues were already raised in antiquity; the questions and the comments of the great authors are of particular interest for contemporary research.

Phenomenon and concept

The difference between a phenomenon (or an event) and the corresponding concept must be emphasized. A phenomenon belongs to reality, whereas a concept is an interpretation of reality, an invention of thought.

Some examples are provided in that purpose:

- The terrestrial revolution is an observable phenomenon which leads to the year as a unit. The year as a unit is an invention of thought, in other words a concept. This is why the year is not observable as such.
- About 2800 and 2500 BCE, after observing the repetition of lunar alternations, nowadays called lunation, the Sumerians invented the lunar month. As a concept, the lunar month is not observable.
- More broadly, we are unable to observe determinism as such because it's not a phenomenon; instead, it's a concept.
- We see the dice, but we can't observe the chance as such. Like determinism, stochasticity is not observable because it's a concept instead of a phenomenon.

In Greece and Rome

The Lydians from Asia Minor, which were the ancestors of Etruscans, have certified to the Greek historian Herodotus (484-425) that they were the inventors of the dice (Book I, 94) [1].

Plato reports that the word chance (hasard in French) is in the Dialogs of the Greek philosopher Socrates (470-399) [2].

The Greek historian Thucydides (c. 465-c. 395) quotes Pericles, who observed that people thought that fatality was the cause of their failures (Book 1, 140) [3].

Thucydides mentioned this excerpt of a speech addressed to the Athenians by the Spartans: Men who put their benefits prudently safe from chance, are truly wise (Book IV, 18) [3].

For the Greek philosopher Epicurus (341-270), events happen either by necessity, or by chance, or by ourselves (133) [4]; he added that chance was not a God (134) [4] and that it was uncertain (138) [4]. The necessity of Epicurus corresponds to our determinism.

For the Latin writer Cicero (106-43), alea designates dice, dice game and chance [5].

Casus means chance and vicissitude in the writings of Cicero, in the writings of the Roman general Caesar (101-44) and in the writings of the Latin historian Salluste (86-34 BC) [5].

We find the word chance in De rerum natura of the Latin philosopher Lucretius (c. 96-55) (Song II, 40 and Song VI, 672) [6].

In the Odes, the Latin poet Horace (64 BC-8 AD) spoke to the Goddess Fortuna: The cruel necessity always walks ahead of you (Book I, XXXV) [7].

The necessity of Horace corresponds to our determinism.

In The Satyricon, the Latin poet Petronius (?-65 AD) mentioned the decisions of fate (CXI) [8]; and he added the fate is also directing! (CXII) [8].

The Latin historian Tacitus (c. 55-c. 120) wondered if human affairs were led by a lasting need, or if it was chance (Book VI, Ch. XXII, 1) [9]. He wrote that the Roman emperor Tiberius knew that the charge of leading everything was depending on Fortuna (Book I, Ch. XI, 1) [9].

The Greek biographer Plutarch (c. 46-c. 126) mentioned the unexpected blows of Fortune (Life of Coriolan, 32, 4) [10], and he noticed that the Goddess Fortuna failed to fulfill the desires of Man (Life of Pompey, 52, 10) [10]. He wrote that the Greek philosopher Anaxagorus (500-428) has established that the world was organized by a pure and simple mind, instead of chance or necessity (Life of Pericles, 4, 6) [10]. Plutarch adds: Chance also made that they had the Moon in the back (Life of Nicias, 21, 11) [10]. Chance often brings back the same circumstances... the favors of fate... (Life of Alexander, 19, 7) [10].

Phenomenology of chance

The Dictionnaire Robert [11] indicates that the french word hasard, which means chance instead of danger, has an Arabic origin: az-zahr for dice game. The dice game is an example of pseudo random situation: indeed, in the same conditions, we obtain the same combination of numbers; however, the means to implement for reproducing the same result are disproportionate.

The chance is neither a divinity, nor a phenomenon: the idea was developed from stochastic events [12].

During the dice game, we see what the dice do; but we are not able to see chance: the reason is that chance is not a phenomenon. Chance is a concept. More broadly, during a random event, we observe the event which is a phenomenon, but we can't observe the probability, that is a concept.

The phenomena are described through statistical modelings, and their forecasts are calculated in terms of probabilities, because we do not know how to do otherwise. Let's remind that these phenomena are not caused by chance and that they are not prescribed by alleged probabilistic laws of the Universe. It must be stressed that a physical law describes, it does not prescribe [12].

The determinism is also a concept instead of a phenomenon: it is a modeling of reality, in which the states of the systems and their occurrences are evaluated through classical mathematical models.

A deterministic event, which is an observable phenomenon, leads to the concept of determinism that is not observable as such. After a physical law is developed, specific events become predictable in the field of this law.

In Le Hasard et la Nécessité [13], the French biologist Jacques Monod is contending that every existing thing follows from chance and necessity, and that chance is at root of species evolution. The word necessity of Monod corresponds to determinism.

For Monod, chance and necessity are phenomena; that is to say that they are active principles of the nature. In fact, chance and necessity are not observable; they are constructions of mind based on observed phenomena: the natural phenomena, which are observable, lead to the concepts of chance and determinism that are not observable.

For example, within the same environment, the intervention of the genes of a DNA sequence is aleatory; the intervention of the genes is not caused by chance; in contrast, chance can be defined by means of this aleatory intervention: the possible intervention of the genes observed in laboratory, leads to the concept of random which is not observable as such [12].

The aleatory intervention of the genes is caused by very complex molecular reactions. This intervention is perfectly observable; but it is senseless to think that chance can be observed, because it's not a phenomenon.

Moreover, we show that determinism, called necessity by Monod, is a special case of chance [12].

The quantum parameters and the relativistic parameters have mathematical properties which seem opposed: stochastic for one, deterministic for the other; discontinuous for one, continuous for the other; invariant for one, covariant for the other. In fact, determinism, continuity and invariance can be considered special cases, respectively of probability, discontinuity and covariance [12].

The result is that the dichotomy between determinism and chance, which is still argued nowadays when chance is mentioned, is unsubstantiated. It also leads to two surprizing concepts: the stochastic time and the stochastic space.

The causes of the neuronal diseases

Neuronal diseases, including neurodegenerative diseases, don't result from determinism or chance, of which we have shown that they are concepts. For example, Alzheimer's disease is not observable as such: in fact the neurologist can only observe the clinical symptoms of Alzheimer's disease.

Symptoms (observable) >>> Alzheimer's Disease (concept).

It's important to emphasize that no disease appears by chance. The causes of the diseases are either genetic, or environmental such as the way of life, and the possible potentiation of both. For example, the abuse of psychotropic substances or the prolonged exposure to certain solvent, leads to serious, and often irreversible, neurological disorders.

The stochastic time

The general definition of time is: time is a concept corresponding to what separates two states of a system [12].

The extension of this definition based on two possible states of a system, leads to the conceptualization of stochastic time: The stochastic time is a concept corresponding to what separates two probable states of a system.

The stochastic space

The general definition of space is: space is a concept corresponding to what separates two systems [12].

When the position of a system is aleatory, it is possible to conceptualize a stochastic space from this general definition: The stochastic space is a concept corresponding to what separates two probabilistic systems.

Some stochastic functions are time and/or space dependent: in fact, time and space are dead continuous or discontinuous variable, that we make intervene according to the clock and/or the measuring systems available in the laboratory.

Conclusion

Although the persuasive habits of everyday language continues to foster the confusion between phenomenon and concept, it can be of interest for theoretical research to take into account that determinism and chance are concepts. Determinism and chance are not phenomena and they do not cause events, including neuronal diseases. The stochastic time and the stochastic space provide an unexpected illustration of the value of describing the nature of determinism and chance. In one way or another, it seems advantageous for a researcher to have them available, in the prospect of a thorough theoretical investigation.

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