

## How Time and Space were Unmasked

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### Abstract

How the nature of time and that of physical space have been unmasked.

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### The knowledge of time and space

Although time and space were used as well in everyday life as in the most advanced mathematical models of Physics, they both were unknown; in other words there were no answer to the elementary questionings: what is time? what is space? A cuneiform sign allowed us to identify the oldest trace of time; and the Latin literature helped us to understand the emergence and the development of the concept of physical space.

### An unexpected result

The study started about twenty years ago, with a long investigation through current books, articles, lectures and debates, in order to assess the level of knowledge in fields such as sciences, philosophy, mathematics, psychology. The interdisciplinary investigation led to an unexpected and disappointing result: apart from a profusion of metaphors, received ideas, formal defects and approximate comments [1], time and space remained not defined; their respective nature was not identified (for example, had they been invented or discovered?); and their properties were not described.

### Shake the target

The more a subject seems obvious, the more it is difficult to explain; therefore you had to shake the target to force it to uncover itself; in other words, it was necessary to get rid of all metaphors, to eliminate comments without heuristic consequences and to find an efficient access way to take a step forward.

From now on, assertions like “time flies” or “space is surrounding us” would be considered as inoperative.

Then, could we find when the temporality and the spatiality have emerged; and the forms in which they have appeared?

A composite hieroglyph engraved or painted on hundreds of monuments and objects (Figure 1) appeared c.2000 BCE<sup>1</sup>: the disc represents the sun God Re, creator of living beings; the spread wings of the Goddess Nephthys symbolizes the Sun's path with the alternation of day and night, and rebirth after death. This graphic precursor of time and space born in Egypt, can be seen in Persia, in

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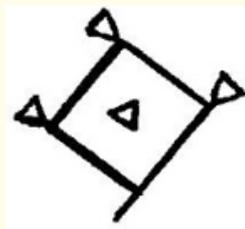
<sup>1</sup>BCE: Before Common Era; CE: Common Era.

Phoenicia, in Mesopotamia, in the Hittite empire, etc [2]. We have been astonished not to find it in Greece, in Roma or in the Roman empire, as well on monuments as on objects and numismatics.



**Figure 1:** A widespread precursor of time and space.

A clay tablet dated 2800 - 2500 BCE has been uncovered in Sumer (lower Mesopotamia), on which is engraved a cuneiform sign (Figure 2) meaning "lunar month" [3]. The investigation through an important archaeological corpus required months of researches, but with a reward because it is the emergence of temporality. It is quite strange that the first trace of time is not mentioned in other researches on time, as we attend the invention of time.



**Figure 2:** The "month" in cuneiform writing.

Then we had to proceed to a semantic and technical analysis of these graphic signs in order to draft the indispensable definitions. The lack of definition is scientifically unacceptable, To define something, is to say what it is. The lack of definition of time and space means ignorance; however everyone, after being trapped by technical field effects<sup>2</sup>, pretends to know what it is about.

### How to define time

We have retraced the approach of the Sumerians:

- They observed the movements of the Moon,
- They found out a repetition, that is to say the return of the Moon in the same state and at the same place in the sky.

Nowadays the complete move of the Moon is called "lunation".

- They gave the name "arhue" ("month" in Sumerian language) to a complete move of the Moon.
- Then the Sumerians started to use "arhue" in their everyday life; it was decidedly a considerable progress.

The lunation is observable because it is a physical phenomenon; on the contrary, the "month" does not exist in the nature: the month cannot be observed, because a concept is not observable.

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<sup>2</sup>Technical field effect: we have introduced this concept to name misinterpretations of nature; Ex. the flow of a river reminds of the passing of time. Field model effects: it designates misinterpretations of mathematical models; Ex.: the role of time in mathematical models.

We noticed that the Sumerians were able to conceptualize a reality (the lunations) and introduce an abstract concept (the month). Unfortunately, the name of the Sumerian scholar who accomplished this intellectual feat, remains unknown. We are talking of the invention of time, a feat as important as the evaluation of the meridian by the Greek geographer Eratosthenes (276 - 194) [4].

A definition of the month can be drafted: "The month is a concept corresponding to a lunation".

We are not allowed to say that "the month is the duration of a lunation", because the word "duration" is not defined yet. The definition of the month will be extended to the definition of time (and duration): "Time (or duration) is a concept corresponding to what separates two states of a system".

### How to define space

Long after Sumerian and Egyptian architects, the Latin literature provides hundreds examples of the semantical emergence of the notion of distance and the gradual introduction of the notion of space:

- In the Roman politician Cicero (106-43 BCE) "communia spatia" means "public square"; "disto" means "be away"; "ex alto" means "far away"; "templum" means "a space".
- In the Roman strategist Cesar (101-44 BCE) "altus" means "high"; "locus" means "place"; "longinquus" means "remot"; "momentum" means "space".
- In the Latin poet Titus Livius (c.59 BCE-17 CE) "trans" means "on the other side".
- In the Latin poet Seneca (c.4 BCE-65 CE) "spatiosus" means "spacious".

An elementary definition can be drafted: "The space is a concept corresponding to what separates two systems"

### Nature and properties

Although they look quite poor, these definitions lead to several theoretical extensions mainly concerning the nature and the properties of time and space: they are deprived of physical properties; instead, the two concepts have mathematical properties which depend on the field of study.

Researchers and thinkers have difficulties admitting that time and space were not discovered in the nature. The conceptualization done by the Sumerians and the gradual development of the Latin terminology led to unmask these two major inventions of the human mind: time is not a phenomenon and space has no materiality.

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