

Mental Presence and the Temporal Present

On the Missing Link between Brain Dynamics and Subjective Experience

Georg Franck
*Institut fuer Architekturwissenschaften
Technische Universitaet Wien
Treitlstrasse 3, A-1040 Vienna
e-mail: franck@iemar.tuwien.ac.at*

Abstract

This contribution ventures a look at quantum brain dynamics (QBD) through the glasses of phenomenology. In this view, QBD is about perception and recollection. Perception implies mental presence. Recollection makes sense only in a context in which present and past denote distinguished modes of existing. In physical theory, both mental presence and the temporal present are supposed to be conscious phenomena. QBD thus is confronted with the question of how the physical and the phenomenal are interrelated.

So far, the difference between the physical and the phenomenal aspect of the brain has been predominantly discussed in terms of the third-person and first-person perspective. In the following, an alternative approach is put forward. The perspective of the first person and the perspective of the third person share a common viewpoint: the temporal present. In the perspective of the first person, the temporal present is indistinguishable from mental presence. In the perspective of the third person, the present is the viewpoint in time shared by all persons. The paper asks how this communality can be made productive for mediating the ontological difference between phenomenal consciousness and the reality described by physics.

How Does It Feel to Be a Brain?

Conscious brains are the strangest of objects. They present themselves in completely different ways depending on whether they are investigated from outside or sensed from within. In the perspective of the outside observer, the brain is an anatomical structure with physiological functions, a conglomerate of chemical and physical processes, whose prime ability is the processing of information. In the perspective of the person who *is* the brain, a world endowed with sense qualities, value and meaning appears. From the third-person point of view, the brain is a net of neurons and glia cells swimming in a water bath. From the first-person point of view, our brain is what provides us with the phenomenal world: the world that is present when we are in the state of mental presence, and absent when we are unconscious.

Mental presence is the feeling of being a conscious mind. Is it the feeling also of being a conscious brain? The question may seem nonsensical since the brain has no organ for sensing itself. On the other hand, does the very fact of one's feeling not imply feeling to be a brain? The difficulty of taking one's mental presence as the way it feels to be a brain is this: Even though our being in the state of mental presence is something we cannot help to be acquainted with most intimately, it is, at the same time, something completely alien to us. The state of mental presence is what we know best of all because it is what every act of experiencing is in. Yet, it is completely alien to us because we cannot grasp it in its own reality. Mental presence is a byword for concreteness. Still, it is not a thing we can experience with our senses. Nor is it accessible by abstract thought. It ceases to be what we are trying to grasp as soon as turned into an object of thought. Mental presence eludes our grasp since it is neither a thing nor an idea. The only way it can be experienced lies in its taking cognizance of itself. In order to reach this state of *self-awareness* we must rupture, however, the everyday intimacy with our being aware *of* something. Self-awareness means being aware without being aware *of* something, an attitude for which there are no words.

An account of what it feels to be a brain that deals with this difficulty is Martin Heidegger's ontology of *Dasein*. "Da sein" literally translates as "to be there". When related to the mode we exist in as conscious beings, "to be there" assumes a double meaning. "Da sein" can mean to exist as a living organism, and it can mean to be present in the sense of mental presence. It is this double meaning of "being there" that is characteristic of the existence of a conscious brain. The organism is an entity. Mental presence is not an entity, but a mode of existing. *Dasein* covers this intrinsic difference. According to Heidegger, *Dasein* is the entity (*Seiendes*) that is aware of itself and cares about its Being (*Sein*). Being, thus understood, means presence. Being, as distinct from entities, means presence, as distinct from the things and events presencing. The conscious brain is that one distinguished entity that itself performs the ontological differentiation between Being and entities.

From the Dualism of Views to the Difference in Ontology

Presence, in the sense of Being, is not restricted to the perspective of the first person. Presence, when tied to the perspective of the third person, is called the temporal present. In the perspective of the first person, mental presence and the temporal present are one. In the perspective of the third person, the temporal present is as objective, however, as is the fact that the reality given to perception consists of things and events that are separated from their temporal environment. It is the *cut of nowness* that singles out the collection of "res" that the concept of reality classically refers to. Part of this collection is the brain as appearing in the perspective of the third person. Accordingly, the ontological differentiation between Being and entities is neutral with regard to the dualism of the first-person and third-person perspective.

The temporal present, though implied in the classical concept of reality, does not come forth in post-classical physics. The present explicitly is expelled from spacetime, it has no place in the universe described by the wavefunction. In relativity as well as in quantum theory, there is no distinguished section of the universe that is raised to presence while the presentification of the rest is suppressed. From a physical point of view it is not the dualism of views, thus, that is relevant for demarcating the physical from the phenomenal. Both the perspective of the first person and the perspective of the third person are bound to the now. They both presuppose the

present. When it comes to the question how the physical and the phenomenal are interrelated, Heidegger's account of *Dasein* is more to the point than the dualism of personal perspectives.

On the other hand, Heidegger's philosophy epitomizes a way of thinking that scientific thought progressively has distanced itself from. Scientifically, entities are all there is. For Heidegger, presence is what deep thinking is all about. Scientifically, even the temporal present is denied objective existence. For Heidegger, modern science is the upshot of *Seinsvergessenheit*: of forgetfulness of Being. In fact, ignoring presence means to ignore the very existence of consciousness. For us, as conscious beings, everything that is supposed to exist does so by making appearance in conscious awareness. The only way we have access to the reality deemed to exist independently of being experienced is conscious thought.

Accounting for the existence of conscious brains thus means to think together totalities that seem to be most intimately related and, at the same time, to be separated by an abyss. It is as if we had to do with different universes, a subjective one that is present and an objective one that is real. It is as if these universes had to come into contact before entities can manifest. Hence, is there any account of the functioning of the brain that accounts for this dualism of universes?

Remarkably, there might be one. Even more remarkably, the account coming into question is a physical one. In Hiroomi Umezawa's quantum theory of thermodynamics, a dualism of universes emerges from the formalism. In thermofield dynamics "every dynamical degree of freedom is doubled; to any operator A is associated its tilde conjugate $A\sim$." (Umezawa 1993: 144). It is an open question what this doubling means beyond the job it does in the formalism. However, thermofield dynamics has developed into dissipative quantum brain dynamics (Vitiello 1995, 2001). Quantum brain dynamics (QBD) is an approach to the brain's capability to memorize (Jibu & Yasue 1995). Memory is that one capability of the brain that has most immediately to do with the differences engendered by presence. Memory lies at the base of time perception and of the brain's way of dealing with temporal change. Temporal change means that world states having been future become present, only to vanish into the past. Without memory, there is no past and no future. Memory, however, has so far escaped explanation by non-quantum approaches to the functioning of the brain. In the brain, memory storage is not localised (see Pribram 1991). QBD is that one approach that accounts for both the enormous capacity and the non-local way of storage. Dissipative QBD, in addition, accounts for the self-organisation of the brain as a system that maintains itself through energy exchange with its environment (Vitiello 2001).

The brain, as a dissipative system, is an open system. Its environment, in terms of thermodynamics, is a heat bath that is an open system as well. In order to say something specific of the brain embedded in its environment, the system brain plus environment has to be closed somehow. Due to the holistic character of quantum theory, this closure is a delicate operation. The device accomplishing this closure is the thermofield dynamical doubling of the system. By this doubling the system is closed and kept open as well. Due to the holistic character of quantum theory, the doubling of every dynamical degree of freedom amounts to a doubling of "worlds". The description of the brain as a dissipative system is thus accomplished by relating two universes, the (nontilde) universe A and its (tilde) double $\sim A$. Umezawa (1993: 34) speaks of "the presence of other universes which are totally dissociated from our world, though they share the vacuum with our world."

The vacuum state is the state of minimum energy. It is the key to the explanation of the enormous capacity and the nonlocal way of memory storage. We shall come back to it in a moment. Since we are looking for an account of brain functioning that accounts for the production of mental presence, Umezawa's talking of the "presence of other universes" looks promising. This promise, however, relies on a misunderstanding. The descriptions of both the nontilde and the tilde universe are wavefunctions. The states that wavefunctions give expression to are possible states. Possible states differ from actual states in that they lack presence. Wavefunctions can be interpreted as relating to presence in a way only that Umezawa certainly had not in mind (see below). Most probably, Umezawa's talking of presence is just a way of dealing with the hard to express existence of wavefunctions in ordinary language.

It was first Gordon Globus who explicitly addressed the question of how the universes addressed by Umezawa manifest. Since manifestation means presentification, he asks how the dualism of un-present universes might relate to the ontological difference between Being and entities. The wavefunctions of the nontilde and tilde universe have the same form, but differ in the sign of the imaginary unit number i . Tilde is the complex conjugate of nontilde. Observables, i.e. descriptions of entities that can be made to manifest, result from a conjugate match of nontilde and tilde. When being made to manifest, the observable turns into an actual happening. An actual happening is what happens when entities present themselves in the present. Since it is fundamentally unclear what the temporal present might be in the absence of mental presence, we should be entitled to say that entities surface in the present when entering some Dasein – or, rather, when getting involved into the happening of Dasein. Globus now embarks on thinking together the conjugate match of the universes and the happening of Dasein. He illustrates his approach by referring to Descartes' dualism of *res cogitans* and *res extensa*. "Descartes' dualism of incompatible yet interacting substances is succeeded by a thermofield dualism in which an interaction takes place in the vacuum states upheld by the living brain. This interaction is ... a lighting process in which *res extensa* is disclosed in virtue of a \sim conjugate match. In the case of match, the physics equations show real numbers, which are associated with observables." (Globus 2003: 81) *Dasein* is what results from the conjugate match between nonpresent tilde situatedness and nontilde potentiality.

Quantum Memory

Physics, to repeat, does not thematize presence. Hence, the conjugate match is definitely not a self-contained account of Dasein. Dasein means to live mentally present in the present. The only way of relating the ontological difference to physical theories of the brain lies in interpreting these theories in the light of the accounts we have of our existence as conscious minds. The account Globus makes use of is the most fundamental notion of *Dasein*: of Heideggerian *Existenz*. Globus deems the notion of phenomenal consciousness to be inappropriate since too closely related to that of classical reality. This is a point with which I disagree. I think phenomenal consciousness to be indispensable for accounting for the brain's way of dealing with presence. Presence, for the conscious brain, is not an all-or-nothing mode of existing. In experience, presence varies in two different, if not independent, respects. Presence can vary in the sense of the varying degree of concreteness to which things are present; and it can vary in the sense of the varying degrees to which we are mentally present. The varying degrees of concreteness are epitomized by the soft transition from future to present and then past (as described by Husserl in terms of protention and retention). The

varying degrees of mental presence are epitomized by the spectrum of arousal that ranges from highest alertness or even shock to the verge of sleep and further from dreaming sleep to dreamless sleep down to the definite loss of consciousness.

Compared to the very existence as a conscious mind, these varying degrees of presence are subtleties. These subtleties, however, are of prime interest when understanding QBD as a theory of the brain's capability to memorize. Memory lies at the base of time perception and of the differentiation between perceptive and reflective consciousness. Time perception is the awareness of the involuntary change of the degree to which things and events are present. The differentiation of perceptive and reflective consciousness relies on the capability of the brain to uncouple the presence controlled by temporal change from the presence controllable by the brain itself. When interpreting dissipative QBD¹ in the light of these capabilities, the following features of the memory system appear in the foreground. (1) Everything lived through consciously is automatically printed to memory, (2) total memory is constantly held accessible and (3) past experience, though having lost its original presence, can be made to reappear in mental presence. Feature (1) relies on an enormous capacity of information storage, feature (2) relies on the conservation of printed memory and its protection against overwriting, (3) means that the experience passed is reproduced by recombining the information stored with mental presence.

Ad (1) According to QBD, memory is printed to vacuum, i.e. minimum energy, states of quantum fields that extend over macroscopic distances in the brain. The main burden of information storage lies on fields that are generated dynamically by the exchange of quanta that correlate the rotational and vibrational dynamics of water molecules in a coherent manner. The submicroscopic constituents of the water electric dipole field are vibrating in phase to the effect, that the field behaves as if it were one molecule that assumes macroscopic size. The quanta exchanged by way of these long-range correlations are massless, which means that they do not add to the energy of the system. What the number of dipole wave quanta condensed in the system does change is the phase that the system is in. Quantum field theory allows the electric dipole field of water to assume an infinity of phases. The idea behind memory printed into minimum energy states of this field is as follows. The equations controlling the time evolution of the field are invariant under some (group-theoretic) groups of continuous transformation. This symmetry spontaneously breaks down when the system reaches its minimum energy state. The vacuum states are no longer invariant under the full group. Nevertheless, there are as many vacuum states as there are phases potentially assumed by the system. The vacuum states are capable carriers of memory if it is possible to stabilize the imprints and to protect them against overwriting by subsequent states of minimum energy.

Ad (2) Vacuum states, by virtue of being states of minimum energy, are stable in principle. The electric dipole field of the brain water is a system, however, that is constantly undergoing phase transitions. The possibility of stabilizing vacuum states of a system that is thus "living over many ground states" (Del Giudice et al. 1988) crucially depends on two conditions. The first is that the system is allowed to be in an open number of states at the same time. In quantum theory this condition is allowed by the so-called superposition principle. Superposition means that the state of a system can be described as the sum of a set of independent (orthogonal) states. The first condition for the possibility of stabilizing vacuum states of the electric dipole field is that the brain is a quantum system that is, and continues to be, in stabilized superposition. This condition is necessary but not sufficient for protecting the

¹ In the following I most heavily rely on Vitiello (2001), (2002).

vacuum states against overprinting. The sufficient condition is that the system is allowed to collect physically inequivalent vacuum states without limit. This condition can only be fulfilled by open systems, i.e. by systems that are connected to their environment. The brain is such a system. As a dissipative system, it is in constant exchange of energy with its environment. By virtue of the brain's being a dissipative system, an overprinting of the vacuum states of the water electric dipole fields can be prevented. By thus being protected, an unlimited number of ground states are allowed to co-exist in stabilized superposition. It is this feature that might explain the enormous capacity of the brain to memorize.

Ad (3) 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 so-called state vector of the system is made of. The states entering the state vector are no actual states. No system whatsoever can actually be in orthogonal states 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 potential states of a system is turned into an actual state. An actualization of this kind must take place also when a memory state is selected for making appearance in mental presence. The states having subsisted in superposition before being actualized in an act of recollection cannot have been just potential states, however. They must have subsisted *really* without existing *actually*. This difference is inconceivable in classical theories of the brain. It is not before quantum degrees of freedom come into play that states are allowed to be real without being manifest. In a sense, thus, the states entering the state vector of the QBD system are sub-present. They do not come forth but by a so-called reduction of the state vector. Reduction of the state vector means that one of the many sub-present states is selected and raised to full presence. This many-to-one projection happens both when a measurement, as understood quantum theoretically, or when a recollection in the sense of the re-actualization of a printed vacuum state take place.

Actualization and Temporality

The memory system theorized by QBD is a macroscopic quantum system. It is macroscopic in two regards. It is macroscopic regarding the coherence lengths of the quantum fields it consists of. And it is macroscopic regarding the perceptions it conserves. The macroscopic coherence lengths of the fields whose vacuum states wear the information could be the explanation of the non-local way memory is stored in the brain. A major part of the information these states wear represents the environment objectified. Perceptions are more than just impressions. The environment objectified consists of the collection of "res" that the concept of reality classically refers to. In terms of quantum theory, this concept of reality is derived. It depends on the process of actualization, i.e. on the process by which one of the alternatives entering the state vector of the system is selected for being turned into an actual happening.

The environment objectified in perception, even though presenting itself in only ever a single state at a time, is actually never in the same state. Actualization means that a state singled out of the state vector is temporarily raised to full presence. That the state is only temporarily raised to full presence implies that each moment another state of the world is made to manifest. Temporality, thus understood, means that each moment a state having been future is made to appear in the present only to vanish into the past. In order to survive the moment of

its first presentification, a state surfacing in the present needs to be refreshed, i.e. made to reappear in the present.

It is not before perception is augmented by recollection that this kind of repetition can become effective in perception. Moreover, it is not before the states actualized are recorded and kept presentified that change becomes susceptible to perception. It is only through re-actualization of the states printed to memory that the reality given to perception extends beyond the immediate present. Or, to put it differently, past and future do not come forth but by re-presenting or pre-presenting, respectively, states that are not immediately present. Hence, it is the interplay of actualization and re-actualization that presents us with a classical reality.

One of the revolutionary novelties hypothesised by QBD is that the states that give rise to the world we perceive are macroscopic quantum states. These quantum states, taken together, contain the trajectories of the objects that make up our classical environment. The space of the memory states are classical trajectories (Vitiello 2004). The states themselves exist in the mode of superposition as long as they are not re-actualized in an act of recollection. This, however, means that the states underlying our feeling of living in a real world are not just sub-conscious when not being in the foreground of attention, but *sub-present*. They are real without being manifest. In order to manifest they have to be (re-) actualized.

The process by which states having subsisted in superposition are turned into actual states is not yet finally understood. One of the unanswered questions is how actualization and mental presence are interrelated. Since not even QBD addresses this question immediately, let us put it for the moment aside. Let us observe, instead, that two further conditions have to be met in order to bring forth a perception. The first is that the brain is coupled to its environment by exchanging energy in a highly specific way. The energy input that results in perception does so by assuming the character of sensory input. The second condition to be fulfilled is that the causal chain connected with the energy input is intentionally inverted in such a way that the object perceived is located out there. Only a tiny fraction of the input processed in the perceptive brain results in conscious perception. In conscious perception, the brain exchanges energy not only, but gets correlated with its environment in a highly specific way. Locating objects out there means that the activity of perceiving reaches out and does not stop short of the object objectified. It makes no sense to say that the perception happens in the brain. The act of perceiving happens in the brain as well as in the place that the object perceived occupies. The relation thus established is non-local in that the object is not just a representation, but identical with the content that the consciousness is conscious *of*. The *intentionality* of consciousness, thus understood, assumes the form that quantum theory describes as *entanglement*.

When recollecting perceptions, these entangled states are re-actualized. In re-actualization, the brain state performing the actualization and the state that is actualized are separated in time. However, how do we get a notion of this? How is it that we distinguish perception from recollection? Both the state initially actualized and the state re-actualized are states presenting themselves in mental presence. What has changed is the source of information. It is not an awareness of the source of information, though, by which we distinguish perception from recollection. It is much more our sense of concreteness that we make use of. The things perceived are more concrete than the things recollected. This difference is even characteristic of the states printed to memory. When being aware of some part of our biography we know, in a how-it-feels sense, whether we recollect something immediately perceived or something we had only indirect notion of. Memory printing depends on energy input. Hence, it should be

the measure of energy exchanged between brain and environment by which we distinguish perceptions from recollections. In recollection, the energy exchange with the environment is interrupted. The result is the how-it-feels difference between perceptive and reflective consciousness.

Interestingly, the brain's capability of re-actualization is not restricted to an either full or nil presentification. We find ourselves capable of interlacing recollections into the ongoing stream of perceptions. We are able, that is, to divide attention. While being aware of what happens before our eyes, an inner eye may attend to happenings quite different from those in the foreground. Moreover, we feel free to switch between foreground and background. The scene perceived in the foreground and the episode recollected in the background are easily made to change position in attention space. When the scene in the foreground of our attention is past or future we just seem absent-minded to those observing our behaviour. In fact, however, it is quite normal that we switch between past, present and future by manipulating the weights of presence of the states that are manifesting at the same time. In order to allow a state to come forth in mental presence it is not necessary, thus, to fully reduce the state vector of the QBD system. We seem capable, rather, to manipulate the weights of presence in such a way that an 'actual' superposition of the states coming forth results.²

We are back to the process of actualization. Actualization means that one of the alternatives entering the state vector of the system is selected for being turned into an actual happening. In the context of perception or, for that matter, of measurement, the states entering the state vector are interpreted as possible states. Actualization, thus interpreted, means that out of the cloud of previously possible states an actual state precipitates. In the context of recollection, a slightly different interpretation may be more appropriate. The vacuum states of the QBD system are not just potential states. They are real states, tracing facts. The states wearing the information of veridical memories are real states that exist in a less-than-full degree of presence as long as they are not selected for re-actualization.

By this interpretation, a distance in time gets involved that separates the initial actualization of states from subsequent re-actualization. At first glance this time seems to be just the distance measured by clocks. On closer inspection we see, however, that distance, i.e. difference in date, is not the only difference. There is a difference in presence as well. Our sense of concreteness does not need a clock for distinguishing perceptions from recollections. It just discriminates degrees of presence. It is a progress hard to be overrated that QBD is capable of translating this difference into terms of energy. By this translation, however, the interpretation of the weights – i.e. the complex terms – of the wavefunction changes. Each state entering the state vector of a system contributes with a definite weight to the superposition. In the context of measurement, these weights (the square moduli of the complex terms) are interpreted as the probability of obtaining the alternative in question when the system is measured. Actualization, thus understood, means that the probability of one of the alternatives shifts from a value less than unity to the value unity (see Stapp 1993 for this formulation). As soon as the states waiting for actualization are not just potential states, the weights with a value less than unity turn into measures of a less than full degree of presence. Accordingly, actualization turns into the process in which sub-present states are temporarily raised to full presence.

² For the formalism of such a superposition see Jibu & Yasue (1995), appendix A.

Epistemologically, this ‘temporalistic’ interpretation is equivalent to the probabilistic one. The closer the degree of presence of a state is to full presence, the higher is the probability of meeting the system in this state when a measurement is performed. The difference lies in the concept of time involved. Presence explicitly refers to *temporal* change. Temporal change has to be clearly distinguished from *real* change. Temporal change, to repeat it, means that world states having been future become present and then past. Real change means that states differing in date also differ in structure or function. Temporal change and real change are independent of one another. We can abstract from temporal change by leaving real change perfectly intact. Accordingly, when consistently disregarding the processes of real change, we are left with *nowness* as such.

The system described by QBD either presupposes or engenders temporal change. The manifestation of perceptions and recollections is bound to temporal change. Dealing with temporal change is what recollection and anticipation are good for. It is not before perception is distinguished from recollection that we realize that time goes by. In the domain deemed to be physically fundamental time does not pass. The question thus is how the passage of time is accounted for in dissipative QBD.

The Passage of Time and the Mirror Image in Time

Asking thus may seem to be besides the mark. As a physical theory, QBD does not account for the process we experience as temporal change. Temporal change means that the state manifesting in the present never is the same, whereas the present itself persists. The states, including the ‘inner’ states of the consciousness, come and go. The Now just *is*. It has been now since time began to pass. As soon as the temporal present is treated as a permanent Now, maintaining its identity while moving relative to the states that make appearance in it, temporal change appears as a relative kind of motion. In QBD, there is no account for permanent presence, nor is there one for relative motion.

Nevertheless, dissipativity allows a singularity on the axis of time to come forth whose emergence involves a symmetry break between the directions of time (Vitiello 2001: 107). The singularity means that there is a distinguished place in time. Breaking the symmetry means that there is a preferred direction of time. The distinguished place in time and the irreversibility are necessary, though not sufficient, conditions for temporal change. What is lacking, still, are the differences in presence and the spontaneous movement we experience as passage. It may be that these latter ingredients are tied to presence as a mode of existence for its own. Still, there is the strange doubling of universes in dissipative QBD waiting to be considered in the light of the experience we have of time. The reason is that the doubling of the system brain plus environment is accomplished by way of mirroring the system in time. The tilde universe $\sim A$ is the *time-reversed mirror image* of the nontilde universe A .

Is there a way of interpreting this mirroring in time in the light of the experience we have of time? As Globus (2003: 138) makes clear, it is pointless to think of a movie that runs forward and backward at the same time. There may be an interpretation, however, when we take seriously the description of passage as a relative kind of motion. Relative motion is a concept that includes, or gives rise to, a mirror image. By definition, relative motion can be looked at in two ways. Each of the relata can be looked at as being at rest while the other one is in motion. This applies to the travel of the Now as well. The Now can be looked at as being at rest while the sum total of the states having passed through or being destined to pass are in

motion. Or the Now can be seen as being in motion while the states are at rest. In order to switch between these views, a transformation is needed in which the direction of time is reversed. In the first view, the Now travels forward in time, in the second view, the states travel backward in time (Franck 2000, 2003).

Both the relative motion and the mirror image in time deal with the relation between the perceiving self and the world perceived. It is thus tempting to assume that the experience of the moving Now is the phenomenal correlate of the dynamics described by dissipative QBD. This interpretation, however, faces difficulties. Even though the dynamics of dissipation breaks the time-reversal symmetry, it does not give rise to a constant shift of an entity relative to another. Since energy is not conserved in dissipation, there seems to be no base for the translational invariance implied in relative motion.

Nevertheless, the brain plus environment is an entangled whole. In dissipative QBD, the brain is constantly entangled with its environment. It is entangled not just in the way that gives rise to a non-local correlation in space. It is entangled in a way also that maintains the unified whole in time. This ongoing entanglement leaves as its trace the perceptions printed to memory. The perceptions printed to memory are processed into the *cognitive map* we construct and maintain of our environment. It is this mental map that appears to be in relative motion when we have the impression that time goes by.

From a physical point of view, this map is not extended in time. It is built up from information that shares the date of its actual use. It is only by interpreting this information in a certain particular way that it turns into a re-presentation of experiences undergone. In order to turn information available at time t_0 into a re-presentation of an event having taken place at time t_1 an attitude is needed that deploys perspectival depth behind the pattern presented. This *intentional* attitude has to perform in time what the perception of objects out there performs in space.

Intentionality is a property of phenomenal consciousness. Accordingly, the mental map, as a map representing temporal regions extending beyond the present, does not come forth but in mental presence. The kinematics of temporal change may thus be purely phenomenal. The relative motion may be absent in the absence of cognitive maps. Hence, we should be careful of not committing a category error when looking for a physical correlate of the impression that the Now travels through time. Before asking what physical process gives rise to the impression that time goes by we should further go into the analysis of the impression itself. How is it that we have the impression of living in a Now that maintains its identity while constantly changing its location in time? What precisely are the relations the combination of which gives rise to the impression of relative motion?

The 'Paradox' of Temporal Change

The only descriptions we have of time's flow are phenomenological. Remarkably, however, the description of this basic experience proves to be frustratingly hard. Since Henri Bergson there is a noted incompatibility between physical time and the time containing the Now. For Bergson (1889), the difference is that between the distance measured by clocks and the duration experienced subjectively. In order to account for the aspect of time that escapes measurement by clocks, Bergson introduced the concept of 'durée'. 'Durée' gives expression of the fact that the Now endures. Bergson did not consider the possibility, however, that

duration may assume two totally different meanings when applied to the Now. The meaning of duration suggesting itself when applied to the Now is the eigentime of the present, i.e. the interval in clock time covered by mental presence (on this point see Pöppel 1997 for an overview). This interval however, as extended as it may be, has to be distinguished from the permanence of the Now. This latter kind of duration is different not only, but even independent of the interval spanned by the so-called specious present. Since Bergson has never been clear about this point, his concept of *durée* became a notorious source of confusion.

The operation of singling out the span covered by mental presence from the duration lived through is delicate when to be performed on the level of phenomenology. On the level of phenomenology, the Now is indistinguishable from the presence of phenomenal consciousness. It is one of the tenets of phenomenology that consciousness is intentional as such. That consciousness is essentially intentional means that being conscious always means to be conscious *of* something. By virtue of its essential intentionality, the presence of consciousness cannot be separated from the contents presenting themselves in this presence. Hence, the problem of drawing the line between the different meanings of duration implied in the concept of *durée* lies in demarcating the pure 'form' of mental presence from the things and events surfacing in it. The problem consists, to put it differently, in distinguishing mental presence from the stream of conscious phenomena. It is this distinction that Edmund Husserl never stopped tackling. Husserl realized that there is a kind of relative motion relating the presence of consciousness to the contents consciousness is conscious of. He clearly saw that there are two views of passage, the one showing the Now as passing while the moments passed through are at rest, the other showing the Now at rest while the moments passing through are in motion. Husserl called the experience of this ambiguity the '*arch-impression of the both standing and flowing Now*' ("*die Urimpression der stehend-strömenden Gegenwart*"). However, Husserl was prevented from taking the relata of this relative motion apart by the dogma of the essential intentionality of consciousness. Taking these relata apart means separating phenomenal consciousness from its intentional content. Instead of daring the cut, Husserl felt driven to treat the ambiguity of the both immobile and flowing Now as a kind of paradox. He was downright haunted by this 'paradox'. He never stopped fighting with the problem. From his lectures on "The Phenomenology of Internal Time Consciousness" in 1905 (Husserl 1966/96) until the manuscripts dating from the year of his death, 1938 (see Held 1966), he grappled with the problem again and again. The tension remained unresolved.

It was first Heidegger who left the dogma of the essential intentionality of consciousness behind. For Heidegger, it is the very distinction between *presence* and the things and events *presencing* that becomes essential. It is this distinction that is drawn when *Being* (Sein) is distinguished from the *being-there* of things and events (Seiendes). Being, as distinct from the things being, means being aware in the sense that a world of experience is present at all. Being, as distinct from the events being in time, is the time being. We have to leave subtleties aside in order to translate "Sein" as *presence*.³ It is this translation, however, by which Being is related to time. Presence, when related to time, is *nowness* as such. Nowness is neither a thing nor is it an event. The things and events presented come and go; presence just *is*.

The reason why it seems so strange and outlandish to draw the distinction circumvented by both Bergson and Husserl becomes clearer when we consider the novelty that the advent of Heidegger's philosophy meant in the tradition of western thought. The distinction between

³ The subtleties disregarded are not negligible. The translation holds, however, as far as "Being and Time" (Heidegger 1927/1962) is concerned.

Being and entities is a differentiation requiring an attitude that never has been cultivated in western philosophy. It requires awareness to get rid of intentional content. As long as awareness is assumed to mean being aware of some *thing*, abstraction from the contents surfacing in awareness is tantamount to abstracting from awareness as such. Only by forgetting or annihilating the objects awareness habitually is concerned with, presence as such comes to the fore. Or, put the other way around, it is only in *conceptless self-awareness* that phenomenal consciousness comes to its own. Only through the exercise of disregarding anything surfacing in awareness, the differentiation between Being and entities becomes intelligible. The way in which presence as such can be experienced consists in avoiding any distraction from one's own state of being aware.

The novelty of Heidegger's philosophy is that it bridges western and eastern thought in an unprecedented way. Being, as distinct from the being-there of things and events, is what eastern tradition calls the *empty Being* or *filled Nothing*. Being, as distinct from any thing there is, is presence void of any specific content. Being, as distinct from any event, is *nowness* experiencing itself and nothing but itself. Being is empty in that it is without inner structure and outer circumscription. It is Nothing in that it is the fulfilment of the absence of anything detracting from presence as such. In this equivalence of Being and Nothing, consciousness escapes the determination of being consciousness *of*. In conceptless contemplation, the unity of the phenomenality and the intentionality of consciousness breaks.

Considering the deep-rooted habits of thought that need to be overcome when drawing the ontological differentiation performed by Heidegger, we understand better why Bergson and Husserl did not succeed in separating the relata that need to be separated in order to be truned into constituents of the relative motion we perceive as time's flow. On the other hand, not even Heidegger asks how the dimension *t* is turned into the process of temporal change. Instead of putting the relata separated by the ontological differentiation together again, he treats these relata as if one had to decide oneself which one to be concerned with in the first place. He belittles the being-there of entities by emphasising, again and again, the overriding dignity of Being. Instead of developing a philosophy of time that reconstructs in depth the interplay between presence and reality, he emphatically focuses on the depth of Being.

Ontological Complementarity

Nevertheless, Heidegger cuts through a Gordian knot. Distinguishing Being from entities shakes the deep-rooted habit of thinking the real to be present as such. Being, as distinct from entities, is the mode in which anything appearing in the light of an awareness manifests. This mode may or may not be included in the description of reality. It may be excluded in the name of objectivity. This is what contemporary physics does. Manifestation means presentification. Presence may ultimately be synonymous with mental presence. However, we do not know whether the advent of presence had to await the evolution of conscious brains. It may be as well that presence is as primordial as is material reality (i.e. matter and physical energy). Heidegger leaves it open how, and whether, Being relates to subjectivity.

Presence, when distinguished from the entities presentencing, can be purified from anything particular that manifests. Conversely, material reality can be purified conceptually from presentification. Presence, when purified from any thing and event manifesting, is the empty Being or filled Nothing. When purifying physical reality from presentification we end up with the universal wavefunction. Remarkably, both the elimination of entities from presence and

the elimination of presence from reality result in fathomless wholeness. Both concept-less awareness and the totally entangled quantum whole are backgrounds of existence that cannot be transgressed. They are both fundamental and extremely symmetrical. The emergence of anything particular presupposes that symmetries are broken. Symmetries break as soon as the pure extremes are left. Concept-less awareness turns into intentional consciousness as soon as the awareness becomes selective. The totally entangled quantum whole turns into a selection of possible states as soon as observables are identified. In both cases, something particular emerges by way of reducing the one extreme and allowing the other mode of existence to enter. The categories that enter when concept-less awareness turns into focussed attention are the forms that entities assume when becoming objects of thought. The observables that enter when probabilities are calculated are forms that entities assume when conceived as objects located in space and time. It is an open question how the selection of states described by the wavefunction and their transformation into local states is related to presence. In the case, however, that it is legitimate to talk of sub-present states whose presence is amplified when an actual happening takes place, the constitution of macroscopic reality implies presence. On the other hand, conceptual awareness ranges from abstract thought to concrete perception. Abstract thought is distanced from concrete perception by steps of reflection whose effect is that the materiality represented is diminished. Most importantly, there is a middle between the extremes where presence and materiality match in a highly particular way. The matching case is the perception whose description renders the collection of “res” that the concept of reality classically refers to. Classical reality is what results when physical reality is reduced to an only ever single and manifest state of the world, and when presence is reduced to the social average of the temporal present.

What we are facing is an ontological complementarity of presence and materiality. We can have presence up to the extreme of fathomless wholeness, and we can have materiality up to the extreme of fathomless wholeness. We can have the maximum of either, but we cannot have both. We can have each to the extent only that the other is reduced. The more materiality, the less presence, and vice versa. This ontological complementarity is one of the fundamental conditions of existing as a conscious brain: of *Dasein*. *Dasein* participates in both materiality and manifestation. The degrees of participation are not fixed, but subject to change. *Dasein* implies the feeling of being free to combine materiality and presence at will.

The ontological complementarity of presence and materiality is a topic also of the philosophical reflection of quantum theory. It was Wolfgang Pauli who suggested that phenomenality and physicality should be thought together in terms of complementarity. “The general problem of the relation between psyche and physis, between the inner and the outer, can ... hardly be said to have been solved by the concept of ‘psychophysical parallelism’ which was advanced in the last century. Yet modern science may have brought us closer to a more satisfying conception of this relationship by setting up, within the field of physics, the concept of complementarity. It would be the most satisfactory of all if physis and psyche could be seen as complementary aspects of the same reality.” (Pauli 1994: 260) Recently, Hans Primas took up the idea, starting from an ontologically undifferentiated whole, an *unus mundus*, in which “[n]either time, nor mind, nor matter and energy are taken to be *a priori* concepts. Rather, it is assumed that these concepts emerge by a contextual breaking of the unitarian symmetry of the *unus mundus*.” (Primas 2003: § 2.3) In Primas’ concept of primordial symmetry, not even the symmetries to be broken are predetermined. Rather, there may be different separations, leading to complementarity descriptions of the *unus mundus* different from the one using the concepts of presence and materiality. Hence, the ontological differentiations characterising specific kinds of existence are assumed to be contingent on the

evolution of the universe. Primas comes very close thus to what Heidegger conceives as the *history of Being*.

Primas refrains from speculating about how the breaking of the symmetry between presence and reality might relate to the evolution of conscious brains.⁴ Primas also refrains from asking how the breaking of the unitarian symmetry relates to the phenomenology of time. This restraint is wise insofar as temporal change still awaits consistent phenomenological description. The question becomes crucial, however, when we ask how the kind of actualization that QBD involuntarily is concerned with relates to the ontological complementarity. In order to go into this question we have to look for the symmetry that needs to be broken for conceiving time as a process instead of as a dimension only. In order to look for this symmetry, let us try to reverse the abstraction that is performed when the physical concept of time is purified from nowness.

When abstracting from the Now, a two-fold abstraction has to be performed. On the one hand, we have to abstract from the spontaneous movement that the Now is in relative to the world states that pass. On the other hand, we have to abstract from presence as a mode of existing. In order to reverse this two-fold abstraction, let us first ask what it means to recombine presence with dimension t . Since it is unclear what presence means in total absence of mental presence, let us start from the specious present. In terms of presence, the specious present denotes an atomic chunk of nowness, i.e. a minimal duration. This duration appears as the eigentime of mental presence when the temporal resolution of our sense of time is measured in clock time. Conversely, to the interval that mental presence covers in clock time a quantum of nowness belongs. These individual nows can be ordered in the same way as the eigentimes can. When ordering the eigentimes chronologically, we obtain dimension t . When ordering the individual nows accordingly, we obtain a present that extends over all time (Franck 2003). When thus co-ordinating distance in time and nowness, we face a perfect symmetry: The diameter of the present is co-extensive with t . Hence, the breaking of the symmetry must have to do with the emergence of the spontaneous movement we experience when having the impression that time goes by. In fact, the synthesis of the individual nows into the permanent Now fundamentally differs from the synthesis of the eigentimes into time t . The synthesis rendering the permanent Now renders a Now whose lifetime is (or may be) co-extensive with t . This (nearly) unlimited lifetime does not mean, however, that the span covered by the Now extends without limit. Rather, the permanent Now has the same diameter as have the individual nows. The ‘paradox’ of a Now that lasts 30 milliseconds and forever at the same time is resolved by breaking the symmetry between presence and distance in time. The symmetry broken is that between the lifetime and the diameter of the Now. The Now is allowed to last 30 ms and forever at the same time by being put into motion relative to the eigentimes adding up to t .

From symptoms of amnesia we know that the synthesis of the individual nows into the permanent Now has to be actively performed in order to engender the impression that time goes by. Without this synthesis, there is just a sequence of unconnected atoms of presence. However, the synthesis that is needed is of a highly particular kind. What is needed is a synthesis that establishes *identity in time*. Such a kind of synthesis is performed when the re-actualization of states that have passed is processed into the experience of recollection. In order to turn re-actualization into a recollection, the state re-actualized has to be identified as a state of this same consciousness. The unity of consciousness lies in the self-sameness of the

⁴ As an approach to this question see Teruaki Nakagomi’s quantum monadology (Nakagomi 2003a, 2003b).

mental presence on which it relies. This self-sameness does not mean that the ‘inner’ states of the consciousness are prevented from changing. Nor does it mean that the intensity of the mental presence must not change. It means, rather, that presence as such perdures while the states presencing come and go.

It is not before the unity of consciousness is thus established that the impression of temporal change comes forth. However, the emergence of this impression is tantamount to the ontological differentiation between Being and entities. In the impression that the Now endures while the states come and go, presence as such is distinguished from the entities passing through. At the same time, the ambiguity characteristic of Bergsonian *durée* is imminent. In order to avoid this ambiguity we have to clearly distinguish the distance denoted by t and the duration, let it be τ , implied in the awareness that the Now endures. The Now extends in both τ and t . Moreover, the extension of the Now in t is independent of its extension in τ . In order to resolve the paradox that haunted both Bergson and Husserl, distance t and duration τ have to be assumed to be orthogonal. If t and τ are orthogonal, we are left with t when the Now is abstracted away. Accordingly, we are left with τ when presence is purified from entities.⁵

We are back to the question of how the time-reversal mirror image in the formalism of thermofield dynamics relates to temporal change. We have seen that the relative motion we experience as time’s flow gives rise to a dualism of views that can be interpreted as a mirroring in time. This mirroring, however, is not the only one that is characteristic of the experience we have of time. With the passage of time we mean the Now travels along t . Travel is a process that combines way and time. The “way” travelled by the now lies in t . The “time” this travel takes is denoted by τ . The travelling Now is thus a process that may be inseparably tied to the existence of the self that undergoes the experience. The experience of the travelling Now is the self-experience of an I that maintains its identity while suffering incessant change. The impression of relative motion relies on self-identification. Self-identification is a feat of the intentionality of consciousness. Since intentionality may ultimately rely in the phenomenality of consciousness we have to proceed very carefully when relating the process of temporal change to the processes described by thermofield dynamics. Nevertheless, self-identification presupposes a kind of mirroring for its own. In every act of recollection a reflective doubling of the self takes place: A state other than the one that the self is feeling to be in is identified as a state of this same self. “Thus the overall mathematical structure of the model and in particular the specific dissipative character of the dynamics strongly point to consciousness as a ‘time mirror’, as a ‘reflection in time’ which manifests as a nonlinear coupling ... with the inseparable own Double.” (Vitiello 2001: 141). It is this doubling of the self that Giuseppe Vitiello associates with the doubling of universes.

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⁵ For further reasons for assuming that t and τ are orthogonal see Franck (2001), (2003).

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References

- Bergson, Henri (1889/1960). *Time and free will. An essay on the immediate data of consciousness*. (F.L. Pogson, Trans.). New York: Harper.
- Del Giudice, E., R. Manka, M. Milani & G. Vitiello (1988). Non-constant order parameters and vacuum evolution. *Physics Letters*, B 206, 661-664.
- Franck, Georg (2000). Time and presence. In R.L. Amoroso, R. Antunes, C. Coelho, M. Farias, A. Leite & P. Soares (Eds.), *Science and the primacy of consciousness* (68-72). Orinda, CA: The Noetic Press.
- Franck, Georg (2001). Time, actuality, novelty and history. In A.U. Frank, J. Raper & J.-P. Cheylan (Eds.), *Life and motion of socio-economic units* (111-123). London: Taylor & Francis.
- Franck, Georg (2003). How time passes: On conceiving time as a process. In R. Buccheri, M. Saniga, & W.M. Stuckey (Eds.), *The nature of time: Geometry, physics and perception* (91-103). Dordrecht, Boston & London: Kluwer Academic Publishers.
- Globus, Gordon G. (2003). *Quantum closures and disclosures: Thinking-together postphenomenology and quantum brain dynamics*. Amsterdam & Philadelphia: John Benjamins.
- Heidegger, Martin (1927/1962). *Being and time* (J. Macquarrie & E. Robinson, Trans.). New York: Harper & Row.
- Held, Klaus (1966). *Lebendige Gegenwart*. The Hague: M. Nijhoff.
- Husserl, Edmund (1966/96). *The phenomenology of internal time consciousness*. Bloomington: Indiana UP.
- Jibu, Mari & Kunio Yasue (1995). *Quantum brain dynamics and consciousness: An introduction*. Amsterdam & Philadelphia: John Benjamins.
- Nakagomi, Teruaki (2003a). Mathematical formulation of Leibnizian world: A theory of individual-whole or interior-exterior reflective systems. *BioSystems*, 69, 15-26.
- Nakagomi, Teruaki (2003b). Quantum monadology: A consistent world model for consciousness and physics. *BioSystems*, 69, 27-38.
- Pauli, Wolfgang (1994). *Writings on physics and philosophy* (C.P. Enz & K. von Meyenn, Eds.). Berlin: Springer.

Pöppel, Ernst (1997). The brain's way to create "nowness". In H. Atmanspacher & E. Ruhnau (Eds.), *Time, temporality, now* (107-20). Berlin: Springer.

Pribram, Karl (1991). *Brain and perception*. Hillsdale, NJ: Lawrence Erlbaum.

Primas, Hans (2003). Time entanglement between mind and matter. *Mind and Matter*, 1, 81-119.

Stapp, Henry P. (1993). *Mind, matter, and quantum mechanics*. Berlin: Springer.

Umezawa, Hiroomi (1993). *Advanced field theory: Micro, macro, and thermal physics*. New York: American Institute of Physics.

Vitiello, Giuseppe (1995). Dissipation and memory capacity in the quantum brain model. *International Journal of Modern Physics*, 9, 973-989.

Vitiello, Giuseppe (2001). *My double unveiled: The dissipative quantum model of the brain*. Amsterdam & Philadelphia: John Benjamins.

Vitiello, Giuseppe (2002). Dissipative quantum brain dynamics. In Kunio Yasue, Mari Jibu & Tarcisio Della Senta (Eds.), *No matter, never mind* (43-61). Amsterdam & Philadelphia: John Benjamins.

Vitiello, Giuseppe (2004). Classical chaotic trajectories in quantum field theory. *Int. Journal of Modern Physics*, B18, 785-792. ArXiv:hep-th/0309197.