

Nothing but Neurons? Examining the Ontological Dimension of Schizophrenia in the Case of Auditory Hallucinations

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Using the example of auditory hallucinations which especially occur in the psychopathology of schizophrenia this text tries to bridge the gap between empirical research in psychology or psychiatry and philosophical reflection on the mind–body problem. It is a fact that the neuronal manifestations of schizophrenia are significantly associated with psychic characteristics of this disorder. But nevertheless, it is questionable how these dimensions of schizophrenia are related to each other, *exactly*. The suggested intuitive plausible *dualistic* solutions of the mind–body problem are problematic with regard to conceptual consistency as well as to the empirically founded theories about schizophrenia. A promising approach seems to be the *monistic* conception of the *identity theory of mind (physicalism)*. A psychic manifestation of schizophrenia and the corresponding neuronal process fuse into only one event, which can be called *psychophysical units*. The perceived qualitative difference between the phenomena which appear in the psychic and neuronal dimension cannot be ascribed to a difference between the phenomena themselves, but to the different representation of one and the same event in the mind of the observer. Furthermore, it can be demonstrated that the processes of interaction between psychic and physical entities, often being postulated within the pathogenesis of schizophrenia, can be integrated. *Functionalism* holds advantages, too. Functionalist explanations make it possible to understand many pathogenetic aspects of schizophrenia. In this way psychopathological phenomena can be accounted for failed attempts to induce certain functional states. A reasonable research paradigm should be raised from the connection between the principles of the identity theory of mind and functionalism.

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A difficult and, in the research on schizophrenia, barely discussed issue is the question concerning the *precise* connection between the symptoms described in detail in psychopathology and the data obtained in medicine, psychology, and

the neurosciences. It cannot be doubted that correlating neuronal activities and psychic manifestations are closely related to each other. But how *exactly* is the connection between the occurrence of hallucination in the consciousness of a person concerned, on the one hand, and the registering of simultaneous increased activity in specific regions of the brain, or even changes in neurotransmitter regulation, on the other hand, to be understood? The question of the connection between mental and psychic entities raised here is a basic philosophical question and is referred to as the mind–body problem. It is the central issue of the so-called philosophy of mind. Today it is principally formulated as the question concerning the possibility of causal relations between psychic and physical events. Typical questions are: How is it possible that thinking and acts of volition initiate bodily movements? What does it mean that physical irritations of our sensory system entail subjective sensations and perceptual experiences? A further dimension of the mind–body problem is the issue of the ontological status of mental states. Thus Metzinger (2007, p. 11) asks: “In what sense are — for example — thoughts or feelings real states, genuine components of reality that perform a causal role of their own? Are they really *in the world* [italics in the original]?”

When the philosophy of mind devotes itself to answering these questions, it seeks an analysis of the assumptions on the basis of which empirical sciences approach the mind or the relation between psychic and physical processes. The scientific relevance of these analyses can be seen in the fact that the sciences that tackle the mind–body problem ultimately cannot adopt a completely neutral stance in respect of this question. The absence of discussion does not imply that a standpoint is not being adopted on this issue. Scientific work never takes place in a theory-free space because objective empirical data are never self-evident; rather, they are always considered from a particular perspective and always need to be interpreted. And this interpretation can vary in important respects in a way that is heavily dependent on the understanding of the mind–body relationship on which it is based. To do this explicitly will make it possible to identify and clear away existing obstacles to research that are the result of an implicitly existing approach which diverges from research area to research area and even from researcher to researcher.

In the following text the implications of the proposed solutions to the mind–body problem for the understanding of the connection between phenomenological and neuronal aspects of schizophrenia will be examined. The consequences of this for the clinical picture of schizophrenia also will be discussed and investigated for their consistency.

It is, of course, impossible in this context to use the current state of research in all its richness as a basis for discussion; rather, in each case only very specific material data shall be used, in order to discuss that data's relation to psychopathological manifestations. The empirical content and the completeness of the associations between neuronal and psychic processes and structures made in

the following are, of course, largely speculative, as the research on schizophrenia is far from complete. It can be assumed that alongside the associations presented here (e.g., of hearing voices and activities in the auditory areas), a large number of further neuronal processes or even of whole networks that are not represented are involved, as is the case in all complex psychological processes. This is not intended to provide an empirically exact and complete localisation of mental states, but rather to address the question of the *in-principle* coherence of the existing empirical findings on the basis of the various proposed solutions to the mind–body problem.

The etiology of schizophrenia remains in large part unexplained. There exists no clearly definable somatic substrate that is typical for the disease. Nevertheless, in order to make the argumentation clear, a fictional neuronal process N_1 , which functions as the cause of psychopathological phenomena, will be assumed.

Epiphenomenalism: Psychopathological Manifestations as Concomitant Features of Neuronal Processes

Dualistic ideas can already be found in ancient myths and religious texts, but it was Descartes (1641/1986) who sought the principle of the duality of substances as unshakeable certainty and who embedded it in a larger philosophical framework. He created a substance dualism that strictly differentiated between the mind (*res cogitans*) and matter (*res extensa*). According to this, there exist two distinct spheres that must stand in some form of relation to each other, and that can be defined in distinct ways such that two different solutions to the mind–body problem emerge. The ability to cause material activities through mental processes may be used as the criterion of differentiation. In the following, the two most important dualistic approaches — epiphenomenalism and interactionist dualism — shall be examined.

The defenders of the epiphenomenalist variety of dualism deny the ability of mental process to cause material activities. In their opinion, the mental processes merely accompany the material activities, without the possibility of their being able to influence them. Although it is assumed that mental events are caused by physical events, mental events here are themselves only epiphenomena. These can be understood as absolute endpoints of causal chains (see Kim, 1998). Particular contents of consciousness, such as thoughts and sensations, thus cannot themselves influence action. All occurrences in the *res extensa* take place along deterministic pathways on which we exert no influence through our feelings and thoughts.

What does it mean, however, when we understand the phenomenological and neuronal aspects of the disorder in terms of epiphenomenalism? On the one hand, for example, we find the experiencing of a hallucinated auditory

phenomenon (e.g., hearing voices), and on the other hand, we find the neuronal structures and processes that are associated with this. In this concrete case, as Dierks et al. (1999) have established, the phenomena of auditory hallucinations are correlated with activities in the auditory areas that correspond to those in the normal hearing of auditory stimuli.

Because the position of dualism involves two domains of reality, the hallucinated voices cannot be equated or identified with the neuronal activity. This must be understood as an independent phenomenon. For the epiphenomenalistic variant of dualism involved here, it still holds that the psychic occurrences only accompany the material activities, without the possibility of their exerting a causal influence. According to this, the psychopathological experiential qualities are to be understood as a purely *concomitant feature* of neuronal processes. Consequently, however, we can rule out the possibility that the neuronal activation patterns on the material side are a secondary phenomenon in the sense that they can be interpreted as the result of the hallucination (as the assumed primary phenomenon). The data only allow the opposite line of explanation: the activities in the auditory areas entail the hearing of voices. That can be interpreted as an (at least immediate) cause of the hallucination.

If the premises of epiphenomenalism are followed in a strict way, it must be concluded that the neuronal processes in the affected part of a stringent causal chain are purely material facts. Because a mental state, construed as an immaterial entity, cannot be “materialized” or “neuronalized,” it would be absurd to attempt to causally connect some processes in the consciousness of the person concerned with the physical development of that person. Thus the life-history represented in the consciousness of the person would sink into complete insignificance for the emergence of the physiological aspects of the disorder. Only pathological neurophysiological processes and/or neuroanatomical deviations can be responsible for the emergence of the phenomena of the disorder.

However, from the twin studies of Kallmann (1938), for example, it can also be clearly seen that if schizophrenia is exclusively caused by genetic factors, the same tendency to develop the illness must be present in both predisposed identical twins, as the twins possess exactly the same genetic material. The fact that this is not so — because in the case of the one twin being affected by the illness, there is only a 48% probability of the second twin being affected — is judged to be a reliable indication that environmental factors must also be involved in the emergence of the disorder. With this in mind, the diathesis-stress approach also assumes a high significance of psychological stress in the emergence of schizophrenia. However, a psychic environment, or the interaction with the environment represented in the consciousness of a person, are excluded as causally relevant magnitudes by epiphenomenal dualism. Does there thus exist a contradiction between the theoretical implications of epiphenomenalism and the empirical findings in relation to schizophrenia?

Not necessarily. It is of course possible to assume that the non-genetic factors involved are purely material facts. Thus the viral infections during pregnancy or perinatal injuries may indeed influence the anatomical development of the brain, as investigations of Wright, Takei, Rifkin, and Murray (1995) or by Geddes and Lawrie (1995) have shown. In the case of psycho-social stress, a “materialization” of this kind seems to be impossible at first glance, as it would contradict the premises of dualism, which clearly separate the psychic and the physical from each other. However, it has to be taken into account that although an (implicit) understanding of the mental as something immaterial and yet causally effective may have been present in the theory formation of the diathesis-stress approach, this does not yet mean that this has been established as real. The effectiveness of the factors postulated in this context (e.g., stressful interaction with parents or peers) could also be traced back to physical entities.

It can be stated that although certain difficulties do exist if both dimensions of the illness of schizophrenia are connected in terms of epiphenomenalism, this does not lead to insurmountable contradictions. Nevertheless, there emerges a picture of the disorder or of the causal factors that deviates from the traditional form of observations, and from (implicit) assumptions in theory formation.

Interactionist Dualism: Psychopathological Manifestations as a Possible Cause or a Possible Consequence of Neuronal Processes

The advocates of interactionist dualism, to whom (among others) Descartes himself and Karl R. Popper (1994) as well as John C. Eccles (Popper and Eccles, 1977) belong, approach the problem in a different way than the epiphenomenalists. Mind and brain can reciprocally influence each other such that causal relations in both directions are seen as possible. Particular psychic phenomena such as thoughts and sensations could trigger nerve impulses that ultimately lead to a physical reaction and, in the opposite direction, it is also possible that neuronal processes — for example, through perception — influence and determine mental processes. This dualistic mindset seems very familiar because it reflects what we experience in daily life, namely, that we can initiate movements in physical bodies with our non-material will, or that when we cut ourselves on the finger an experience of pain is triggered.

If the premises of dualism are investigated in temporal terms, it can be inferred that dualism must involve the succession of the two phenomena. These results lead to the assumption of two clearly separable entities, which amounts to a non-identity of mental and physical occurrences. If one has an effect on the other, in the case of the latter, we can only speak of a consequence. It thus seems to be possible, that — just like in epiphenomenalism — a hallucination arising in the psychopathology of schizophrenia is a *consequence* or the activity in the sense-specific areas (or if one conceives the context more

broadly — of the unknown neuronal process N_1). More precisely, we must differentiate here between the physical process as the primary phenomenon and the misperception caused by it as a secondary phenomenon. This is also the causal direction that is embraced by the neurophysiological model ideas here discussed. In the context of the Weinberger (1987) model, it is postulated that the positive symptoms of schizophrenia (such as hallucinations or cognitive thought disorders) result from an over-activity of the mesolimbic pathways and that the negative symptoms (such as cognitive deficits) result from a reduction in activity in the mesocortical pathways of the dopaminergic system and also from impaired synchronization processes (e.g., Uhlhaas and Singer, 2006).

On the other hand — against epiphenomenalism — the opposite causal direction can also be regarded as possible. The psychopathological manifestations that emerge in the context of schizophrenia can be regarded as both the *consequence*, but also as the *cause* of neurophysiological processes. Psychic processes qua psychic processes have their own effective power, with which they can bring about or modulate physical changes as well as neurophysiological processes in particular.

With the acknowledgement of this causal direction however, we can equally construe the case in which it is not N_1 or the activity of the auditory areas that causes the hearing of voices, but where, on the contrary, the hallucinations arising in consciousness trigger neuronal processes on the physical side which could be connected to N_1 , which in turn entail the activities in the auditory areas. The psychic occurrence can thus now be potentially interpreted as the *cause* of the now secondary neuronal events. This causal direction seems to run contrary to the general understanding of these matters. This could be due to the circumstance that appealing to this causal direction can quickly lead to contradictions. As we are still on the terrain of dualism here, and as such have to differentiate clearly between the material and the psychic modes of being, the present psychic manifestation cannot be understood as a physical process — it must be an immaterial phenomenon. If, however, we deem an influence of a non-physical event on psychic occurrences to be possible in principle, we find ourselves faced with the well-known difficulty that this would imply a violation of the closed nature of the physical world, or the principle of the conservation of energy. Both principles amount to the assumption that if “a physical event has a cause at time t , then it has a physical cause at t ” (Metzinger, 2007, p. 14). As this basic postulate is at the basis of the whole object conception of the natural sciences, the acceptance of a violation would have grave consequences. For if it is possible for a mind that is thought to be immaterial to move material objects (like a human body or even only individual atoms of that body), then it is uncertain as to where the energy with which this is carried out should come from. In order to resolve this dilemma, repeated attempts have been made to conceive of an autonomous mind that can exert an effect on the physical brain without violating the laws of physics. Thus dualistically-oriented neuroscientists

like Eccles (Popper and Eccles, 1977) and Libet (2004) defend theories in which occurrences of consciousness are understood as “mental fields” or in which the mind is supposed to be able to influence the probability of the emergence of physiological events in a “quantum physical” manner. The fact that there hardly exists any empirical evidence for this makes interactionist dualism as a whole seem to be unconvincing.

Identity Theory: Psychopathological Manifestations and Neuronal Processes as the Levels of Observation of One and the Same Event

The monistic (acknowledging only one substance/reality) conception of mind–brain identity theory also attempts to give an account of mental and material phenomena. Psychic events and the physiological processes connected with them are conceived as something identical. That the psychic and the physical seem so diverse to us is simply due to the fact that we have a different access to an object: “We explain to ourselves the difference of the modes of appearance in terms of the difference in the standpoint adopted by the observer. A process appears as something mental from an internal standpoint, and as something bodily from an external standpoint” (Fechner, 1851/1922, p. 112). In the context of the notion of a psychophysical identity at the basis of this, the psychopathological manifestations of schizophrenia and the neuronal states corresponding to them now merge into a single entity.

In contrast to an interactionist dualism, mind–brain identity theory in no sense contradicts the principle of the conservation of energy or the assumption of the causally closed nature of the physical world. As mental processes always have a physical reality too, there is no interruption of the chain of cause and effect of the physical or bodily phenomena through the operation of an immaterial mind.

Thus within both the dimension of psychic and within the dimension of bodily facts, there exist causal relations that determine the progress of the given events. On the one hand, the bodily causal chain can be investigated, and, if possible, an order of events can be determined which leads from a genetically fixed vulnerability via perinatal adverse factors, impaired cell migration processes, a misdirected anatomical brain development, functional neuronal deficits in the presence of particular illness-triggering (physical) environmental conditions to the neuronal phenomena typical of schizophrenia. In the theoretically simultaneous observation of the order of mental events, as conjectured by Scharfetter (1986/1999), there may in the course of the life of the person emerge disorders in the various basal ego-dimensions that may be interpreted in the sphere of psychic causality as a cause of mental psychopathology.

The crucial point is that on the assumptions of identity theory there really is only *one* order of events, which is considered on different levels. The perceived

qualitative difference of the phenomena manifesting themselves in the mental and neuronal dimensions is not due to the difference in the phenomena themselves, but is due only to the different representation of one and the same occurrence in the consciousness of the observer. In this way, the auditory hallucinations occurring in the mind of the person and the simultaneous neuronal activities in the auditory cortex which are easily detectable with imaging techniques can be understood as different representations of one and the same phenomenon. What constitutes the difference between them is not any inherent fundamental difference in essence as in dualism, but only a shift in our point of view. An articulate schizophrenic patient could describe the occurrences experienced in the subjective perspective of her consciousness in terms of the five basal dimensions described by Scharfetter (1986/1999) following Jaspers (1913/1973) of ego-vitality, ego-activity, ego-demarcation, ego-consistency, and ego-identity. If a neuroscientist simultaneously carries out investigations in the same patient by means of fMRI and discovers activation patterns, in particular, neuronal systems, the data collected here from the outsider's view — that is, from an "objective" perspective — are no less a description of one and the same event. In this case it is only another, more distanced, observation standpoint. One can of course ask whether that which the schizophrenic and the neuroscientist *see* or that to which they *relate* really are the same thing. And it is precisely here that the difference is to be found: they do, in fact, see something different. A hallucination appears to the schizophrenic patient in her subjective experiential perspective; the scientist records specific patterns of activity in the brain by means of fMRI. But in fact the two do ultimately relate to the same thing; both are confronted with one and the same section of reality from differing perspectives in each case.

In this context, however, the question has repeatedly arisen of whether doubts are not cast on identity theory by the circumstance that, in an identification of this kind with the experiential perspective, the third person perspective of the scientist itself is inseparably tied to a first person perspective and that no complete identification is possible. This epistemological argument is certainly warranted, yet it does not provide a fundamental objection to identity theory, which is an ontological position. Thus monism has "no direct understanding as to how our *knowledge of* neuronal processes relate to our *knowledge of* mental processes, rather, it makes a statement on the relation between these processes itself" (Pauen, 2001/2005, p. 181, italics in the original). Nevertheless it is important to realize that the actual physical event in the brain of the patient to which the brain scientist refers cannot be equated with the experience of this that the scientist attains by means of, e.g., fMRI recordings. Otherwise there would be an extremely problematic confusion of evidence and reference through the so-called "fallacy of introjections" (see Feigl, 1967).

Instead of the "one-after-another" that predominates in dualism, in monism we are concerned with a simultaneity of correlated physical and phenomeno-

logical phenomena. Thus at first glance it seems to be the case that statements which have a causal connection between the psychic and the physical as their object, such as: "The auditory hallucination is a *consequence* of activity in the auditory areas," are invalid. This is because these kinds of statements imply two different entities of which one functions as the primary entity, while the other represents a secondary phenomenon. Instead of this the correct statement should be read: "The activity in the auditory areas *is* the arising auditory hallucination." Because, given the premises here, we are actually concerned with a series of events, there arises the question of whether identity theory can integrate the processes of interaction between psychic and physical features that are frequently postulated in schizophrenic pathogenesis.

If it is true that there are particular events in the world that appear in a manner dependent on the observer either as brain processes or as psychic experiences, then in the case of such an event we can correctly speak of a *psychophysical unity*. A psychophysical unity of this kind, which consists, for example, of an auditory hallucination from one perspective and of an increased activity in the auditory cortex from another perspective, can be described in a simplified way in terms of the model: "hallucination – activity in auditory cortex." It can be assumed completely unproblematically that such a unity exists in a causal connection with other psychophysical unities, or also with purely physical processes that do not emerge from any perspective. As a preliminary psychophysical unity, we might imagine, by way of illustration, specific cognitive processes which have as their object an ego-fragmenting experience as an impairment of ego-consistency (see Scharfetter, 1986/1999). Processes of this kind can now be speculatively associated with the postulated causal neuronal process N_1 , with which the unity "ego-inconsistency experience – N_1 " is maintained. This process can now exert an effect on and modify the unity "hallucination – activity in the auditory cortex." On the premises of identity theory, the unity "hallucination – activity in the auditory cortex" can thus certainly be embedded in a causal network with other psychophysical units or (exclusively) physical processes. However, the *single* causal process can be considered on different levels. On the mental level of the experiencer there would initially be a loss of the certainty of being a coherent, unitary whole (the experience of ego-fragmentation), which would then lead to thoughts being no longer perceived as one's own and consequently to the experiential quality of hearing voices. Were a brain scientist simultaneously to observe the identical processes which are represented in his perspective as physical processes, he would first detect the process N_1 and after this the activities in the auditory areas. Thus in this case there are not two causal series or nets that run completely independently of one another. The psychic causal nexus is the physical causal nexus from another perspective.

If this version of connection is accepted, this would mean for the clinical picture of schizophrenia that the phenomenologically expressed symptoms always have a

neuronal reality too. This also means, though, that the simultaneously activated cerebral areas cannot be the (effective) cause of the hallucination — because of the assumption of simultaneity this could only be the events preceding these processes and the conscious events potentially associated with them. It can be further extrapolated that, because one and the same process is involved, a change in consciousness of the person concerned can never take place without a neuronal change, and that, vice versa, a neuronal configuration involved in the actual-genesis of consciousness can never change without this being reflected in the consciousness of the person concerned.

Even if objections have been made to identity theory on the theoretical level — which I will go into in the course of the discussion of functionalism — with regard to the current empirical findings on schizophrenia it has proven to be very consistent. Both dimensions of disorder can be equally well integrated on the basis of this version of the connection of mind and body.

Functionalism: Psychopathological Manifestations as Dysfunctions of Interchangeable Neuronal Structures and Processes

Functionalism established itself primarily in reaction to the argument for multiple realizability of Putnam (1967), which was developed in opposition to identity theory. If identity theory in the form of its stronger type-theoretical formulation claims that mental event types *are* physical or neuronal types of events, then functionalism claims that any mental phenomena that could exist at all must be neuronal phenomena. This is vehemently rejected by the advocates of functionalism. In their view, mental states can also be realized in structures very different to those typically seen in neuronal processes. According to this a specific phenomenal quality is not tied to the presence of a neuronal process. Two psychic processes of the same kind are not necessarily reducible to a specific event in the brain, but are simply considered as merely functionally equivalent; they have the same functional role. So “pain is definable as being in a state (or instantiating a property) that is caused by certain input (i.e., tissue damage, trauma) and that in turn causes certain behavioral and other outputs” (Kim, 2005, p. 24). Thus pains instantiated in two life-forms with strongly divergent biological bases — for example, the human being and the earthworm — exhibit one and the same function, namely, to draw attention to a local injury of the body in order that appropriate counter-measures can be taken. In the eyes of the functionalists, a specific system-state that generates a mental event is thus independent of any concrete material realization. A functionally equivalent system could generate the same mental state.

Because functionalism postulates the multiple realizability of mental processes, and as a system is thus ultimately independent of concrete physical realization, the realization basis that actually exists in a specific individual case has a cer-

tain arbitrariness to it and thus only a small significance. In a concrete case of the presence of brain processes such as N_1 or the activity in the auditory cortex, there is therefore a necessary precondition for the emergence of a hallucination; however, the fact that this involves precisely these neural processes and no other is of no further importance here. The precondition is the mere presence of any appropriate physical system. Thus the present physical processes could in principle be exchanged for completely different ones. According to this, then, an auditory hallucination could also be generated in another functionally equivalent system, and thus also in artificial systems. It is difficult to imagine, however, that an artificial system that realizes a functional state will also by this token exhibit a mental state, such that, like a person, it has its own conscious sphere, an "inner space."

This leads to a difficulty in relation to the phenomenological symptoms of schizophrenia. The hallucinations that emerge in the consciousness of the person concerned must — because they form a mental state — also be regarded as a functional state of the system. This applies equally to all other symptoms that manifest themselves in the phenomenological perspective such as an inadequate emotional response, as well as the intuition, dissemination and withdrawal of thoughts, delusions, and so on. This of course raises the critical question: What is the function of all these mental states supposed to be? The functionalist would most likely respond that states of this kind are expressions of a failed attempt to construct a functional state. They are thus *dysfunctions*. There are also numerous examples of positions of this kind in the psychopathological literature. Hence, the emergence of delusional and hallucinatory symptoms, including a pathological transformation of function, can be ascribed to a "loss of habit-hierarchies" (Huber, 1974/2005, p. 274) in the context of an impairment of information processing. An inappropriate amount of irrelevant and situationally inadequate information enters into consciousness from long-term memory.

A difficulty that unavoidably arises in the evaluation of functionalism concerns the question of what ontological connection the functional explanations have to the introduced intermediate level of formal algorithms, or of the information-processing with the phenomenological symptoms on the one hand, and to the neuronal processes on the other. From an ontological point of view, the problems thus seem to have increased, as now there are no longer two, but three dimensions whose relation to each other has to be determined. Recently, though, in particular since the rise of the recent imaging techniques such as PET and fMRI, efforts have increasingly been made to find the neuronal correlates of the postulated functional (information-processing) processes. However, this ascribes a greater role to specific neural structures and processes than should be granted to them according to the premises of functionalism. For when we look for the substrate of working memory disorders, the intention of the research is not to find a completely arbitrary material basis of the phenomenological symptoms