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# Time in Mathematical Models

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## Abstract

Time is in all the mathematical models that describe the movements of objects and the state changes of objects. However, can time be considered a cause of these movements ? Is it an active factor of these changes ?

**Key words:** Naturalia ; Artifact ; Physical law ; Field effect

## Introduction

It is commonly thought that mathematics is complex. In fact, nature and more broadly the Universe, are indefinitely more complex. Paradoxicaly, mathematical modeling sallow a significant simplification, because natural objets are imperfect where as mathematical objects are perfect. But in order to avoid the risk of « field model effects », it's important to identify the limits of mathematical models.

## Mathematical Modeling

The complexity of reality can be reduced by representing it using mathematical concepts and mathematical models; but of course, although concepts and models represent reality, they do not themselves constitute this reality. Such representations simplify the analysis by keeping only the essential features of reality. A mathematical modeling consists in identifing the parameters implemented in a phenomenon, and establishing relatinonship inside one or several equations. Then mathematical modeling allows one to quantify reality, predict events, and develop physical laws. In addition, it is essential to distinguish between an observed reality and a correspoding concept, as well as between an observed phenomenon and a corresponding concept.

## Naturalia

Mathematics does not exist in nature; it is a tremendous invention of thought, in fact, a product of culture which has been largely inspired by nature, especially during the gestation of mathematics in Sumer about 5000 years ago. In contrast to reality and in contrast to natural phenomena, mathematics is purely conceptual. Certain objects of nature and certain natural phenomena, such as the skyline, hexagonal honeycombs, natural rhythms, objects in number, or waves on the surface of water, may suggest that mathematics exists in nature. These objects and these phenomena are called naturalia, from Latin naturalis which means natural, from nature [1]. Naturalia are irregular, imperfect, rough, and they should not be mistaken for mathematical objects, which are perfect and which obey strict laws: mathematics simplifies by building sets of mathematical objects, all of which have the same properties.

## Mathematical Artefacts

Artefact comes from Latin artist factum, which means done from art. The idea here is to match mathematics and nature, in order to evaluate some aspect of the latter, using concepts and mathematical models. It will then be possible to subject time and space to nature's scrutiny with the help of mathematics, but with an important reservation: concepts and mathematical models represent reality, but they must not be confused with it. Mathematical artefacts represent reality, but they are not reality: this is precisely the difference between reality and mathematical artefacts.

## The Origin of Mathematics

Some very basic mathematical forms emerged in the early Neolithic, about 7000 years ago; their origins, in various cultures, were diverse, polygenic. In Iraqi Kurdistan, archaeological strata of this period have returned small spherical, or cylindrical, or conical ceramics, called calculi, which were intended to keep accounts [2, Ch. I]. In the early Neolithic age, with this small and elementary arithmetical model represented by calculi, our ancestors invented one of the first mathematical models. Painted pebbles, found in Mas-d'Azil in Ariège France, dated about 9000 BCE, are interpreted as memory aids [2 , Ch. I], and a likely precursor of calculi. In Egypt, geometry has triumphed with the impressive stone step pyramid, designed by the great architect Imhotep for Pharaoh Djoser in Saqqara, about2700 BCE; then with the legendary rhomboid pyramid, built for Pharaoh Sneferu, about 2600 BCE: the changing slope of the ridges was intended to reduce the risk of collapse. These architectural feats reveal an astonishing mastery of physical space.

According to the Greek geographer Strabo (c.58 BCE-22 CE) [3], arithmetic was invented by the Phoenicians for the purpose of maritime trade. In Mesopotomia, arithmetic has been identified as early as the late fourth millennium; calculations of surface area are attested there during the eighteenth century BCE [2, Ch. IV]. Since the highest antiquity, symbolic arithmetic has played a significant role. This shows how numbers have had a fascination on all cultures which projected such constructs on Nature. « Seven »was the number of time in Mesopotamia, then in the Bible; it has imposed the rhythm of celebrations since protohistory. We find the day of rest on the seventh day following biblical creation, the seven visible stars of the constellation of the Pleiades, and the seven planets of Hebrew cosmography [4, Ch. I]. The Mesopotamians invented the psephy, which consists in assigning numbers to signs, to syllables, to words, and to letters, so as to extract secret meanings. They were imitated by the Egyptians, and also the Greeks, who believed that odd numbers had a mystical power; Hebrew Ghematria and Islamic Sîmiâ are manifestations of the same approach [5, Ch. V]. The current success of numerology in the tabloids is a survival of the psephy. Astrology uses the same process:its practitioners claim that the organization of the sky prescribes the psychical predetermination of each individual, as well as his or her future, depending on the planetary configuration at birth. Such mathematization gives a scientific appearance to something devoid of science. As an example, the interaction between Jupiter and the Earth is 22,000 times weaker than the interaction between the Sun and the Earth [6, Ch. 4], which annihilates the scientific claims of Astrology.

## Arithmetical Modeling

### Illustration with trees

a. « tree»is a signifier, linguistically speaking, a word which is known to almost everyone. The mental representation varies according to individuals and cultures, including metaphors, polyvalent symbols, polymorphic myths, and arborescent hierophanies [5, Ch. VIII].
b. « the tree » names the object in general; the object as such, or a specific object.
c. « 1 tree » associates the word with a number, which does not exist in the nature, because « 1 » is a mathematical entity; therefore, « 1 tree » is an abstract being which represents reality: this is a concept.
d. « 2 trees » is an arithmetical operation: the addition of two objects of the same category, although they differ from each other; all trees are heteromorphic.

Therefore, it is an approximation, a compromise, an arrangement with nature: « 2 trees »is an arithmetical model; it is a representation of a reality, but it is in no case the same as this reality.

### Illustration with years

The same abstract approach will be used with second, hour, day, month, meter, when these concepts are defined. For example, « year X » and « year Y » represent two different realities, therefore « 2 years » is a way of modelling reality.

## Geometrical Modeling

### Illustration with the ogival architecture

In the history of architecture, the transition from the Romanesque vault to the Gothic warhead was a major step in the mastery of architectural space. The curves of the future structure were modelized using a simple compass: the vault is represented by an arc centered on O; the warhead results from the intersection of two arches of the same curvature, but centered on two different points $O_1$ and $O_2$.

Paraphrasing the Belgian painter René Magritte (1898-1967), *This is not a pipe*, painted in 1928, the Figure 1 is neither a vault nor a warhead but a geometric model [7]. The drawing is a model, not reality. Without this graphical modelling, the ogive would never have been conceived; the ogival architecture would probably never have been invented.

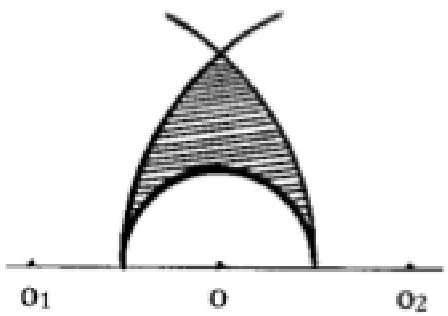

Figure 1: This is not a war head.

### Illustration with the Valdivia cosmogram of pre-Colombian Ecuador

The disc (27 cm) has engraved dots representing star positions, and arrows representing the motions of celestial bodies. It is an early example of complex spatial modelling of the sky (2300-2000 BCE) [8].

## Statistical Modeling

### Illustration with the bacteria

Bacteria are prokaryotic unicellular organisms whose genome consists of DNA with one chromosome. The statistical modelling of their development can help us to understand aging. Bacteria reproduce by splitting through scissiparity: one mother turns into two daughters, which in their turn become, each giving two daughters, etc. The population doubles in each generation; if the starting population is $N_0$, at the $n^{th}$ generation there are N bacteria, such as:

$$N = 2^n N_0$$

The modelling is statistical as it is assumed that, under the same conditions, all bacteria duplicate at the same speed.

### Illustration with the brain

The dendromorphous structure of the human brain contains a little less than100 billion neurons ($n \# 10^{11}$): each neuron input, called synapse, is connected by axons to about ten thousand neurons ($m \# 10^4$), sometimes less, sometimes more [9, Ch. IV]. The number "N" of axons is $N \# nm/2$, with $n \# 10^{11}$ and $m \# 10^4$, so we obtain $N = 5.10^{14}$, approximately 500,000 billion axons. The amplitude and modulation of electric pulses for each axon increases this complexity. The number of neurons is the same for all individuals, and a normally developed brain uses all of its neurons. On the other hand, positive stimuli, including education, learning, and curiosity, can facilitate an increase in the number of axons and also their preservation (apart from degenerative diseases), in spite of chronological age, but not in spite of biological age. These two statistical modelling sallow one to reduce the complexity of reality and to enrich our knowledge.

## Diachrony of Physical Laws

A modelling is an arrangement with physical reality, but not a substitute for it. However, it allows a description, quantification, an evaluation, and a certain prediction. Observation, experiment, the replication of findings, and mathematical models of physics lead to the formulation of laws which depend on the concepts and models used; they depend on the progress of research and progress of thinking in general. A physical law is not discovered in nature, but follows from a construction of the mind.

This provides grounds for making the following observations

a.The accuracy of laws is not absolute; they do their best, but they inevitably convey inaccuracies.

b. Physical laws are not immutable. For Einstein, laws are only « temporary solutions » to our conceptions of reality [10, p. 219]. Concepts and models evolve independently of time; this evolution leads to changing laws. For these reasons, neither nature nor the Universe obeys our laws; they are not compelled to abide by our laws; they do not operate from a law, ex lege according to the expression of Cicero (106-43). Our physical laws provide certain descriptions and they make some predictions possible, but they do not prescribe anything. The main feature of our physical laws is that they provide a temporary description rather than a permanent imperative. Repeated train or aircraft crashes often make people conjecture some law about series of accidents, but this is a mistake, because the essence of a law is to predict, while these events are not predictable. The economic cycle is not a law of economics, because collapse is unpredictable. Moreover, economists and politicians are unable to predict crises; they do not even agree among themselves about how to find a way out of a crisis. The principle of Roman law, leximperat (the law dictates), is not true inphysics; so the ambition to circumscribe the Universe (totum, the whole, the totality) with a corpus of immutable laws within a final theory is utopic, in no place, and uchronic,, never, at no time. Einstein gave up looking for a global picture of the Universe, explaining that he was not disavowing a principle, but applying a method [10,p. 160]. More thorough observations, more accurate measurements, more advanced mathematical models, and new theories will lead to changing laws, to the rejection of some laws and the introduction of new laws. Some of the current laws will bed one away with, or modified. Moreover, the laws of physics have been developed with concepts of time and space, which are prevalent, although they remain undefined. Therefore, this quite legitimately raises a question concerning the progressive precariousness of existing laws in favour of new ones which may not involve time and/or space, but some more efficient models, with more effective parameters. Expressions such as laws of the Universe and laws of nature, lex naturae in Cicero, are survivors from ancient divinations of Nature, which were considered superstitions by Lucretius (c.95-55 AEC) [11, Song II, 653]. These expressions are examples of epistemic immoderation which should be excluded from scholarly semantics and replaced by more circumstantial expressions, such as laws of biology, laws of astronomy, laws of thermodynamics, laws of physics, or physical laws.

## Field Effects

A field effec**t** is a disruption of perception and interpretation of an object, a phenomenon, or a model.

### Primary field effects

The primary field effect was theorized by the Swiss psychologist Jean Piaget (1896-1980): The perception of an object or a phenomenon can be disrupted by its surroundings. Two examples:

a. Heterochrony: time passing at different rates, depending on whether the activity performed is enjoyable or not. But the velocity of time related to time is a sophism.
b. Metaphors associated with time, including the arrow of time, are primary effects of field.

In the following, we introduce two more precise developments of the concept of field effect.

### Technical field effects

The observation of certain phenomena frequently leads to misinterpretations; reality can mislead the observer. Here are two examples:

a. The assimilation of a river flowing with time flowing; but the comparison is inappropriate: we know why the water is flowing, and if the flow were to reverse, we could explain why.
b. The Plague in Athena: Thucydides (c.465-c.395) gives a geographical explanations of the causes of the plague that struck Athens in the fifth century BCE, by the progression of the epidemic from Ethiopia to the Pyraeus, after propagation in Egypt, in Libya, and in Persia (12, Book II, Ch. II, 47-54). It was not poisoning, or an attempt by the Gods to vent their anger or curse the people, or anything of this kind. The plague did not cross space either. The spread of the desease was driven by contagion between individuals.

### Field model effects

Dynamic phenomena are modelized using mathematical equations in which the presence of time suggests that it has an active function; but the proof of the alleged active role does not exist. Here are three examples:

a.The use of « zero »:

When a system does not possess a parameter « X », it should not be described with this parameter of zero value. « X = 0 »is a mathematical transgression. For example, the charge and the mass of the photon are not zero; in fact, the photon has no charge and no mass: it does not possess these two parameters. We would not say that someone without a car has zero car.

b. The equation describing the space traversed by a train:

The speed is the dynamic feature of the movement; if the speed is zero, the distance travelled by the train is zero. The duration does not play any active role on the movement of the train, because the duration is just what is indicated by the clock at the railway station.

c. We have the same risk of field model effect with the equivalence of mass and energy which was predicted by special relativity:

$$\Delta E = \Delta m\, c^2.$$

This relation is confirmed in the strong nuclear interaction: the mass of the atomic nucleus is less than the sum of the masses of its nucleons. The missing mass « Δm » is hidden in the form of a binding energy« ΔE » between the nucleons, and this energy is released during the process of disintegration of the atom. Mass and energy are said to be equivalent because they are proportional; but they are not identical, because the properties of matter and the properties of energy are radically different.

## Conclusion

The physics equations are models of reality: they are not this reality. The study of time gives a decisive illustration of the risk of misapprehension caused by field model effects. It allows one to demonstrate that time is not involved in changes; for example it is not a cause of aging [13]. Ultimately, time is not a physical phenomenon.

## References


1. Gaffiot F, Flobert P (2000) Le grand Gaffiot: latin-french dictionary. Hachette, Paris.
2. Jean-Paul B, Renisio G, National Galleries of the Grand Palais (France), Meeting of National Museums (France) (1982) Birth of writing: cuneiforms and hieroglyphs: [exhibition], Grand Palais National Galleries. Ministry of Culture, Editions of the Meeting of National Museums, Paris.
3. Strabo, Tardieu A (1967) Geography of Strabon. Hachette and Co., Paris.
4. Marques-Riviere J (1950) Talismans and Pantacles Amulettes. In Oriental and Western Traditions. Payot, Paris.
5. Eliade Mircea (1987) Treaty of history of religions. Payot, Paris.
6. Ekeland I (1991) Random: luck, science, and the world. Editions du Seuil, Paris.
7. Magritte R. This is not a pipe. Los Angeles County Museum, USA.
8. Me Besch Cannes (2007) Cabinet d'Expertise Origine.
9. Jean-Pierre C, Connes A (2000) Matter of thought. Odile Jacob.
10. Einstein A (2009) How I see the world. Flammarion.
11. Gale MR (2008) Lucretius: On the Nature of 5. Liverpool University Press.
12. Jean Voilquin J, Capelle J (1964) Thucydide. History of the war of the People.
13. Dassonville, Patrice F (2017) The Invention of Time and Space. Springer.