On the Justifiability of Establishing a Science of Time

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Abstract

Physicists think that they are the ones who will have the last say about time and answer the questions: what is time, how is it manifested, how is it measured, as well as a series of other questions that appear when we think about time. Biologists, psychologists and philosophers do not believe that physicists have a monopoly on the topics dealing with time. Dissentions of the kind have led us to consider time as a phenomenon that needs to be studied in a multidisciplinary scientific way. Time is a subject of scientists, artists, philosophers, theologians, spiritists, as well as all the others who build the form and define the content of human spirit. Science is the leading category of human mind and leads civilization to factual truths. This is an attempt to give the reasons for establishing the science of time.

Key words: time, science, phenomenon, measurability, value

Introduction

Time is one of the most intriguing subjects of today, as well as of the past. The question is very simple: *Why*? If all concerning time is precisely defined and clearly stated, then: *what is it that still induces contemporary thought (scientists, artists, thinkers and other interested people…) to struggle with time?* The common opinion is that there is not much left to say about time,[1] but the number of studies and books with time as their subject grows with great rapidity. There is a certain contradiction in this. In this study, I am going to attempt to give the reasons for establishing the science of time.

Judging by certain modern trends, the quality of scientific thought seems to be changing fundamentally. It appears that some long established truths are becoming less important and less stable. Man primarily aims this at the perception of time. Much is written and said about time but all the ideas are disparate and ambiguous to a great extent. To perceive more clearly the history and development of the understanding of time phenomenon, as well as the modern approach to its observation, it is necessary to precisely define the principles of its study.

The hypothesis is: ***The science of time should be formed!***

There are different approaches to the observation of time phenomenon, and likewise to it's defining. The subject of time can be treated ontologically, teleologically, physically, metaphysically, mathematically, psychologically, biologically, sociologically, philosophically, cosmologically, theologically etc. Generating the form of time from this position, one gets the impression that time is a phenomenon or a value that can be interpreted in different ways. In order to do so it is necessary to form a multidisciplinary approach to time, to find a common denominator, if one exists, in all the fields where time is an essential feature.

Time exists on its own or man to describe a certain phenomenon invented it. We know that different forms of motion are studied in biology, chemistry, physics, etc. The science that deals with the most basic forms of motion is mechanics. We know

that time is studied from the aspect of biology, physics and psychology, but there is no science that deals with time in the manner in which mechanics deals with motion.
Reality can be: objective (measurable) or subjective (immeasurable). To establish the science of time means to define measurable parameters that prove the existence of time: whether it is the number of Earth's revolutions, whether it is the quantity of processed information or decay of a chemical element or anything that can be measured in order to confirm assertions about time. George Frank interprets time as a fundamental dimension of experience. [9] Immanuel Kant sees in time a category of our mind essential in putting our experience in order. According to Kant time is an a priori form of human sensibility, a consequence of transcendental intuition. Time does not originate from experience; it is "… a form of perception of consciousness, constitutive for the subject".[13]
Once: Hegel, Kant, Newton, Saint Augustine, Aristotle, Plato, Plotin, Zeno…
Today: Reichenbach, Heidegger, Einstein, Penrose, Hawking, Prigogine, Levich, Fraser, Whitrow … we could go on enumerating the famous thinkers who influenced human civilization and who made their mark on the subject of time. The intriguing nature of time and the people who had time as their subject confirm the thesis that its study has to be systematic.
In this "time of technology" when the amount of information is multiplied with an almost incredible speed, in order to control useful information and separate it clearly from "trash", it is necessary to establish recognizable systems to prevent unwanted straying. Human civilization is loosing momentum. Time as a phenomenon and concept is becoming a problem for the human race endeavoring to control itself, the egocentric point of the conscious universe that contains all within its understanding. In the modern digital, technological culture measurability and evaluation have become basic categories of identification. The length of human life has acquired the meaning of the search for information that does not restrain human spirit. To manage the confusion man needs his own time, which is becoming the most valued quality. In the words of consumer society: *It is no trifling matter how one "spends" ones time!* The time at human disposal is limited. It is made up of experience, and it determines the way it is evaluated. As time becomes increasingly important it starts to get attention on a level that is no longer individual in character. The "critical mass" seems to finally exist, having the ability to demonstrate the importance of the most serious study of time. The establishment of the science of time is based on these grounds.

On time

Time can be dealt with in different ways. Here we are interested in the scientific approach, since, over the past few hundred years, science has proved the prime model of human knowledge formation. Science is knowledge organized. It is based on the methods of fact discovery. It is subject to challenges and reviews, both experimental and theoretical. It is opened to discovery of new facts and testing of established truths. Science is "*a set of methodically acquired and systematically processed information about a group of phenomena or objects that are somehow determined or limited and make up a group*."[23] With the help of science people define methods that make possible the understanding of the detected regularities. Through precision of event prediction and fact verification a certain scientific method is confirmed. Science is based on facts, not opinions. Anything that aspires to be scientific must be mathematically consistent. Mathematics is an abstract model by which the

"ponderable world" is projected into the "world of symbols". Predicable symbolic notes are made with the help of mathematics.
In different disciplines time is observed in different ways. This "multilevel" nature of time lacks unity and some authors feel that uniting factors cannot be found (J.T. Fraser). Personally I do not agree with this position. In the question of solving the time puzzle the multidisciplinary approach is the only natural answer. Time is dealt with in all the fields of human spirit.
Ontologically, by acknowledging the fact of the existence of being, we see time as its inseparable part, generated at the time of its genesis. In different segments of **physics** time is viewed in different ways, from classical mechanical that defines time as a physical value to quantum mechanics that has no need for time. According to Einstein, time is what we see on the clock. Time is a value explicitly symbolized by real numbers. **Mathematics** is timeless according to its principles. However, mathematics does sometimes deal with time when it is used to form a certain idea in which time exists. Hawking's mathematical time, for example, has no physical significance. **Psychology** deals with human perception, the ability of people to perceive time, and their impressions of what they call time; how time is seen by the human mind. Schneider emphasizes, "rigorous research of the mind-matter problem demands an insight into the concept of time."[11]. **Biology** has perhaps made the most progress in the research of time, in the research of its effects on organism in order to understand time the way a living organism does. According to A. P. Levich time is something that definitely exists and as such is closely connected to man as a subject with limited life span: *"... biological time is not the stretching of the fabric of life, it is its very creation."*[1] Different social settings are fertile ground for the appearance of different attitudes towards time. In **philosophy** the dissention is even greater than in mathematics, and all of its subbranches deal with time. Modern **cosmology** is physics. The time question raised in different cosmological theories is basically a question of physics. In modern superstring theory time is a derivative value that is not found in basic equations of the theory.[20] Different religions deal with man, spirit and God[2] in different ways. Faith in the basic premises religion is based upon is embodied in the understanding of time, which is the **theological** perception of time. **Teleological** hypothesis on the meaning of time is present in all the authors who deal with the reason why time, as an everyday occurrence, occupies us so much.[3]
Time is one of the basic qualitative categories human consciousness is guided by. Ever since people came to realize their impermanence it has remained the focus of their attention. In order to be able to tell more about time, everything directly connected to it has to be stated precisely and clearly: dimension, orientation, space, change, anthropocentrism, and consciousness…
The usual opinion about time is that it constitutes an interval between two events. The usual opinion is not the only one, although it is deeply embedded in the stereotypes of acquired knowledge and principles that it is based upon. C.F. von Weizacker claims *"experience demands time"*[13]. Time can be seen as a subjective factor. It is a mistake to understand time as a phenomenon explained solely by the analysis by means of natural sciences. The idea of time is used in a multidisciplinary way, and has to be studied as such. In **economy**, for example, time is *"...life accumulated in money..."*[4]
When we think about time we do it from different points of view and then we discover aspects that are different but interfused. It is necessary to synthesize this partiality in order to unite the hologramaticity of what we call time.

It would not be biology, physics, chemistry, philosophy, sociology (form the social point of view) nor any other branch of natural or social sciences. Physics is a science about motion and its basic principle is that all is in a state of motion, which is the only real form of existence. In order to turn physics into the science of time this basic principle has to be changed**. Motion is not the basis of everything, but it is time that is incorporated into existence, whereas motion is the physical manifestation of duration.** In the above-mentioned branches of science, time is a value that describes the forms of motion and the type and object of motion defines the very branches of science.

The treatment of time phenomenon

This study is an attempt to complete the work of many authors all over the world, as well as to point out the need for the beginning of a scientific study of time.
The Moscow interdisciplinary seminar for the study of time in natural sciences, led by Alexander P. Levich, has already won acclaim by its serious approach[5]. The activities of J. T. Fraser, the founder of the International Society for the Study of Time, meetings like the one in Slovakia in 2003 under the patronage of NATO, different internet groups that have been discussing time for years based around the works of Hitoshi Kitada, Julian Barbour, I. Prigogine, or G. J. Whitrow, are no coincidence. Only a few references are mentioned that deal with the time phenomenon and they are all scientific, methodologically defined and developed in different fields of natural sciences and supported by credible researchers.
There are studies and databases of these studies. A large database of studies dealing with time, although not as precisely defined as the Moscow interdisciplinary seminar ones, can be found at the PhilSci archive[6] by entering the reference *time* in the browser. The archive was started in 2001 and it is supported by the Center for Philosophy of Science, the Philosophy of Science Association and the University Library System of the University of Pittsburgh (USA). Another huge database can be found at arXiv[7] site also by entering the reference *time* in the browser. It comprises electronically printed studies in the fields of physics, mathematics, non-linear science, computer science and quantitative biology. ArXiv is the property of a private not-for-profit educational institution, supported by Cornell University and the National Science Foundation.

To establish the science of time means to establish a terminological consistency that, at the moment, does not exist among the scientists who deal with time. The same phenomena, divisions and characteristics have different names. Like that of Levich: Pre-time and parametric time, or Franck: real change and temporal change in what is differentiated as physical time, biological time, psychological time, or any other time.

Authors deal with the problem of time from different positions, trying to form the concept of a new science.
N. A. Kozyrev's starting point is the principle of causality as the basic principle in natural sciences. He put forward the following hypothesis: *"time extends qualitatively, creating differences in the causes of effect that can be caused by direction or model. This rule determines the difference between the past and the future."* as well as the axiom that cause and effect are outside time. He presents his theoretical concept with experimental data adhering to a strict scientific matrix. By

defining different qualities of time that can be experimentally processed he has laid groundwork for the creation of the science of time.[17]
A. P. Levich of the Lomonosov faculty of Biology at Moscow National University poses this question: should the science of time be established? He calls this science temporology and stiles it the science of the future. In order to make time an object of science, Levich considers it necessary to separate it from *"the undefined concept of scientific terms"*. The idea of time has to be changed with the help of other fundamental axioms that would give it the status of theorem.[1]
For J. T. Fraser the basic problem in the comprehension of time is the conflict between the sensation and understanding of time. His published works are: *Of Time, Passion, and Knowledge* (1975, 1990), *Time as Conflict* (1978), *The Genesis and Evolution of Time* (1982), *Time the Familiar Stranger* (1987, 1988), *Time Conflict and Human Values* (1999). He has also published *The Voices of Time* (1968, 1981) and the ten issues of *The Study of Time* (1972-2000). He was the first to attempt the systematization of the knowledge about time, founding the International Society for the Study of Time (ISST) in 1966, guided by scientific and humanitarian ideas. This society holds theme conferences where participants deal with time in a multidisciplinary way.
G. J. Whitrow of the Imperial College of the University of London, together with Fraser as honorary secretary, founded the International Society for the Study of Time and presided over the first conference about time at Oberwolfach, Germany in 1969. He has published a number of works on the subject of time logic and the development of human understanding of the importance of time in life.
Many important creators of the science of time have been unjustly left out, but the aim of this study is not to enumerate them all and assign individual merit. The idea is to point out the aspects and alternatives that give the insight into the different concepts of time and demonstrate the need for a science that is to unite all present differences.

The treatment of time in Serbia

No one has worked on the phenomenon of time in an organised fashion in Serbia. There were some attempts in the past to form a multidisciplinary approach at certain seminars, like the theme double issue of *Kultura* that was entirely devoted to the meaning of time viewed from different angles.[16] However, everything remained at these feeble attempts. Some translated works were published that had time as their subject but they were, on the whole, irrelevant. There were individuals whose work was more or less about time but only as a peripheral activity, like Branislav Petronijević [16], and others. There are such individuals today, the most significant being Miloš Arsenijević and Velimir Abramović. The former is a full professor at the University of Belgrade Faculty Of Philosophy and the latter works at the BK University in Belgrade Faculty of Art.
Miloš Arsenijević has been working on the study of time for some time and has a clear picture of what should be studied in order to acquire knowledge about time from the viewpoint of **logic**. He is not interested in whether time should be made a science in order to learn what it is. He deals with specific questions, inseparably connected to time (structure, topology, ontology, metrics, direction, course, modality, infinity), which are considered to be more clearly defined than time itself. Dealing with these questions Arsenijević poses but does not answer the question of the meaning of time.[15]

Velimir Abramović sees time as the basic natural law that governs all other laws and is embodied in them. His theory of time is incorporated in Euclidean geometry and he makes consistent metaphysical conclusions. In his broader, metaphysical sense Abramović is attempting to unite a multidisciplinary view of time in different branches of the human spirit.[24] He is also the founder of the private *Institute for the Science of Time*, the presentation of which can be found at: http://www.scienceoftime.org/. It is a pioneer attempt that clears the way for the idea featured in this study.

Thematic disciplines of time study

On the bases of everything written so far one notices the intention to ascribe particular importance to time. Time does not exist in certain circumstances; it is the circumstances that dictate the manner in which time is treated. Time can be treated as a:

1. Phenomenon (as something that exists outside the subject and is independent of its capability for conceptualization, which corresponds to the substantial definition of time);
2. Concept (as construction of the subject, that can be made equal with time as a value when we see it as a relation factor in the description of the phenomenon);
3. Clock (the time measuring device)

Looking at difference characteristics of time, we see that time corresponds with many values in physics that define the fundamental base of the Universe. Its existence is inseparably linked with the most important questions of humanity. Values are used to describe phenomena and they are the instruments used to define a clear idea about a phenomenon.
To establish the science of time is to:

1. Attempt to determine the boundary between physical and metaphysical ideas about time;
2. Ascertain measurable factors in the study of time in different scientific disciplines;
3. Find common denominators in the study of time in different scientific disciplines;
4. Use scientific methods;
5. Classify by characteristics and define the problem;
6. Define the disciplines concerned with the study of time (history of the development of the understanding of time, calendar, rhythm, synchronicity...).

Time is a subject of study in different scientific disciplines and that is one of the basic ways of distinguishing the different starting points in the understanding of time phenomenon. Intuition and experience make it clear that the time intervals we observe, measured by various standards, are not always equal. The first inequality comes from the subjective and objective content, that which concerns us personally and that which exists without us. Thus we have physical time (the intervals of which do not depend on the individual subject) and biological time (the intervals of which do depend on the individual subject).

Every division and subdivision needs to be studied very seriously by competent experts. What especially need to be studied, in any one of the mentioned divisions, are time structure, time topology, time ontology, time metrics, time direction, time course, time modality and time infinity.[15] Any of these characteristics can be treated differently in various scientific disciplines, natural or social.
A special field of time study is the understanding of time by different cultures in historical context. There are reasons why time was respected in some segments of history, in certain places and cultures. There were individuals who stood out by their views on time and whose influence extended far beyond their biological existence. This historical and culturological observation is a serious scientific enterprise and has to be clarified to the utmost. How much was the general understanding of the time phenomenon influenced by, say, astrological and alchemical concepts of thought in different cultures.
To study time means to study reversibility, synchronicity, rhythm, metrology, cyclicity and linearity.
This discussion is of great import. If we succeed in proving that time is a phenomenon than, as such, it "claims the right" to be studied by scientific language and methods because it is tangible enough for the findings to be checked. **All the theories about time have to be concentrated in one place and all the bases of their differences clearly defined.** In itself this is a great step towards finding the way out of this "forest" of concepts. This is reason enough to establish the science of time. This kind of revision "eliminates noise" that is present in the attempts to give stability to the concept of time.
Everything listed above is intended to truly present the seriousness of the problem at hand. Because of the extent of the problem, it is necessary to work on time thematically. No person can perceive all the problems connected with time. It is necessary to form a study group that would educate interested students in clearly formalized subjects of time study.

Conclusion

To create the science of time means to form an organized approach to time study. If this is achieved it will probably lead to changes in the paradigm of the understanding of time. This is not a solitary idea. Rodger Penrose writes about time: *"It is my opinion that our present conception of physical reality, especially when the nature of time is concerned, is ripe for great upheavals – perhaps even greater than the ones that followed the creation of present day relativity and quantum mechanics."*[8][21] I agree with this view and consider it the reason to establish a separate science of time in order to perceive the hidden nature of time more precisely.
Today, different schools of time interpretation (which has been discussed in the text) are carried on by some enthusiastic scientists who perceive the problems of the current concept of time and work on the ways to solve them. What they agree on is that it is necessary to pay special attention on the phenomenon of time.
Many of those who work on the problems of time do it as individuals, disorganized, always forming the terminology anew. This kind of disorder will be put aside once we start dealing with time in an organized fashion. The science of time cannot be established by decree. It is a continuing process, the form of which, though not yet defined, can be clearly discerned. This study supports further development of planned time research, with defined disciplines, the study of which will provide more precise knowledge of time.

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[1] There is hardly a course book that provokes reflection about time. Personally, I have never had an opportunity to peruse a course book explaining time as anything else but a physical category.
The problem of time is like an actor destined to always act the same type of character, because his first director saw him like that and the actor simply did it very well.

[2] Gods, in polytheism.

[3] In one of his lectures, Miloš Arsenijević talked about his inner conflict and the difficulties he had coming to terms with his impermanence as the most probable reasons for his work on time.
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