Lecture: The Concept of Time and the Hard Problem of Consciousness

Lecture 2 hours, winter term, by Prof. Dr. Georg Franck

Objective:

Time and consciousness are among the most basic and the most contended concepts in philosophy and science alike. The objective of the lecture is an in-depth introduction into these concepts including the development of novel ideas regarding the joint solution of the hard problems they pose.

Contents:

- three concepts of time: (1) homogeneous, symmetric parameter time, (2) anisotropic, directed time, (3) tensed time, i.e. the time containing the Now.
- The concept of time appropriate to account for motion (1) is not rich enough to account for life (2), the concept of time rich enough to account for biological life is too poor to account for conscious life (3). A classification of the sciences according to the definition of time they adopt renders a hierarchy of increasing experiential concreteness and decreasing formal

rigour. The richer a theory's account of what we experience as time, the looser become its definitions (1. physics, 2. the life sciences, 3. psychology and cultural studies).

- The measurement of time: an operational definition of time?
- Clocks do not measure the passage of time, but translate distance in time into distance in space.
- Logical problems of accounting for the Now and its travel
- How relativity theory excludes the Now from physical reality
- The block universe. The distinction between real change and temporal change
- Temporal change (=passage of time): a subjective illusion?
- Nowness and mental presence
- Mental presence as the mode phenomenal consciousness exists in
- Presence and reality: two modes of existing
- Is presence, as a mode of existing, without prospects of being acknowledged scientifically?
- The mind-body problem: How is it to explain that brains process information not only, but bring forth mental presence also?
- The hard problem (regarding the very existence) and the easy problems (regarding the contents surfacing in experience) of consciousness
- Mental presence and attention. How do we control the focus of attention? The problem of free will and mental causation
- How do we distinguish mental presence from the temporal present? (1) The distinction of temporal change from focal change, (2) the temporal present and its travel are objective in the social meaning of objectivity.
- Is there a mechanism synchronizing the Now inter-subjectively?
- Leibniz' idea of synchronization: pre-established harmony
- Is there a physical re-interpretation of pre-established harmony?

- Quantum entanglement and non-locality
- The measurement process, understood quantum theoretically
- Measurement and the constitution of local facts. Parameter time t and the time observable T
- Measurement as a ubiquitous process of the constitution of facts. The concept of a growing universe (contrasting the block universe).
- Quantum measurement and the quantum Zeno effect
- Henry Stapp's idea of how the quantum Zeno effect might explain the capability of steering the focus of attention freely
- Remaining problems:
    - Free will and causal closure of the universe
    - Conclusive conceptualisation of tensed time
    - Description of the meaning of "awareness"

Précis:

1. *Three Concepts of Time*

Why caring of the concept of time? Isn't there an operational definition of the concept? Isn't time simply that which is measured by clocks? Or, conversely, aren't clocks devices supposed to measure time? Hence, where is the problem with the concept of time?

The problem starts with the question of what it is that is measured by clocks. Clocks do not measure in the way that measuring rods do. Time cannot be

measured by comparing a piece of time with another. There are no pieces of time capable of being compared. The only time we have immediate access to is the moment of the Now. In the Now, peaces of time different from the present one are out of reach. Accordingly, there is no ground into which we can throw an anchor in order to measure distances from a given place in time. The only thing we can do is to make observations within the Now. We can look for processes that are stable in the sense that, what happens, happens over and over again. We can count the times that the happening repeats itself. We can count, i.e. the beats of a rhythm (of, e.g., a klepsydra or a pendulum). By assuming that the intervals between the beats are constant, we find ourselves measuring a single-valued parameter by counting the intervals. The assumption, of course, that the intervals are of constant length cannot be tested empirically since the intervals cannot be compared immediately. In a sense, thus, there is no definite measure regarding the precision of clocks. In a sense, rather, it is arbitrary which process we choose as the normal (official) clock. Henry Poincaré pointed out that the best choice we can make is to select that one process as the normal clock that makes our theories most simple.[1] Even in this best case, however, the question is in place whether it is the concept of time that finds itself thus operationalised. Even though a concept may differ from the meaning of the word in ordinary language, concepts, in principle, have to be a conclusive description of the meaning hat the word has. The meaning of the word time is, in the first place, what we experience as time. Time, as we experience it, is a process: the travel of the Now relative to the places in time that can be dated. Time, as we experience it, is the *passage of time*. Clocks do not measure the passage of time. The single-valued parameter, conventionally called t, can be taken to represent a distance, but never a process however. A distance and a process are fundamentally different categories. Confusing a process with a distance amounts to a serious category error. We must therefore find that the operational definition of time by way of measurement definitely does not exhaust the meaning of time. Reducing the meaning of time to the parameter measured by clocks rather amounts to

[1] "First, we have to bear in mind that we never measure time t but some indicators which we parametrize in terms of some clock variable c(t) of an auxillary real-valued parameter t, where the function t c(t) is chosen such 'that the enuncition of the natural laws may be as simple as possible' (Poicaré 1907, part I, ch. 2, sect. 13)." Primas 2009, p. 180

splitting the concept of time into a variety of concepts. There is time as experienced and time as measured.

This splitting of the concept of time is momentous for theory-building. In fact, there are as many concepts of time in the sciences as there are distinct bodies of knowledge. It depends on the phenomena a theory is accounting for which concept of time it adopts. The concept of time appropriate to account for motion is not rich enough to account for life, the concept of time rich enough to account for biological life is too poor to account for conscious life. A classification of the sciences according to the definition of time adopted renders a hierarchy of increasing experiential concreteness and decreasing formal rigour. The richer a theory's account of what we experience as time, the looser become its definitions. The higher the standards of precision in a field of theorising, the narrower becomes its notion of time.

The concept of time suited to account for motion is homogeneous, symmetric *parameter time*: the parameter t measured by clocks. It is the concept of time that fundamental physical theory (classical mechanics, relativity theory, the wave function in quantum mechanics) works with. Parameter time is the time represented as the one-dimensional continuum of datable points. In parameter time, differences in time are reduced to differences in date. Parameter time is homogenous and symmetric, i.e. without differences regarding presence and without preferred direction. In parameter time, there are no regions differing in the mode of existence (past, present and future). Parameter time is reversible, the processes running in parameter time can be reversed by exchanging t for –t. What this reversal symmetry amounts to is that the distinction between cause and effect becomes arbitrary.[2] In parameter time, *actio* exactly equals *reactio*.

The preferred direction of time (the so-called arrow of time) is introduced into physics by thermodynamics and its notion of entropy. Without the growth of

[2] "Since fundamental physics has no means to single out the notion of a Now, *the first principles of physics alone do not distinguish cause and effect*, and therefore cannot account for efficient causation." Primas 2009, p. 175

entropy, there is no self-organisation, i.e. no generation of islands of growing order in the sea of growing entropy. The most notable form of self-organised order is life. The life sciences thus work with the concept of *anisotropic, directed time*.

The entropy of a closed system (such as the universe) grows unidirectionally in the sense that an ordering of its states according to entropy renders an order according to date in the direction from past to future. Since the increase of entropy is a statistical law that cannot - at least until now - be reduced to basic mechanics (which continues to be symmetric), parameter time and directed time are not only different, but may turn out to be incompatible notions of time. The direction in which entropy grows has to be clearly distinguished, moreover, from the process we experience as the passage of time. The growth of entropy does not imply that there is something like the Now, which travels in the direction of this growth. Or, to put it differently, the notion of a *direction* leading from past to future does not imply the notion of past and future as *regions* of time. Talking of past and future as regions of time presupposes the existence of a moment that, by virtue of being actual, separates two regions of non-actual time. The concept of time containing the Now is *tensed time*, time as implicitly defined by the grammar of the tenses in language. Tensed time is the concept of time that psychology, the social sciences and the humanities work with.

2. *Problems with the Concept of Tensed Time*

The concept of tensed time is the most problematic of the three concepts of time to be met in the sciences. The experience we have of time subjectively has so far escaped empirical test not only, but even conclusive conceptualisation. Paradoxes abound as soon as the attempt is made to account for the Now when defining time. The Now, when identified with this very – immediately present – moment, is the most fugitive thing there is. On the other hand, the Now is the most permanent thing there is since it is always now; it has been now since time began to pass. The ambiguity regarding transience and permanence grows into a patent contradiction when we ask after the duration of the Now. The Now, even when identified with

the present moment, is not a point-like instant. Instead of being a razor's edge, the Now that separates past and future is a 'specious present', i.e. a presence that covers an interval in time. It is extended on various levels of *eigentimes*, ranging von 10 milliseconds to 3 seconds (see Atmanspacher & Filk 2003). These eigentimes can be measured by making use of both clock time and subjective reports of test persons. When measured in clock time, the specious present appears to be extended three seconds and to last forever at the same time.

The Now, when measured in eigentimes, appears as a series of momentary nows. The momentary nows are short-lived and constantly replaced by the next one. This process of constant replacement is what we experience as the passage of time. Constant renewal of the present moment amounts to putting the permanent Now into travel along the chronological axis of time. Time, as we experience it, thus finds itself turned into a process (which, to repeat it, is another category than a dimension). This process of temporal change differs fundamentally from all the processes that kinetics and dynamics are about. It resists to being measured and even to being conceptualised in a physically sensible way. When accounting for a travelling Now we have to account for the velocity with which the Now travels. No movement without a velocity. When trying to define the velocity with which the Now travels, we are facing another paradox. The dimension of velocity is way divided by time. The way that the Now travels is distance in chronometric time. What however is then the time travelled? It makes no sense to say that it takes an hour conceived as time to travel an hour conceived as way. The speed thus defined would be an hour divided by an hour, which renders the dimensionless value of 1, which certainly cannot denote a velocity.

There are further paradoxes awaiting the description of the experience we have of time. There is, e.g., J.M.E. McTaggart's infamous proof of the "Unreality of time" that has been awaiting conclusive refutation since 1908. It is thus tempting to dismiss the experience we have of time as a merely subjective impression by arguing that inconsistent concepts cannot denote something real. There are, however, even stronger arguments. Relativity theory denies the possibility of an objective, i.e. universal Now. Relativity theory is a principled theory deducted

from the absoluteness of the finite speed of light. With the absoluteness of the finite speed of light, simultaneity becomes relative to the location of the observer or frame of reference. If simultaneity is relative to that location, the Now is relative to the frame of reference, too. Locations that are spatially distant or distinct with regard to relative motion will accordingly differ in time (cf. Gödel 1949). In the case that only the present state of the world would be 'real', reality as such would become observer-dependent. In order to keep reality objective, it seems that the Now has to be denied objectivity.

In relativistic spacetime, the world states we experience successively are given 'in block'. The entire collection of states, successive for us, is arranged as if located in another dimension of space. There is no difference between these states as to their mode of existing. In spacetime, the world states differing in date co-exist side by side. The state incidentally being present this moment is neither more nor less real than any other state of the universe. When strictly speaking, there are not even 'things' and 'events' in space-time. The objects we experience as three-dimensional things and momentary events are cut out from their temporal environment by the Now. Things appear to us as three-dimensional objects because it is only ever one single temporal state that is *present*ed to us. Events are momentary by virtue of the fact that only one state is allowed to surface in the Now whereas the appearance of the rest is suppressed. It is not before this *cut of nowness* separates the state *presenced* from its temporal environment that we experience reality as a collection of things and events. Since the difference between past, present and future is not acknowledged as a difference in the mode of existing, there are no such qualities as 'thing-ness' or 'event-ness' to be found in spacetime. There are only the four-dimensional trajectories encompassing, without discrimination, the totality of the states assumed by the objects during their lifetime.

In spacetime, to put it succinctly, all the processes of *real change* are contained, but there is no process of *temporal change*. Real change means that states that differ in time (i.e. date) also differ in structure or function. Temporal change means that states having been future become present only to vanish into the past. In experience, real change and temporal change are united. We undergo the

experience of change by travelling with the Now along trajectories of real change, thus going successively through the states that are given in spacetime 'in block'.

In the context of relativity, past and future denote directions of time, but not regions differing in the mode of existing. All you can say is that, from the viewpoint of a certain moment, moments located earlier in chronology lie in the past, whereas moments that are later lie in the future. The existence of the Now and its travelling turn into a subjective impression to which nothing corresponds in objective reality. Taking together those logical reasons with this physical argument we understand how it could happen that it is "the general view today of scientifically minded philosophers concerning the temporal passage is that it is a subjective illusion." (McCall 1994, p. 26)

3. *Mental Presence and the Temporal Present*

With the Now, phenomenal consciousness has vanished from the screen of scientifically minded philosophers. Consciousness cannot exist but in the Now. Conscious phenomena, called qualia, do not come forth but in mental presence. Mental presence, the mode in which phenomenal consciousness exists, is tied to the Now. It cannot help to travel with the Now along the chronological axis of time. Mental presence shares with the temporal present the place it is occupying and the way it is travelling in time. Neither mental presence nor the temporal present are excluded from physical time, be it parameter or directed time. Both mental presence and the temporal present are accordingly ignored by physical theory, thus implicitly denied objective reality. By being denied objective reality they find themselves implicitly declared purely subjective phenomena. It thus appears that both the feeling of being mentally present and the experience we have of time are subjective phenomena to which nothing corresponds outside themselves.

In fact, the very existence of phenomenal consciousness has so far escaped scientific explanation. In contrast to the question of how brains process information, the question of how they engender mental presence has remained mysterious. In order to dispense with the problem, various forms of physicalism have been proposed that explain away mental presence and the temporal present in one go. The strategy seems convincing. The Now resists to being accounted for conclusively. Conscious phenomena do not come forth but in the perspective of the first person (i.e. the person who *is* the brain). Science is committed to the perspective of the third person (i.e. the detached observer). In the perspective of the third person, the search for phenomenal consciousness in the brain looks like a 'search after the ghost in the machine' (Gilbert Ryle 1949). In order to be acknowledged as something real, consciousness would have to show causal power. So far, however, mental causation could not be demonstrated in experiment. Rather, mental causation contradicts the assumption of causal closure of the physical universe, which is one of the metaphysical tenets that scientists feel committed to (see, however, below p. 20f).

Explaining consciousness away is not so appealing an idea for those, of course, who are interested in the mind-body problem for reasons of understanding themselves as conscious minds. Instead of being provided insight into what they feel themselves being, they find themselves declared zombies: biological automata free of phenomenal consciousness. They learn that the mind is nothing but the capability of processing information, the brain just a wet computer. They are asked seriously to deny that they are mentally present. Isn't this a lecture bristling with absurdity? If you know by your very 'being there' that you are mentally present, you may take pity on those who feel committed to think that they are unconscious robots, but you will be simply unable of sharing the belief in the doctrine of reductionist physicalism. Instead, you will embark on searching the flaw in the argument reducing existence to physical reality.

The issue, of course, is hotly debated in science and philosophy alike. It is far from obvious where – and whether at all – physicalism goes astray. Challenging physicalism means opposing to the mainstream of scientific minded philosophy.

Characteristically, the arguments put forth by physicalists are carefully crafted and close to watertight. Nevertheless, there is a point that seems to have escaped attention so far. Does it indeed go without saying that mental presence and the temporal present are subjective to the very same degree? Mental presence, to be sure, is the epitome of subjectivity. Within mental presence, however, there is a distinction not so easily dismissed. Regarding presence, we clearly distinguish two kinds of change. There is an involuntary change of presence that we call temporal change, and there is a voluntary change of presence that we call focal change. Focal change concerns the presence of phenomena we focus on by way of steering attention. By focussing attention, phenomena having been resting in the background are made to appear in the foreground, by steering attention we constantly change back and forth between foreground and background. The difference between background and foreground is itself a difference in the intensity of presence. In a sense, the allocation of attention means to pass presence to the phenomenon focussed on. Focal change thus equals temporal change in that it is just the intensity of presence that changes. Focal change however differs fundamentally from temporal change regarding our feeling of agency involved. Focal change is wilfully controlled, temporal change is completely withdrawn from control. This difference is extremely interesting regarding causality. Temporal change seems to be spontaneous, whereas focal change relies on – or should we say: makes use of? – a process of real change. Focal change relies on the capacity of the neural machinery to process information selectively.

In the case that the temporal present and mental presence were one and the same, temporal change and focal change would have to be indistinguishable. Remarkably though, it is just our feeling of being free to control the focus of attention that allows us to draw the distinction between temporal change and focal change. Focal change is the influence we feel to be exerting on the otherwise autonomous change of presence. We cannot stop the flow of time, but we can temporarily redirect certain parts of it now and then. We can be certain that the development of this capability predates humanity in evolution. Higher animals are capable to control the focus of their attention as well. To be free to allocate one's attention according to intention is of utmost importance however for the

development of higher mental capabilities. Manipulating the presence of phenomena in a controlled way lies at the heart of goal-oriented mental activity. Thinking starts with selectively activating or suppressing the presence of phenomena. Activities such as focussed observation, manipulating mental objects, imaginative problem solving, deliberation, judgement etc. fully rely on the ability to allocate presence freely. We are even led to assume that the evolution of higher forms of mentality mainly consisted in the development and sophistication of this ability.

4. *The Social Objectivity of the Now*

Treating mental presence and the temporal present as equally subjective is questionable for still another reason. In contrast to mental presence, the temporal present is objective in the social meaning of objectivity. People agree on living in one and the same Now. They even agree on the particular world state happening to surface in the Now. This agreement came up to a miracle if presence were the exclusive product of the individual brain. Since brains are well shielded from one another (and thus prevented from inspecting immediately other brains' worlds of experience) the production of nowness by the individual brains should result in a multitude of individually differing nows. There should be as many nows as there are individual brains. In this case, the pace of the passage of time (if there were such a thing) would be set by the biological clocks of the organisms. As we know, the biological clocks deviate inter-individually. They are definitely not suited to make the society of subjects march in perfect unison through time. The only way to account for the social objectivity of the travelling Now lies in postulating an over-individual way of synchronization.

This argument may seem subtle. The mind-matter distinction is subtle however, and the argument is promising in that it involves the most relationship-rich branch of physical theory: quantum theory. When looking for possibilities of accounting

for the synchronization of the experience we individually have of time, *entanglement*, i.e. the long range correlations once labelled disbelievingly by Einstein as "spooky interactions at distance" come to mind. The correlations that entangled states exhibit prevent these states from being localised unequivocally in space. Entangled states are synchronized holistically in a way that is reminiscent of what Leibniz once called "pre-established harmony". Pre-established harmony is the metaphysical device that Leibniz invented for showing how it is possible that the experience of individual souls, i.e. of monads, is synchronized inter-individually even though the monads are without window to one another and even though there is no direct interaction between the mental and the material. Pre-established harmony means that the mental domain and the material domain have been synchronized from the very beginning of the universe with so much art and accuracy that their agreement is guarantied thereafter. In Leibniz, the magnificent watchmaker accomplishing this synchronization is God. The question thus is whether quantum theory affords the means for translating the metaphysical concept of pre-established harmony into a physical concept of holistic synchronization.

5. *Quantum measurement and holistic synchronization*

There are hints, form within quantum theory, how this synchronization might be accomplished. In a very principled way, Primas (2003) explores the possibility of accounting, in the language of algebraic quantum theory, for a tensed domain, i.e. a domain where local facts (or memories) are constituted out of entangled quantum holism. In Primas' account, this domain is synchronized by way of entanglement. This quantum Leibnizian account is highly involved and leading far beyond the scope of this lecture. What is of immediate relevance for our purpose is that the constitution of local facts amounts to what quantum theory conceives as measurement. Measurement, conceived quantum theoretically, means that non-local correlations are suppressed to the effect that local facts emerge. Remarkably, this suppression is not an instantaneous 'collapse' of the state vector, but a

transition from entangled states to disjoint states that itself takes time. From within the *event* of the transition, it makes no sense to distinguish temporal parts that are earlier or later since there are still no facts to be ordered sequentially. When measured externally, however, the event covers an interval that can be subdivided.

These temporal properties of the measuring event closely resemble those of the temporal present. As we have seen, the temporal present as well cannot be assumed to be point-like. The present that covers an interval in time rises the problem of consisting of parts that are earlier and later. When looked at from within, the 'specious present' appears as an eigentime that resists to being subdivided into parts. When measured from outside, the present covers a time span that can be subdivided as long as the diameter is positive. Might it thus be that this conformity with the measurement event is more than just by chance?

The time covered by the transition from propensity to fact is different from the parameter time used to order facts. In the formulation of the measurement process (by Lockhart & Misra 1986), an internal time of the event stretching over a finite interval Δt, when measured externally, is given expression by a time operator – or time *observable* – T. Substituting a parameter for an operator means to substitute a number for an action. The action that the operator T gives expression to involves a *non-locality in time* that is indeed strongly reminiscent of the extended present. The operator T "operationalizes (externally) the size of the time interval over which temporal nonlocality persists (internally)." (personal communication with Harald Atmanspacher and Albrecht von Müller)

The introduction of the time operator must not be confused with the involvement of an observer that is mentally present. Rather, the temporal present is thus explicitly distinguished from mental presence. The introduction of the time operator means, to be specific, that two basically different aspects of time are distinguished. One of them parametrizes time as the temporal succession of sequential facts that have been constituted by measurement. The other is more

fundamental as it refers to the emergence of facts. Facts are interpreted as traces of measuring events, which in turn take place in an extended present.

Measurement, understood quantum theoretically, does not happen only in the lab. It is a ubiquitous process, happening wherever and whenever new facts are constituted. In time, novel facts cannot emerge but in the Now. Is it, thus, trivially true that measurements only happen in the Now? Or is this apparent truism highly revealing but overlooked so far because of its seeming triviality? – What about measurements in the block universe? There are, of course, countless processes contained in the block supposed to be measurements. Yet, these procedures cannot be addressed as the reductions that quantum theory conceives as measurements. The reduction of the state vector (whether sudden or not) means that one of the states having co-existed so far in superposition is selected for being actualised. Superposition is the mode in which quantum theory allows sums of orthogonal states of a system to exist or, rather, to *sub*sist without being manifest. These superposed states are what the state vector of the system is made of. The states entering the state vector are no actual states, to be sure. No system whatsoever can actually be in orthogonal states (i.e. states that exclude one another) at the same time. Conventionally, the state vector is interpreted as an expression of the states that the system possibly is found to be in when subject to a measurement. In the context of quantum theory, measurement means that one of the (contradictory) potential states of a system is turned into an actual state. In a sense, thus, the states entering the state vector are sub-present. They exist in a mode other than actuality. Reduction of the state vector means that one of the many sub-present states is selected and raised to full presence.

The selection of the state to be actualised is where randomness enters quantum measurement. The selection is not deterministic, but statistical. There are only probabilities attached to the states arrayed in the state vector. Hence, there is an irreducible element of chance in the process of measurement. This element of chance is what the famous ‘quantum leap’ refers to. In the block universe, there is no quantum leap. There is no place for randomness to happen. The block exists as such, encompassing the totality of states from big bang to big crunch. The

measurement processes contained in the block are thus dead measurements. They look like measurements, but they are prevented from doing what quantum theory asks them to do. In the block, there is no state vector made of superposed states nor is there a collapse selecting one of the sub-present sates randomly. It is only the Now where randomness can happen. Might it not be, however, that measurements are synchronized in the same way in which the individual nows are synchronized? That the measurements happening at a time constitute universal simultaneity by way of entanglement? The holistic correlations that give rise to entanglement are not subject to the prohibition of universal simultaneity as decreed by relativity theory.

Both the time observable and the randomness involved in quantum measurement are indication of a close relationship between nowness and the production place of new facts. The process suppressing, or minimising, non-local correlations to the effect that objects are separated from disentangled observers plus environment resembles the process of ongoing actualisation, experienced by us as temporal change, too closely for being left out of consideration when we look for an interface that synchronizes nowness inter-subjectively. We are led to conjecture that it is not just by change that the objects constituted by measurement surface in the Now. We hypothesise, rather, that the Now itself is the collective effect of the measurements going on at a time. This conjecture, of course, is highly tentative. It is far from clear how the actualisation of states, understood quantum theoretically, relates to their actualisation by way of becoming temporally present. We are far from understanding, moreover, the dynamics of the process we experience as the passage of time. So far, there is not even a conclusive description of this process (see above). Remarkably though, it is also the measurement process that continues to pose riddles. What grows in the time that it takes to perform a measurement is the distinctiveness of the states turned into facts. This growth in distinctiveness is of a kind that is fundamentally different from the change that the sequential order of the states measured gives expression to. The kind of change that the sequential order of states measured gives expression to is real change. The growth of distinctiveness is much more of the kind that tradition has called temporal becoming. Temporal becoming means the growth of the presence of a state that is

approaching the Now. In the case that there are forms – or proto-forms – of presence below the level of mental presence, temporal becoming would not be restricted to conscious experience. Rather, the emergence of facts, as attributed to the process of measurement, would be a proto-form of temporal becoming. When trying to account for this proto-form we should be prepared to face difficulties. It is therefore no bad news to learn that the measurement process, as a process, has so far resisted satisfying description as well. Both the world of totally entangled holistic states and the world of localised objects are described to an amazing degree of clarity. "But the measurement *process* itself, in its dynamical, not only in its structural and logical features, is not yet finally understood. Up to now we do not have a formally rigorous, logically consistent, and intuitively satisfying description of what is 'really' going on in a system when a measurement takes place, i.e. when a local concept of reality replaces a holistic concept of reality since local objects are constituted." (Atmanspacher 1997, p. 341)

6. *Focal Change and the Quantum Zeno Effect*

Our hypothesis is that the time observable, i.e. the temporal non-locality involved in the emergence of local facts, is what remains of presence when mental presence has gone. Each moment, novel facts emerge world-wide. Each moment, the present moment is supplanted by a next one to the effect that the moments it takes to perform the measurement fuse into an enduring Now that finds itself put into motion in relation to the chronological order of facts established by the ongoing process of measurement. What grows in the time it takes to perform the measurement is, to repeat it, the distinctiveness of the states turning into facts. The Now, thus conceived is the growing edge of the universe.[3] Our thesis is that it is here where both the flow of time and the stream of consciousness have their origin. The evolution of consciousness amounts to a kind of emancipation of an individual stream of consciousness, i.e. of a stream of phenomena brought forth by an

[3] For conceptualisation of a growing universe see McCall 1994.

individual brain working as a measurement device, from the flow of time. It started when some form of life (we don't know which one it was) detected and learnt to utilize the universal measurement process as a proto-form of presence. By way of the amplification and sophistication strategies that evolution is famous for, this proto-form of presence developed into early forms of mental presence. What thus emerged might be the condition for the possibility of the development of the faculty we call awareness. So far, our understanding of this faculty is so poor that it is otiose to speculate about its evolution. What may be not totally idle however is to speculate about the survival value of the capability to control focal change.

The feeling of being free to steer one's focus relies on self-awareness. It is the proprioperceptive feeling of one's own effort having the effect intended. Proprioperception is well studied in the context of perception involving sensomotorics. As intensively, however, as proprioperception is investigated in the context of gathering and processing sensory input, as rare is systematic research in the context of paying attention.[4] Paying attention means to control, to a noticeable extent, the ongoing *process of presentification*. In order to feel oneself being in control of one's attention, aspects of the 'stream of consciousness' must show to correlate with the effort one exercises. Since the reshuffling of presence qua temporal change is autonomously going on, controlling the focus means just to intervene into the ongoing process of presentification.

In the neuroscience committed to the paradigm of classical physics, such intervention has no place. In this context, the impression of being free to intervene cannot be but an illusion. In the context of quantum theory, things are not so clear. Quantum theory includes the role that the experimenter plays in gathering information. Gathering information from experimentation presupposes that the experimenter is free to ask questions that nature is supposed to answer. The experimenter must be free, that is, to manipulate initial conditions in a way that is

[4] In Pashler 1998, the standard reference of the psychology of attention, proprioperception is no indexed keyword.

not predetermined by the theory under test.[5] The lack of predetermination usable is the Heisenberg uncertainty. It is only the asking of questions – not the answering – where experimenters need to be free. By asking questions, i.e. by choosing initial conditions, the properties are pre-selected that are supposed to either manifest (in the 'Yes' answer) or not (in the 'No' answer).

Choosing initial conditions makes no sense if it does not connect to a feeling of agency. In a study exploring the possibility of accounting for this freedom of choice within quantum theory, Henry Stapp (2005) goes into the question of how agency might work in connection with measurement. He recurs to an effect first described by Misra & Sundarshan (1977) and called the quantum Zeno effect. Since measurement is not a sudden collapse of the state vector, but an event that takes time, a rapid enough succession of monitoring events can have the effect of 'freezing' the state of the system being measured. By increasing the rate of measurements intentionally, Stapp sees a possibility of intervening into the flow of phenomena manifesting themselves. In particular, he sees the possibility that the brain increases the rate of measurements initiated when the answer obtained motivates the continuation of monitoring events. "If a 'Yes' response occurs and includes a positive evaluative element that instigates a quick re-posing of the query then the quantum Zeno effect can convert this positive evaluation into positive action. Such a use by nature of the quantum Zeno effect would promote the survival of any species that can exploit it. Thus the physical efficacy of conscious effort entailed by this quantum model would provide a naturalistic explanation of how and why our brains developed in a way that can exploit the quantum Zeno effect." (Stapp 2005, p. 51)

[5] Sometimes it is claimed that such a freedom is illusory. Yet, without this freedom all experimental science would be pointless: *To deny the freedom of action of an experimenter is to they the meaninfulness of experimental science.* Every experimental investigation presupposes that the specific design and implementaion of an experiment is compatible with, *but not exclusively determined by, known physical laws.* This situation does not imply that the first principles of physics are inconsistent or not valid, but only that they cannot account for intentionally chosen experimental arrangements and initital conditions." Primas 2009, p. 174f.

The quantum Zeno effect, if capable of being induced by the brain, might amount to an intervention into the autonomous flow of phenomena. The initiative would be not on the level of facts, but on the level of measuring events. It would only be the asking – not the answering – of questions that is influenced by the effort. Nevertheless, the effort would result in a remarkable effect. By speeding up the succession of monitoring events, the phenomenon focussed could be 'frozen' transitorily. This effect is enough for intervening into the process of presentification.

Stapp conjectures that intentionally inducing the quantum Zeno effect may be sufficient for triggering templates of mental action that eventually will have effects on the level of facts. Indeed, it is only by virtue of real effects that the capabilities provided by the quantum Zeno effect can have been detected by natural selection. Irrespective of the question what freedom of choice means in the last analysis, the quantum Zeno might be the key to understanding where the intuitively compelling impression of being in control of one's attention stems from. Accordingly, vigilance may then be another expression for the capability of speeding up the succession of measuring events in the brain. The intensity with which we feel to be mentally present may be the 'how it feels' quality of maintaining the rapid enough succession of measuring events capable of exercising a strong enough influence for rendering the impression of being in control of one's focus of attention. Dreaming and daydreaming would then result from the Zeno effect becoming too weak for being effective.

7. Summary

By suggesting where the solution of the synchronization problem of mental presence should be looked for, we also find ourselves approaching the problem of the very existence (the hard problem) of consciousness from a new angle. The mode in which phenomenal consciousness exists intersects, but is not identical,

with that of the temporal present. Consciousness does not exist without the Now, it is tied to the position and forced to travel with – or in – the Now. By being tied to the Now, mental presence shares the objectivity of the temporal present. The place of consciousness in nature, accordingly, is the growing edge of the universe. This place offers the particular opportunity of making use of quantum indeterminism. Mental presence, as we know it from our own – human – experience can be distinguished from the temporal present dynamically. We can distinguish, i.e. focal change from temporal change. The distinctive feature is the feeling of being free to control focal change, whereas temporal change is withdrawn from our control. Focal change is the voluntary kind of the redistribution of presence, temporal change is the involuntary kind thereof. A conceivable way of translating quantum indeterminism into this kind of freedom lies in the utilization of the quantum Zeno effect. As far as this freedom goes, as far is mental presence a genuinely subjective mode of existing.

8. Open Problems

Focal change is distinguished from temporal change by the feeling of being free to steer attention. In the case we are free indeed to allocate attention wilfully, we have to do with a case of mental downward causation. The neural correlate of paying attention is the selective processing of information by the nervous system. This kind of causation clearly contradicts the assumption of the causal closure of the physical universe. If this causal closure is an unshakable truth, wilful control of attention cannot be but an illusion. The question thus is whether the causal closure of the physical universe is an unshakable truth. In fact, the assumption of causal closure is a correlate of the conservation law of energy. All conservation laws, according to the theorem of Emmy Noether 1919, rely on basic symmetries. The basic symmetry that the conservation law of energy relies on is the time-reversal symmetry. "[T]he scope of validity of conservation laws is well understood: *a conservation law holds if and only if the system considered is invariant under the corresponding Noether-symmetry operation*. … Intentional influences are not invariant

under time-translations, so that in this case any argument involving energy conservation is misplaced. Whenever energy is well-defined it is conserved by definition. Therefore it makes no sense to speak of the violation of energy conservation." (Primas 2008, p. 173) Since the symmetry that the conservation law of energy relies on is the time-reversal symmetry, physics is silent about causal closure in the domains of directed time and tensed time. The causal closure of the physical universe is not a scientific fact (exposable to empirical test), but a metaphysical tenet (however convincing it intuitively may be).

Connecting temporal change to the measurement process presupposes that the concept of tensed time can be given a consistent definition. It presupposes that McTaggart's proof of the unreality of time can be conclusively refuted. Such a refusal should be possible by programming the use of the tenses in language. If a computer can use the tenses of time consistently, a conclusive definition of tensed time is included in the algorithm. The use of the tenses in fact becomes programmable as soon as the properties of pastness, presence and futurity are translated into relations between dates. Pastness, presence, and futurity are dynamic properties. Each moment, a moment having been future becomes present only to vanish into the past. Each moment, the totality of moments still future move closer to the present. Each moment, the totality of moments already past recede further away from the present. To each moment, thus, a unique past and a unique future belong. Since past and future do not exist but in actual recollection or anticipation, respectively, events that are past or future carry two dates: the date of their supposedly *real* occurrence and the date of their *actual* re- or pre-presentation, respectively. By dating events appropriately and making consistent use of this two-tier dating system, a machine can be taught to use the predicates "is past", "is present", "is future" without problem. What is interesting however is that you have to make use of two-tier dating coordinates in order to represent time as a process. There is one coordinate used to date the occurrence of an event, t_o, and another one that is used to date the position of the Now, t_s. Once fixed, t_o must never change, whereas t_s is bound to change constantly. t_o is the date written into and retrieved from memory, t_s is the date to be read from the system clock in so-

called real time. The dates t_o and t_s are varying independently, which means that the 'times' they measure are orthogonal.

By thus representing time as a process, the passage of time finds itself represented as a process of relative motion. By being relative, each of the relata can be looked at as either moving or resting. If t_s is looked at as standing, the historical order, the whole block of events, is put into motion. If the t_os are looked at as resting, the Now appears as travelling through the block. This change of perspective is brought forth by nothing more than a coordinate transformation. The ambiguity thus handled corresponds, however, to the classical dualism of world views. When we take the now as the resting pole, reality presents itself as a continuous process of creation and annihilation. In this view, each moment a state of the world is created anew only to vanish, thus giving way to the next act of creation. When we switch the perspective and take the block of states as being at rest, a world view suggests itself in which nothing changes in temporal change except the subjective impression of being in a certain state. The first view is Heraclitian, characteristic of psychology and the humanities. The latter view is the Parmenidian one, adopted by relativity theory. Might it thus be that a conclusive description of what we experience as time translates the age-old dualism of world views into just a question of perspective?

A characteristic of consciousness as fundamental as presence is awareness. Mental presence is the presence that is aware. Awareness lies at the heart of the hard problem of consciousness. There is no awareness without presence. Presence, however, is not all there is when presence is aware. A presence that is aware is – at least implicitly – self-aware. Every conscious phenomenon – be it a feeling, percept, mood, thought or whatever – implies a feeling of ownership. This implicate feeling of ownership is constitutive of conscious experience as such. It is constitutive of the very subjectivity of awareness, it is what ties awareness to the perspective of the first person. Regaining consciousness after a phase of unconsciousness is a coming of awareness to its own. Awareness comes to its own by (re-)establishing the background awareness of its own. Consciousness is lost as soon as this background awareness of its own is interrupted. It is only by

understanding how consciousness comes to its own that we will understand why there are nervous systems that are processing information not only, but capable also of engendering mental presence. Awareness, however, seems an even harder to deal with constituent of consciousness than presence. The maximum that seems possible at this point of time to contribute do a solution of the hard problem of consciousness is its decomposition into the problem of awareness and that of presence.

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