

ON THE ROLE OF PRESENT IN TEMPORAL ASYMMETRY

Karl K. REBANE

Eesti Teaduste Akadeemia Füüsika Instituut (Institute of Physics, Estonian Academy of Sciences),
Riia 142, EE-2400 Tartu, Eesti (Estonia)

Received December 21, 1993; accepted March 31, 1994

Abstract. Asymmetry in time is considered as a fundamental difference between the past, the future and the present. The present is a time domain between the future and the past which transforms the future possibilities into the facts of the past. The free will (FW) participates in forming the facts of the past. The FW exists in the present and is confined to the present. Causality does not have full control over the FW and, consequently, causality and the meaning of time-arrow are fundamentally modified for the present. Theories pretending to describe reality should not contradict the existence of the FW, possibilities for the appearance of the FW in some phenomena, including experiments in physics, should be left open.

Key words: time arrow, causality, free will, science and religion.

1. INTRODUCTION

In [1], asymmetry in time is considered as a precondition of experience, and outlines of the construction of an abstract quantum theory as a theory of knowledge based on the asymmetry between facts from the past and possibilities for the future are presented. Nothing is said about the present, but in fact the conclusions of [1] draw attention to it, to the stripe of time between the past and the future.

2. PRESENT, FREE WILL, CAUSALITY

The present separates the future from the past, it transforms the possibilities of the future into the facts of the past. Nobody and nothing can change the facts of the past. The situation with the future is entirely different. We think that we are able at least to a certain extent to control the future events, to change the probabilities of their possibilities. History and everyday experience show that we are right – we really can. To succeed, we have to act in the present. Actions in the present are our only possibility to influence the course of events.

If the role of the present in cognition is taken under consideration, it becomes difficult to ignore the problem of the free will. Facts of the past are consequences not only of the causality, but also of the decisions taken by the FW. We accept this very naturally in our everyday thinking and decision-making, e.g. considering the events of history, or telling about what happened last week. Causality is understood to comprise as causes also the actions initiated by the FW decisions not only in everyday life, but also in social and humanitarian sciences. This understanding of causality – more general than in physics – (naive for physics, but adequate for history and everyday life) is fundamentally different from the versions of causality proposed and (successfully) used in physics. Considering our future we always proceed from the everyday understanding of causality, we always take into account the possible FW decisions made by ourselves or by others. Are we physicists really entitled to entirely neglect the FW in our science? Why are we so firmly convinced that we are able to isolate our objects and means of experimental investigations so perfectly that absolutely nothing can be brought into our experiment of the features of reality which would provide and guarantee the possibility for the FW actions?

I think that the reasonable position to be taken is to simply recognize the existence of the FW. The everyday life's experiences tell us that the FW does exist, and it is reasonable to accept it also as a fact in physics – the recognition may be constructive.

I would completely agree with Schrödinger [2] that we possess the ability to command our own body. By means of the actions of my body controlled by the FW I can spread the influence of my FW into the environment and up to a certain extent also obtain control over the events outside my body. For instance, I can take a free will decision to push or not to push a red button of the nuclear war if only among the facts of the past there were the presence of that button at my disposal.

Two features of the FW should be mentioned in the context of our consideration here:

1. FW belongs entirely to the present;
2. FW is not entirely subordinated to causality.

The FW exists exclusively in the present. The present is a time domain (producing history and sliding ahead of it) in which causality is present and confined. The FW is not absolutely free, of course. The FW cannot change the facts of the past, the environment formed by them for a particular present in which the FW has an opportunity to act. The FW decision-making is influenced and helped by knowledge, on the other hand it is also limited by the limits of knowledge. The important point is that there certainly does exist a considerable field of physical, mental and emotional activities which I can control by means of taking a FW decision about what my body has to do and executing this decision at the present moment.

Human society has always taken the FW for granted. Otherwise it would not be justified in considering a person responsible for his deeds. Until there is no confidence that the FW does exist, we should apply the

presumption of innocence and no punishments for breaking laws is not justified. Why rules and laws at all if there is no FW to decide whether to observe or not to observe them?

What could be the purpose and value of cognition if there is no a free will? Why send signals and messages, if there is no FW to use the information they bring in decision making? How can a signal be sent without the FW involved in preparing the content and performing the act of delivery?

Once the FW is recognized as a feature of reality, it should be required that descriptions of reality, including theories of physics, must not contradict the existence of the FW, all theoretical descriptions of reality must have some resort, some space of uncertainty for FW.

Quantum mechanical relations of uncertainty have introduced some feeling of flexibility into the interpretation of physical phenomena as causal chains of events. On the other hand, as far as a theory considers only causal ways of changing the distributions of probabilities, it is a causal theory.

Causality and time-arrow cannot have full power over the FW. Consequently, they are not in full power in the time-range called present. Maybe they should not be defined for the present in a sense conventional for exact sciences at all.

Note that a look from the side of theoretical physics reveals that in many of the general formulae (e.g. the dispersion relations, formulae of the theory of relativity) there are singular points (areas) just at the time moments corresponding to present. These points are dealt with by procedures, which are not strict mathematically, e.g. taking integrals by the principal value.

3. CONCLUSION

If a theory treats the past and the future as qualitatively different time domains, the present has to be considered as the third qualitatively different domain. Causality in physics has various definitions (see e.g. [3]). Nevertheless, we can state with certainty that its role in the three time domains is distinctly different. Assuming causality for the past events, we get a tool for analyzing the events of history. By assuming causality for the future, we are trying to predict the coming events, to estimate the probabilities of future possibilities. It is not the only objective. The main objective is to utilize the results of prediction in designing our future, in trying to change the probabilities in our favour. The only opportunity to reach this goal is to take FW actions in the present.

Causality operates also in the present, but its ways of influence are significantly modified, because here causality has to leave space for the FW.

For any modern physical theory it has been and is a must to represent or illustrate the theory by means of mathematics. To do it in a theory which recognizes the FW is really difficult if not hopeless, may be even

impossible. Perhaps the strong demand for mathematics with very little hope to meet this demand is a reason why physicists are not enthusiastic to consider the FW, and are inclined to ignore its existence as long as possible. Yet, can our unwillingness to be accused of returning back to the era of natural philosophy serve as a justification in ignoring the FW in our science, especially in problems of causality and time-arrow?

The FW is a fundamental constituent part of cognition. The facts of the past show the role of the FW in the process of their becoming facts. The FW is active in the present, participating and, to a considerable extent, controlling transformation of the future possibilities into the facts of the past. Is it reasonable to suppose that physics can (or even more – is bound to) ignore the FW everywhere and forever? That elaborating increasingly more sophisticated theories and setting up ever more subtle experiments, physics will never face such features of reality which exist in it because of the fundamental commitment that opportunity for the FW must be provided?

When the FW is important, its role and (or) the influence of the requirement to leave space for the FW, could be somehow manifested also in experimental results of physics. Maybe an experimentalist can to some extent control by her (his) FW (in addition to the FW role in her (his) becoming a physicist, in studying theories, in designing experiments, etc.) the outcome of his experiments on the FW-sensitive physical phenomena? The answer could be the question "Why not?" The necessary prerequisite for getting a serious answer is to recognize that there does exist something correlated to the FW to look for also in physics.

If the philosophy proposed above is accepted to be reasonable, it will open a new approach to understand and ease the stale controversy between science and religion. As far as one of the foundation stones of a religion is the presumption of free will and responsibility of a human being for his (her) free will triggered deeds, this philosophy provides some ground for that foundation stone.

The existence of present as a broader stripe between future and past separates time into two principally different domains: the one for sovereign reign of causality, the other – for actions only in part subject to causality (truncated causality). The latter leaves space for the free will. Thus a resort for the free will – for one of the fundamental constituents of the world we live in and of the cognition of it – is found without arising sharp controversy with the causality governed field of nowadays physics. Further, the role of religion in attempts to create positive shifts in solving global problems, must not be neglected (see e.g. [4]). And that is really important.

REFERENCES

1. Görnitz, Th., Ruhnau, E., and Weizäcker, C. F. v. Intern. J. Theoret. Phys., 1992, 31, 37–46.
2. Schrödinger, E. Was ist Leben? Piper, München-Zürich, 1987.
3. Nussenzweig, H. M. Causality and Dispersion Relations. Academic Press, New York-London, 1972.
4. Rebane, K. Energy, entropy, environment: Why is environment protection also objectively difficult [in Estonian]. – Akadeemia, 1990, 3, 451–468.

OLEVIKU OSA AJA ASÜMMEETRIAS

Karl K. REBANE

Olevik on aegruumi osa, milles tuleviku võimalused saavad mineviku faktideks. Vaba tahe on meie maailmas realselt olemasolev tegur, mis toimib olevikus ja ainult olevikus. Vaba tahe näitab, et on olemas põhjuslikkuse piirangud. Füüsikateooriad ei tohi hoida põhjuslikkusest kinni niivõrd jäigalt, et vabale tahtele ei jää enam ruumi. Vaba tahte ja selle koha tunnustamine füüsika poolt on oluline täppisteaduse ja religiooni vastasseisu leevendamisel: enamik religioone võtab nurgakiviks vaba tahte olemasolu ja nõuab sellest tulenevat vastutust vaba tahte teostajalt.

РОЛЬ НАСТОЯЩЕГО В АСИММЕТРИИ ВРЕМЕНИ

Карл К. РЕБАНЕ

Настоящее – часть пространства-времени, в котором возможности будущего становятся фактами прошлого. Свобода воли есть реально существующий в нашем мире фактор, который действует в настоящем и только в настоящем. Наличие свободы воли показывает, что имеются ограничения на причинность. Теории физики не должны быть привязаны к причинности так жестко, чтобы не оставалось места для свободы воли. Признание физикой свободы воли и определение ее места в картине мира важно для смягчения противостояния между точными науками и религией, поскольку многие религии свободу воли берут за основу и, следовательно, требования ответственности предъявляют осуществителю свободы воли.