

ON THE "HISTORY" OF THE UNIVERSE AND THE BEGINNING OF TIME

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Abstract. The current 4 D (or N+1 D) model of the Universe often describes it with words of ordinary language such as "history", and "evolution". Any reference to an historical evolution refers to a notion of time. The structure of "time" underlined by ordinary language is investigated and it is shown that, if the word is the same, its structure is radically different in Physics from ordinary language. Using the word "time" in the sense of ordinary language is thus a source of ambiguity and confusion in Cosmology. I then address the question: in terms of "time" in ordinary language, "when and how did time begin?"

1 What is Cosmology ?

Cosmology is often presented as the study of the history (and structure) of the Universe, even in the professional literature. In this paper I analyse the status of the notion of "history" of the Universe, addressing the question: is it a scientific notion?

Let us recall that Cosmology consists in two activities:

- collecting data, essentially astrophysical ones, results of our perceptions
- attaching them mathematical symbols, themselves arranged in a structured way called theory.

Thus, what is not written in mathematical terms has no status in cosmological theory. An important character of mathematization is its purely mechanistic nature (at least for the Mathematics used in Physics), with no underlying semantics (apart from the very notion of symbol). On the other hand, Cosmology aims to be(come) a theory of everything, including thus the notion of history. Let me examine whether these two requirements are compatible. On the way I will try to go to the ultimate roots of the notion of History, although the ultimate root is that there are no roots in this matter.

2 History and time

Every conception of History rests on a conception of time. It is therefore necessary first to say something about that concept, knowing that when one pulls its thread, everything comes together: language, paradoxes, apories and the unutterable. Indeed, there is always something that cannot be written in these matters; for instance, it is impossible to formalize the gesture, or a definition, of formalization.

I will start from everyone's basic experience of time. First, time is always apprehended as present. This present presents itself on different, coexisting, scales: short and long durations of "suspended time" (as in musical time). Second, the present is experienced through different modalities: projects, memory etc (which are always actual). They show why time is a subtle thing since the escape to the present is part of the present. Then enters another actor: language, especially with different tenses. They serve to express short and long presents, projects and memory. They fabricate in this way a "composite" of experienced present and its conceptualization. It is this composite which constitutes everyone's time.

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There are five steps in this construction:

1. The present instant is seen as a "closed" entity
2. As escape toward another (future) instant it is considered as a transition, related to a presence (the latter aspect has been profoundly analyzed by Heidegger, 2002)
3. The past tense of verbs leads to the imagination of other instants, called past instants
4. The transitional nature of the present leads to extending it to the (imagined) past instants with an associated past presence
5. The transitionality of past instants leads to ordering them in a series.

Therefrom emerges a genetic image of a time which passes on, where each instant gives birth to another one which it already contains in gestation. It is this genetic time which lies at the foundation of History, as felt by anyone. A formalization, denying the Zermelo-Fraenkel set theory axiom of foundation (implying therefore that $x \in x$ is permitted, contrary to standard set theory), has been proposed by Schneider (1994, 1997). This non standard formalization offers a new solution to the Zeno paradox.

3 Time and Physics

Does Physics deal with the above notion of time? Not at all. In rupture with Aristotelism, Physics substitutes to the search for essences relationships between observations, correlations between data. Science is nothing but that. These relations can only be abstract. They are expressed by pure mathematics, whose efficiency has been empirically widely proven. For instance, to the intuitive feeling of the intensity of a motion one has substituted the abstract ratio of meters per second. As for "time", Physics only deals with objects called watches and the comparison between them and other observables. It builds a parameter T that is essentially the position of a tick on a dial. An event is said to occur at time T if it coincides with a certain position T of the tick. The equations of "evolution" are then nothing but correlations between T and other observables. The choice, among objects, of a subset of watches is arbitrary and guided by the wish to make equations of evolution as simple as possible (ruling out for instance the conceivable but inconvenient choice of number of undecayed nuclei in a large radioactive sample). T being a number, mathematics allows one to make any arbitrary division or multiplication and to invent very short and very long "times". They are nothing but the result of the abstraction power of mathematics. For instance, what is called a "millisecond" is the fiction of a time taken by a plane to cover a distance of 1 mm, or "million year" is the fiction of a time taken by light to go from one galaxy to the nearest.

Astrophysics then tells nothing more than that there is a correlation between the T-line extrapolated to large values and observables such as the redshift of quasars or the mean temperature of the Universe. Of course these different T's have a great coherence between themselves and with the rest of physical data. But these are only mathematical fictions representing only themselves, and it is a great epistemological mistake, perpetuated by physicists and journalists¹, to call "time" such a T-line and to pretend that watches "measure" time. The belief that T describes time is similar to the belief in the pre-relativistic absoluteness of instantaneity or in the pre-quantal reality of the value of a physical observable (in fact the majority of physicists do still not accept that observables have no value before an experiment). Among other consequences, the T-value for which the extrapolated mean temperature of the Universe becomes infinite is by no means the beginning of time. As an analogy, it is strictly speaking no more justified to call "time" these very small or very large numbers than to call "color" a wavelength smaller than 400 nm or larger than 700 nm.

Why does T not represent time? Because nowhere in the mathematical symbol T one can find the passage from one instant to another or the singularity of the "now". "Now" is never the same: it is "the time at which one speaks" (Benvéniste). It is impossible to express this structure in terms of equations of Physics, as was noticed for instance by the H. Weyl (1918).

There is no "history" of the Universe in astrophysics because it lacks a mix from one instant to another. If one nevertheless finds often a history-like description of Cosmology in popular books, it is only by an effect

¹see for instance E. Klein *Chronos: How Time Shapes Our Universe*, Thunder's Mouth Press, 2005.

of everyday use of words. But one can notice that the concept of history, as defined above, is of no technical use in Cosmology. There is no single technical astrophysical statement to express any observational fact in terms of "passage of time". It is in particular incorrect to pretend that the present Universe (i.e. the set of all observations) results from a past world; there is no "past world" in Physics, there are only present experiments and observations.

To be complete, an open question remains, to be treated elsewhere: how to deal in the present scheme with the so called "irreversibility" of time and the second law of thermodynamics?

4 When did (ordinary) time begin ?

If the observed Universe (existing only in the present tense mode) is not the result of a history, one can nevertheless ask the question "when did time begin ?" and try to give an answer, if it makes any sense. Let us first analyse the structure of ordinary time.

4.1 Scientific analysis of ordinary time

To understand scientifically the passage of time and the now, it is necessary to analyse the instrument by which experience gives access to them. This is exactly the operational approach taken by Relativity and Quantum Physics. Here the only instrument known is natural language (with a specific complication symbolized for instance by the paradoxical statement " 'word' is a word"). It is thus necessary to start with a minimal analysis of how it works. The key point is that any "normal" statement is made of what it is about (the *theme*) and what is said about it (the *rheme*). Thereby, it presents itself as saying something about an external, pre-existing, object (the "referent" in linguistic theory). But we never experience the object itself. Experience only provides sensations, perceptions and words to speak about the perception "of" something. In this respect, one of the first statements of Kant's *Critique of Pure Reason* remarkably summarizes the situation: "If all our knowledge begins WITH experience, it does not prove that it derives all FROM experience, for it could well happen that our knowledge through experience is a mixture of what we receive from our sensations and of what our ability of knowledge [i.e. concepts] produces by itself: an addition that we do not distinguish from the 'prime data' until our attention has taught us, after a long exercise, to detach it from them." (my translation and brackets). The idea of a reality as source of perception is purely metaphysical and in this sense "realism" is an idealism. To summarize, language speaks in a second step about things that it presents, afterward in a non linear time, as pre-existing but that it has in fact built itself in a first step. To be more exact, language does not build objects from perceptions, but attributes of objects (color etc) which serve in turn to build an object having these attributes. Physical attributes of objects are, as built out of logical concepts, subject to logical rules imposing constraints on them; it is these constraints that lead to the notion of a solid, stable, reality and make perception different from hallucination. This notion of afterwardness is, together with relativity or set theory, one of the greatest conceptual inventions of the XXth century. And this afterward construction holds among other for the past.

4.2 Construction of the past and beginning of time

The past is, as everything, the result of a construction. The building blocks of that construction are memories (images, sounds or other sensations) and objects called "records" on the one hand, and natural language on the other hand. Memories and records are always actual experiences treated by language and in particular the past tenses of verbs. The latter are given a priori (in a Kantian sense) and are not deduced from experience. Records are only afterward, thanks to words, "record of" something. It is analogous to the "mirror stage" where the child, seeing an image in a mirror, transforms it, thanks to his parents words "it is you", into an "it is me", becoming therefrom a person. In the same way, the personal past, suggested by a picture, is built by the words "it was me". Let us note in passing the absurdity, from a strictly logical point of view, of the past tense. It denotes a self-contradictory notion of "past presence". Indeed, while the present tense refers to a presence (Heidegger 1957) the past tense refers to an absurd "unpresent presence". The, apparent, depth of past is then like the third dimension of a "trompe-l'oeil" which, in reality, is nothing but a 2-D surface (more exactly a surface with the thickness of the now). This analogy resolves the above mentioned contradiction of an unpresent present. This trompe-l'oeil we do not only contemplate it from outside, but, since we identify ourselves to it like the child to "its" image, but we are in it. And only natural language is able to add the

mix of instants founding, with its genetic dimension, the notion of History. So, “when did time begin?” To summarize again, the answer is that there was no real beginning since there is only the present, only an afterward beginning, located arbitrarily anywhere, This vagueness of the beginning is well accounted for by the expression “mists of time”.

5 Epistemo-analysis of the “history” of the Universe

One can then wonder why, since a rational analysis shows that there is no history in Physics, there is a solid persistence of a belief in an history of the Universe among physicists. It surely is because it provides some social advantages, but that is not the only reason. To understand this persistence, epistemology is not sufficient, one needs to invoke epistemo-analysis². Epistemo-analysis unveils and analyses the emotional roots of concepts. Briefly speaking, it makes use of the notion of “family romance”. The latter is not a literary decoration, it is an elaborate and operational concept (see Laplanche and Pontalis (1964) for an account). It is an a priori “symbolic form”³, in a Kantian sense, preceding individual experience. On the one hand it is a narrative (linked to the notion of “narrative identity”); on the other hand, it involves, through the word “family”, the genetic, “hereditary” aspect of time. In Philosophy of History, it corresponds to what is called “setting History into intrigue” (Veyne 1984, Ricoeur 1988). The family romance unconsciously implements maternity and paternity relationships with an imaginary and fantasmatic past and, through the so-called “primitive scene”, with origins. It is also the root of the genetic notion of time and of the notion of causality. This genetic relationships with the imaginary past exerts such a powerful attraction that cosmologists and their readers are not ready to renounce the narrative version of cosmology; it has the same roots than the adoration of ancestor’s relics encountered in many civilizations. That explains why it is fashionable to give the name “Origins” to different astronomy programs. In a sense it is a kind of astrophysical analog of the “Intelligent Design” ideology. In that, cosmologists and their readers are not only victims, but also party, at least unconsciously, to the above-mentioned trompe-l’oeil. That is why, let us not delude ourselves, to the prejudice of lucidity the magic thinking of cosmological narratives has a flourishing future.

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²this neologism was first introduced in “L’exobiologie, l’imaginaire et le symbolique” www.obspm.fr/~schneider/15mai.html

³in the sense of Cassirer