

# Outer and Inner Dimensions of Brain and Consciousness—Refining and Integrating the Phenomenal Layers

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## ABSTRACT

## KEYWORDS

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In view of the unresolved mind–brain problem, we examine a number of prototypical research attitudes regarding the question, how the mental and the neuronal realms are related to each other, both functionally and ontologically. By discussing neurophilosophical and neuropsychological positions, the mind–brain problem can be recast in terms of a structural relation between methodological and content-related aspects. Although this reformulation does not immediately lead to a solution, it draws attention to the necessity of searching for a new way of balancing separating and integrating elements regarding content as well as method. As a relatively unknown alternative in this context we investigate an approach by the philosopher Rudolf Steiner. It comprises a first-person method, along with the theoretical background of what has come to be known as the mirror metaphor – an analogy for the brain as a necessary but not a sufficient basis for mental activity. Through a first-person study, this approach is scrutinized using volitionally controlled perceptual reversals. The results allow for a phenomenological distinction of processual phases which can be summarized as engaging and disengaging forms of mental activity. Finally, we initiate a discussion in view of related philosophical concepts and give an outlook on the next possible research steps.

## INTRODUCTION

In science as well as in philosophy, it has been widely recognized that brain and consciousness have something to do with each other. Regarded critically, however, we actually do not know much more than this. The *hard problem of consciousness*, as denoted by Chalmers (1995), still seems to be unsolved. In spite of considerable research efforts such as the “Decade of the Brain” or the “Human Brain Project” and intense philosophical debates there is still no resounding and consensual approach in sight which could explain why, on the one hand, brain processes and conscious events appear maximally different on the descriptive level, and how, on the other hand, they are functionally and ontologically linked (Wagemann, 2010, 2011; Majorek, 2012). Remarkably, in prominent accounts of cognitive neuroscience, such as the *integrated information theory* (Tononi, 2008; Tononi, Boly, Massimi, & Koch, 2016) or the *model of semantic pointer architecture*

(Eliasmith et al., 2012; Thagard & Stewart, 2014), this question is completely ignored. It is indeed the case that Daniel Dennett’s self-confident message of “consciousness explained” has to be skeptically eyed and maintained as an open question, since it will not be possible to reach general agreement on the reductionist strategy of “explaining away” what ultimately has to be explained (Dennett, 1991; Churchland, 2008). Dennett’s claim that “only a theory that explained conscious events in terms of unconscious events could explain consciousness at all” amounts to the claim that consciousness is unexplainable in terms of an approach immanent to consciousness (Dennett, 1991, p. 454). The

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other way round, from an antireductionist point of view, consciousness may be considered to be unexplainable, since no objective explanation can exhaust its idiosyncratic subjectivity (Nagel, 1986; Searle, 1992). By accepting the very subjective character of conscious experience, its irreducible existence seems to be granted, regardless of whether it is assumed to exist prior to physical processes or as their outcome. Seen from this angle, both reductionist as well as certain antireductionist accounts are equally compatible with an attitude of scientific unexplainability, even though they express it in quite different philosophical modes of thought. Certainly, there are antireductionist approaches that consider consciousness-immanent explanations to be possible (e.g., Chalmers, 1999; others will be discussed below), but from the perspective of the other approaches mentioned, these are mostly criticized as unscientific. In fact, however, things seem to have reversed, since the apodictic assertion of unexplainability, be it only in certain aspects or in totality, tends to convey in itself an unscientific and fundamentally non-philosophical attitude: If there is no experientially accessible explanandum, we have no need to seek a deeper explanation beyond speculative assumptions and logical reasoning, or even any explanation at all. Interestingly, this may remind us of Heinz von Foerster's remarks on the cybernetic challenge of *non-trivial machines*, which could be understood as a technical metaphor for consciousness (von Foerster, 1991). In dealing with this issue von Foerster sees three basic options,<sup>1</sup> of which the first—"ignore the problem"—seems to reflect the attitude of unexplainability. However, this negative solution cannot claim to be a real solution since it simply disposes of the problem itself by asserting either the non-existence or inaccessibility of consciousness. The second option described by von Foerster suggests that we "trivialize the world," which could be taken as an ironic version of the conventional call of scientific standard research "to measure what is measurable and to try to render measurable what is not so as yet" (Weyl, 1949, p. 139).<sup>2</sup> Following the well-rehearsed path of identifying more and more brain areas or brain processes that allegedly cause consciousness—or do not cause it—only results in quite detailed knowledge of specific brain-consciousness correlations, but it does not allow any inference to a causal or functional relation between these two descriptive levels (Bennett & Hacker, 2003).<sup>3</sup> It is only the third option adduced by von Foerster that may open a path towards a new kind of explanation to deal with the core question of consciousness: "develop an epistemology of non-triviality." This could be a first clue that previous efforts in this field were not quantitatively insufficient but that they are probably lacking a sophisticated methodical or epistemological component. Hence, a first step in this direction could be to recast the problem in view of the relation between content and methodology.

## RECASTING THE PROBLEM

Regarding the polar content of the brain-consciousness problem, the first two options outlined by von Foerster can be associated with certain varieties of *monistic* and *dualistic* positions. The reductionist attitude considers phenomenal consciousness a priori to be a result of physical processes in the brain and thus adheres to a materialistic mon-

ism. The antireductionist attitude may also involve a monistic stance of this kind; however, in this case it is more or less permeated by a *property dualism*, since both levels of description, the material and the mental, are taken into account. While the reductionist attitude denies the relevance of first-person phenomena and the antireductionist stance rejects the possibility of an exclusive third-person account, standard neuropsychological research, here associated with von Foerster's second option, seems to balance both perspectives of unexplainability. As an empirical research discipline, it has to deal equally with both levels of description without necessarily taking sides for a distinct philosophical position. However, even if the neuroscientist tacitly adheres to a materialist monism, in his work he or she has to maintain, in order not to drop the research program, a quite pragmatic form of property dualism. The difference between neurophilosophy and neuropsychology only seems to be the style of their attempts at explanation – leading to different forms of unexplainability on the one hand, or, on the other, to a philosophically unsatisfactory explanation relying on mere neuro-mental correlations which cannot claim to represent causal relations.

Neurophilosophy and neuropsychology must also be differentiated with regard to method. While psychological brain research uses certain empirical methods for collecting data from the neuronal processes as well as from the mental events of test persons, neurophilosophy deals with rational concepts or thought experiments which should interpret and explain the phenomena in question in the sense of an overarching thought system or worldview. Nonetheless, both disciplines have an important methodological aspect in common inasmuch as they remain at a distance from the specific phenomenal content of their investigations. They remain, so to speak, in the third-person perspective even when they argue for the significance of first-person phenomena. For the neuronal level, as an original object of natural science, the third-person perspective seems to be appropriate, but for mental phenomena this is not the only option, as they originally occur in the realm of first-person experience. Although, in neurophilosophy, human consciousness is a central topic of investigation, it does not, at least explicitly, serve as a reflective research method. The ability to think consciously, to argue logically, and to reason is naturally taken for granted by philosophers, even when they assert the non-existence, inaccessibility, or unexplainability of consciousness. The subjectivity of consciousness is the objectified content of such an investigation, but the investigation itself as an expression of ongoing conscious action and experience is not being reflected from this methodological angle.

To summarize this short excursion about content and method, both parts, whether brain and consciousness or neuropsychology and neurophilosophy, seem to stand equally in a relation of separation and integration. Regarding content, we have to face the tension between ontological monism – which today mostly appears as naturalism or materialism – as the desire to comprehend the universe in a uniform (integrated) manner, on the one hand, and pragmatic forms of property dualism as the necessity of distinguishing between (separating) different forms of data collection and levels of description, on the other. Regarding method, philosophy and psychology use separate forms of reasoning which can be referred to, on the one hand, as intellectual

argumentation based on rational concepts and on the other, as the empirical collection of different types of data and the correlation of these data. At the same time, the two disciplines are closely related in their general style of thought (Fleck, 1935/1980), since their methods are mutually based on the apodictic distinction between subject and object of enquiry, without being able to fully disentangle this polarity. This paradoxical relationship is expressed in the impossibility of deciding between monistic and dualistic aspects, as well as in their joint adherence to the third-person perspective (Steiner, 1918/1958; Günther, 1978). To put it in more general terms, while natural science and the humanities have no common methodological paradigm at their command, they are chained together by a one-sided research attitude, that is, the third-person perspective or the subject-object split. With respect to the humanities, this may come as a surprise, since the third-person perspective is normally only associated with the experimental procedure in the natural sciences. However, even without being committed to the methods of empirical research, also the research and publication practice of the humanities convey a strong detachment from an immediate experience of their objects in order to comply with disciplinary constraints. For them, as for the natural (and social) sciences, lived experience may be a research object, but by no means, at least in their standard forms, a method. Referring this to the brain-consciousness issue, the crucial problem seems to be to find a balanced relation between separation and integration of brain and consciousness in terms of content and method. However, due to the implicit entanglement of content and methodology in a bivalent (e.g., subject-object, true-false) mode of thought, such a balanced conception could probably only be found through a sophisticated enhancement of this scientific mindset in the sense of von Foerster's third option. As Einstein is said to have put it, the problems we face cannot be solved at the level of thought at which we were when we conceived them. Or, as Gotthard Günther puts it in view of the restricted character of the bivalent style of thought of the Aristotelian logic underlying Western (scientific) culture as a whole: "The transition from the classical Aristotelian form of thought to a new and more comprehensive theoretical mindset requires a mental metamorphosis of the whole human being" (Günther, 1978, p. 114). Accordingly, the following parts of this study can be understood as an attempt in this direction through the development of a non-trivial epistemology which also advances to the multivalent dynamics in the formation of subject and object.

## INTEGRATING CONTENT AND METHODOLOGY

As was already said, neither monistic nor dualistic accounts satisfy the challenges of phenomenal separation and ontological integration of brain and consciousness (Wagemann, 2010). Whether more sophisticated accounts such as *neutral monism*, *dual-aspect monism*, or *pluralism* can lead to a solution seems doubtful, because all of them remain within the intellectual sphere of rational—but speculative—explanations tacitly derived from the central issue under investigation (consciousness) without a methodological justification. In other

words, we understand rationality as the philosophical or scientific mindset that is ready to reflect on thinking and acting and to explain it as completely as possible, but that, with its means, is not able to permeate the explanation process itself as an implicit form of ongoing thinking and acting. Rationality, of course, goes beyond the levels of an instinct- or desire-driven life, but still places its own mental basis of life at the service of its own (intellectual or other) needs without establishing an experiential access to the source and structure of its own activity. Only that would open up a perspective of real explanation. Therefore, in searching for a new way it would not be adequate to identify the term *non-trivial* with *non-rational* in the sense of pre-scientific forms of knowledge such as mysticism or superstition. For *non-rational* must not only mean *pre-* but can also suggest *post-rational* forms of knowledge which science would yet have to invent (Gebser, 2010). From this perspective, *pre-rational* in the sense of *pre-reflective* can also indicate the ongoing process of consciousness preceding the specific states and contents of everyday consciousness, as well as the outcomes of mainstream philosophy and science. In this context, *post-rational* would denote a methodological approach to the investigation of the pre-rational process taking place in the normal, rational state of mind. But how to get there without philosophical speculation or merely measuring from a third-person perspective?

Here, it is worthwhile to briefly recapitulate the wrangling between various schools of psychology in the late 19th century, which resulted in the paradigmatic formation of psychology as a natural science. Although other psychological schools such as Gestalt theory or analytic psychology were established in parallel to the rise of behaviorism, humanistic, holistic, and introspective aspects were relegated to the background. Franz Brentano's approach, for example, which attempted to establish an introspective psychology that would meet the requirements of full, natural, science-based methodological rigor, could not be maintained for mostly biographical reasons (Meyer, Hackert, & Weger, 2018; Walach, 2016). Likewise, the attempts of the Würzburg school to establish introspective methods in the early 20th century were overrun by behaviorism – although, from today's perspective, the methodological problems were not insurmountable (Danziger 1985; Weger & Wagemann, 2015a). The phenomenology of Husserl, a successor of Brentano, was already located on the other side of pure philosophy, subjecting natural science to fundamental criticism and aiming instead at transcendental ideation. Today, however, new connections of different forms of phenomenology under umbrella terms such as *experimental phenomenology* (Albertazzi, 2013; Vermeersch, 1999) or *enactivism* (Thompson, 2007) are being developed and generating interest among consciousness researchers.

At the same time, though in the background of "normal" science and conventional forms of phenomenology, the German–Austrian philosopher and consciousness researcher Rudolf Steiner, another follower of Brentano, further developed the project of an introspective psychology up to an empirical as well as conceptional account of a brain-consciousness correlation (Steiner, 1918/1958). With respect to the philosophical conception, Steiner approached this issue from different angles. Initially, in his early works (e.g., Steiner, 1918/1958), he

proposed an account in terms of a synthesis of J. G. Fichte's and J. W. Goethe's ideas (Wagemann, 2016). Later on – and then also addressing a non-philosophical audience – he developed a metaphorical account which has been discussed by two of the present authors (Weger & Edelhauser, 2014). The main idea of this account is as follows: Since brain processes can be considered as a necessary but not sufficient condition for conscious events, they can be metaphorically grasped as a mirror, serving as a necessary condition for displaying patterns of light and color that would remain invisible without this facility (Steiner, 1917/1983). Since this metaphorical relation, on the one hand, seems to be able to illustrate Steiner's more intricate conception and, on the other hand, is related in certain ways to other non-reductionist accounts (e.g., Beauregard, 2012; James, 1898; van Lommel, 2010), it seems to us to be of vital importance and will be scrutinized in the following. However, before digging more deeply into the mirror metaphor and Weger & Edelhauser's related interpretation, the relevant neuroscientific findings and discussions should be briefly outlined.

Since the 1990s, at the latest, neuroscience has been working at full speed to explain the relationship between brain and consciousness as the last great conundrum of science. Once it became clear that neither the previously known principles of signal processing nor individual regions in the brain were to be regarded as responsible for consciousness, it was necessary to look for other potential candidates for a solution of the binding problem. In this course, researchers turned their attention to the phenomenon of synchronous neuronal oscillation that occurs spatially distributed in the brain and in parallel to the events of phenomenal consciousness (Buzsaki, 2006; Buzsaki & Draguhn, 2004; Gray, 1994; Gray, König, Engel, & Singer, 1989; Müller, Elliot, Hermann, & Mecklinger, 2001). Beyond the mere evidence of this phenomenon, the following hypotheses have been raised in the aforementioned and other studies: (a) Synchronous neuronal oscillations originate from neuronal self-organization (e.g., Lewis & Rinzel, 2000; Bayati, Valizadeh, Abbassian, & Cheng, 2015); (b) Neuronal rhythms are causal for the emergence of phenomenal consciousness (e.g., Ward, 2003; Gallotot, Sack, Schuhmann, & de Graaf, 2017). These hypotheses have been propagated with further neuroscientific findings in the scientific world as well as in the general public and form an important basis for various reductionist or materialistic philosophical accounts, as indicated above. Various arguments have also been put forward against these hypotheses, as mentioned in the introduction in the context of antireductionism and in the last paragraph, referring to other alternative accounts. The idea often contained in these approaches – that the brain is a necessary but not sufficient condition for phenomenal consciousness – comes to a very striking expression in Steiner's mirror metaphor. However, this metaphor requires a high degree of interpretation in order to be able to place the findings on neuronal rhythmicity in a new light.

So what are the specific features of brain action that make it possible to interpret it as a mirror? Weger and Edelhauser (2014) distinguish two aspects of brain action, firstly, the fact that it essentially depends on material conditions (neurons, synaptic connectivity, etc.) and secondly, that it appears in the form of a synchronized rhythmicity

of neuronal assemblies. While it would involve a category mistake to regard phenomenal consciousness as a result caused by brain action, it could be understood as a “different mode of expression of a common reality” underlying both the mental and the material realm (Weger & Edelhauser 2014, p. 120) – similar to neutral or dual-aspect monism. This common reality, to take the metaphor further, would be the invisibly spreading light in the sense of a formal or conceptual dimension that manifests in material and mental phenomena. With regard to the physical level of description, according to Weger and Edelhauser, this formal aspect could be seen in the synchronized neural rhythmicity as an outer expression of an inner mental experience – just as a mirror does not produce the objects displayed in it but rather makes them visible (Steiner, 1917).

This interpretation of Steiner's mirror metaphor gave rise to a discussion between the authors of this article. Basically, we found two points of inconsistency, one with respect to the philosophical argumentation and one regarding the methodological question. To begin with the former, we realized that the aspect of conceptual lawfulness which plays a central, mediating role in the argumentation has to be scrutinized more closely. By asserting that it is the same conceptual lawfulness which merely takes on different modes of expression, material and mental, we get into trouble with the question as to what content this lawfulness consists of. On the one hand, we have to speak about a neuronal rhythmicity in terms of an alternating generation and discharging of action potentials and of other physical properties such as frequency, amplitude, and so forth. Even though these notions of rhythmicity are just the formal representational aspect of the underlying physical processes and, therefore, are not identical with the latter, they exclusively refer to the physical level of description. This denotes the functional relation of the notions and patterns of neuronal rhythmicity, which are conceptual in nature, and its physical realization in the material brain. The mental level of description, on the other hand, also requires concepts, but of a completely different kind, referring to experiential qualities such as bright or dark, and meaning structures such as tree or beautiful. From a formal point of view, both realms, the material and the mental, are methodologically accessed by concepts, but in each case the conceptual content, that is, its specific lawfulness, obviously refers to different descriptive levels; therefore, the contents cannot be equated. This is due to the fundamental difference between the conceptual complexity or “richness” of neuronal rhythmicity on the one hand, and of the contents of phenomenal consciousness on the other. While the former solely consists of the repetitive and monotonic forms of oscillation properties, the latter comprises the whole universe of perceiving, thinking, feeling, and so forth, including experience of and insight into that oscillation and rhythmicity. Hence, the mediating aspect in the mirror metaphor cannot be found in the conceptual dimension of neuronal rhythmicity – even though it could be comprehended as a somehow reduced, mirror-like stage of resonance. Rather, we have to clearly envisage the content-related independence of the mirroring process and the mirrored object. For a mirror, the content depicted in it is obviously a matter of indifference. With regard to the brain-consciousness problem, this metaphorical relation illustrates the

brain as a necessary, though insufficient condition for consciousness, but does not explain its functional relation at this level.

The second concern about the interpretation under discussion focuses on the methodological aspect. As mentioned above, Steiner's account includes two converging lines of reasoning: a philosophical or argumentative one – which also includes the mirror metaphor – and an empirical one in the sense of consciousness-immanent, introspective, or even meditative observation. The latter aspect is also mentioned by Weger and Edelhauser (2014), although they did not align their own method of investigation accordingly. It became clear that the inner, experiential dimension of consciousness can neither be replaced nor explained by means of processes or contexts originally belonging to the neuronal level. With von Foerster's third option in mind, "developing an epistemology of non-triviality," this could be taken as a strong indication of the necessity of a methodological reorientation. As a first step, instead of conceptually equalizing brain and consciousness, the latter has to be empirically investigated with the same rigor and precision as the brain—though from an appropriate (first-person) research perspective. We can only hope to shed new conceptual light on the relation between brain processes and phenomenal consciousness by means of such a non-trivial perspective that deals with a genuine philosophical issue—consciousness—in a non-philosophical, namely, empirical way, without, however, falling into the trap of scientific reductionism.

In other words, to adhere to the mirror metaphor, we need to find a way to search and observe the "light" before it has been reflected in the mirror. Otherwise, we are in danger of confusing the entity which is being reflected with its reflection—or even with the reflecting medium.<sup>4</sup> The above-mentioned phenomenal and conceptual independence of neuronal and mental phenomena should consequently allow for independent research methods without excluding the possibility of conceptually matching the two descriptive levels. Based on an introspective and self-referential method for accessing processual information about consciousness, a refined interpretation of Steiner's mirror metaphor can be expected. Since many severe concerns about introspective or meditative research methods have been extensively discussed in the last years (Jack & Roepstorff, 2003; Petitmengin & Bitbol, 2009; Weger & Wagemann, 2015a), we shall focus on just one central point. In comparison with the complex processuality of neuronal phenomena, mental phenomena seem to be more simply knitted at first glance. As mere "autophenomenological anecdotes" (Metzinger, 2006, p. 4), they normally appear as apodictically given results which cannot be questioned; therefore, they do not seem to provide appropriate information at the level of reliable scientific research. They seem to be incorrigible, infallible, and indubitable (Schwitzgebel, 2008, 2010). In fact, as long as consciousness research restricts oneself to the superficial layer of everyday consciousness, this diagnosis inevitably fits. However, as found by Lutz et al. (2009), for example, pre-reflective contents can be gradually made conscious and controllable by adequate mental training. So should we not concede that consciousness includes processual layers underlying the seemingly ready-made contents of everyday consciousness? Since, under normal conditions, we do not know anything about such "deeper layers," the consequence must not

be to deny the possibility of their existence at all, but—analogous to brain research—to dig more deeply in order to attain important information which is missing as yet.

A central turning point here is the discovery of pre-reflective mental acts and states by different phenomenological accounts that, for example, have been carried out by Husserl and his successors. In this line, the *neurophenomenological project* (Varela, 1996; Thompson, Lutz, & Cosmelli, 2005) characterizes the methodological steps necessary for this discovery as following: (a) suspension (bracketing) of everyday belief-constructs, (b) redirection of attention toward the phenomena of lived experience, and (c) receptive openness in order to get access to the pre-reflective level of experience (Thompson et al., 2005). As mentioned, Steiner also developed an experience-based research approach with quite similar objectives (Steiner, 1918/1958, 1924/2003), which, however, is more rooted in the phenomenological tradition of Goethe's natural research and has been further developed in H. Witzmann's structure phenomenology (Witzmann, 1983). Compared to the (neuro-) phenomenological approach standing in a Husserlian tradition, Steiner has set a slightly different focus by investigating specific forms of mental activity, the interaction of which is supposed to play a central role in the constitution of everyday consciousness. Therefore, Steiner's methodological approach seems to be partly compatible with neurophenomenology, at least in the first step of establishing an "exceptional state" of processual observation (*Ausnahmezustand*, Steiner, 1918/1958, p. 25). The second step of redirection, however, appears in Steiner's approach in the form of attentional control by means of explicit handling with conceptual orientations in the field of pre-reflective experience (*Aufmerksamkeitslenkung*, Steiner, 1924/2003, p. 39). This obviously implies an attitude of active targeted observation, which, referring to the third step, has to be differentiated from a mere "receptive openness" (Thompson, et al., 2005, p. 73). In philosophy of science, it is nothing new to speak about the fact that every observation is theory-laden (Popper, 1934/1989; Fleck, 1935/1980; Kuhn, 1968)—the philosophical analogue to the psychological notion of perceptual priming—which especially applies in the natural sciences. Without any idea or theory about what could be observed, nothing will be observed. And making any incidental or scientific observation should remind us of the conceptual horizon in which this observation appears as such (Hayward, 2007). Against this background, every measuring instrument, be it physical or psychological, essentially contains whole theories about the physical world or the human psyche – which does not prevent us from gathering experimental data and interpreting it in a certain way. The crucial point here is to keep these general conditions of the cognitive process in mind as clearly as possible and extend them in an adequate way to the phenomenology of pre-reflective mental action.

Hence, for example, the mirror metaphor itself could serve as a refineable conceptual "measuring device" in the sense of an ocular to view the mental processes in which we are normally pre-reflectively engaged. Speaking of reflection, in any case, implies that the process concerned includes two orientations or movements in opposite directions, one towards the reflecting medium and one coming back, typi-



cally in different directions and based on the principle that the angle of incidence is equal to the angle of reflection. If the mirror metaphor makes any sense on a deeper level of understanding, such opposing mental movements should be detectable. In other words, the functional or processual aspects of the mirror metaphor should be developed as a working hypothesis for introspective consciousness research. In relation to the resultant mental contents appearing in the naïve state of consciousness of untrained lay persons—the "mirrored images" in a narrower sense—the hypothetical mirroring processes, that is, the mental dynamics engendering the resultant contents, should now be investigated by themselves with more detail and greater methodological rigor.<sup>5</sup>

## EMPIRICAL ENQUIRY

The aim of this two-stage study, divided into an initial pilot phase and a subsequent main phase conducted on an independent sample of participants, was to examine introspective findings with regard to their power of interpreting certain phenomena of neuronal activity. As already indicated, a crucial point of departure in first-person research is the balanced methodological relation of individually performed and experienced mental action and its transparent description and conceptualization. In accordance with our experience from previous studies (Weger & Wagemann, 2015a, 2015b; Weger, Meyer, & Wagemann, 2016; Weger, Wagemann, & Meyer, 2018), it is reasonable to elaborate a road map in order to clarify the steps of the experimental procedure for the participating researchers and to anchor the ensuing observations in a reproducible setup of elementary forms of mental actions which could serve as a "criterion of performative coherence" (Petitmengin & Bitbol, 2013, p. 270). In the context of brain and consciousness, we decided to undertake a *perceptual reversal task* for two reasons. Firstly, a perceptual reversal triggers both the whole neuronal signal processing line from the visual stimulus up to inner brain action, on the one hand, and the possibility of a voluntary change as an introspectively accessible intervention, on the other. While the neuronal layer of description refers to subpersonal nerve-sense processes only accessible to third-person observation, the mental layer of description requires genuinely mental, first-person observation to obtain the full range of phenomena. Secondly, it can be assumed that the reversal of perceived content might stand in a processual relation with a change of the attentional direction and, therefore, would make it possible to assess the hypothesis of the mirror metaphor as indicated by a bidirectional mental dynamic. We chose the Necker cube as an experimental stimulus; it has become a well-known reference object through frequent studies in the psychology of perception since it provides an elementary geometrical setting with two equivalent variants of spatial vision.

The following reflections led us to the experimental task: As Kornmeier and Bach (2012) mention, a voluntary reversal can be triggered by winking or by changing the fixated point in the figure. However, in order to investigate the impact of mental action as clearly as possible, we minimized these factors by maintaining fixation on one particular point of the figure and by intentionally conducting the

reversal. Thus, the reversal had to be performed primarily by means of acts of thinking and observing. Accordingly, the prescribed task was to permanently alternate between the two (major) spatial variants and to observe in parallel as precisely as possible the mental actions and transitional states performed in carrying out the reversal.

## Pilot Phase and Hypothesis Building

In our pilot study, over the course of four weeks we engaged in the trial individually and repeatedly; subsequently, we exchanged and discussed our experiences on the basis of our personal notes as described below. To begin with our observations, we noticed that it initially took some effort to perform the perceptual reversal with full deliberate control without recourse to the body-related aids of winking and wandering with the eyes. After several repetitions, it became progressively easier to perform the reversal by purely mental means; hence, we can speak of a training effect. So far, this is nothing spectacular, since voluntary reversals of bistable figures are a well-known topic in the research literature (e.g., Liebert & Burk, 1985). Only the fact that a voluntary reversal does not seem to necessarily require the mentioned body-related facilities could be viewed as an addition to Liebert and Burk's results so far. Thus, our attention was sharpened for the features of the mental activity we were engaged in. In this respect, we realized that we effectively used certain mental "tools" in order to succeed in the task of alternation between the two spatial variants of the cube. In further pursuing the exercise, an effect of mental time-stretching or "slow motion" occurred, making it possible to discriminate the function of these tools more precisely.

Interestingly, we became aware of something like an "inner winking," analogous to the body-related facilities while maintaining the physically fixated focus. Initially, this unfamiliar impression was accompanied by a momentary loss of representability of what was going on in the visual background—which was perceived as slightly unpleasant and disturbing. However, upon closer analysis, this inner winking could be further differentiated into two aspects of mental action. The first of them could be identified as an intention, or even as the performance, of turning away from the stimulus which was consistently seen up to this point in terms of the initial variant, but then loses its former coherence, its sense of spatial structure. With eyes open and continually oriented towards the stimulus, nothing specific is seen for a moment; rather, the impression of fragmented, incoherent parts arises. The second aspect of mental action could be denoted as an attempt to anticipate the other variant of the Necker cube. In some way, we were producing mental content pointing to the alternative version of what is in sight, be it words denoting a spatial relation or motion (e.g., *forward* or *backward*) or memorized visual representations, which could possibly open a path towards the anticipated reversal. Overall, it became clear that the two inner gestures of dismissal and anticipation could not be carried out separately and apparently belonged together as two sides of the same coin. In order to escape a consistent variant of perception, we inevitably had to produce alternative mental content; in the course of this action, the former view lost its conciseness and inner

coherence. However, to be precise, we could not complete the reversal simply by inwardly speaking words or grasping for promising memory fragments; rather, this only made it possible to dispose of the former perception and paved the way for an alternative one.

At the same time, this anticipating reorientation of attention remained open in the sense of an unanswered question for the inner, lawful consistency of the alternative variant. While this movement of reorientation and inner search was clearly dependent on our own mental effort (inner speech, memorized clues), the emergence of certainty and vividness regarding the anticipated content appeared to not be susceptible to our influence. Rather, if successful, a clear and certain comprehension of what could potentially be seen occurred as a compelling resonance to our individual mental efforts (Petitmengin, 2007). However, note that at this point, the reversal was not yet completed in the sense of an outer perceptual certainty, but rather, as an actualized insight about the necessary spatial relations of the anticipated variant. Subsequently, by turning our attention towards the stimulus again, we could observe that our gaze was still slightly defocused; accordingly, the supposed corner point of the figure appeared to be slightly blurred. From here, with appropriate practice, we finally succeeded in seeing the anticipated variant as externally reified and with full perceptual rigor. The isolated black lines fused into the spatial appearance of a cube—but now in terms of the alternative variant. Additionally, some of us experienced this last phase as a kind of plasticizing, like molding clay with our hands—with the result of the reversed perception. Once more, we want to emphasize the training effect: The reversal, which at first was very fast, was now experienced as temporally stretched; therefore, like in a zoom-in, a higher resolution of details became accessible.

To sum up, several stages in the exercise as a whole and different processual phases within one reversal could be outlined. Let us begin with the former; with reference to the initial training period, three stages could be distinguished: (a) Untrained and naïve. It is difficult to perform the mental task; when it is accidentally successful, no further nuances beyond the resultant percepts are noticed; (b) Slight training and first superficial observations. After a number of attempts, a skillful reversal could be established; first observations of the mental performance are made, but they remain unspecific and incomplete (mentioning, e.g., the mere fact of inner winking). The observations remain fragmentary and apodictic; (c) Trained and more fine-grained observation. Specific phases of mental action can be differentiated and appear in a closer relation to each other. The mental processuality of the reversal comes into focus. These findings led us to subdivide the instructions regarding the main study into a preliminary phase with a focus on practice and a subsequent phase with a focus on observation.

The introspective observations made on the level of the third training stage shall now be condensed into a hypothesis of four processual phases with respect to mental action and its interaction with structural components (Wagemann, 2018): (a) Turning away from the stimulus via conceptual search and reorientation ("No longer the one – not yet the other"); (b) Logical confirmation of conceptual evidence regarding the anticipated variant ("The other could be actually conceived"); (c) Turning towards the blurred perceptual field again and searching for

validating indications ("Can it also be seen?"); (d) Reorganizing the stimulus in accordance with the altered conceptual pattern ("The other can be consistently seen!"). It seems to us to be important to stress the different experiential qualities of the outlined phases in relation to each other; we have tried to express them by means of brief characteristic phrases (in brackets). Another fundamental distinction refers to the overall processual aspects of the transitional phases in contrast to the static character of the starting and end points. To begin with the latter: While only the starting and end points of the reversal appear to us in the form of stable mental representations, the transitional phases seem not to be conceivable in this sense – but nonetheless, they, too, were definitely observable.<sup>6</sup> From the perspective of an untrained test person, only stable perceptions or representations are registered, whereas the transitional phases pass by as if completely nonexistent. With increasing practice the result oriented, reifying character of mental experience is reduced in favor of an increasing awareness of one's own process-immanent mental action as described above.

A further distinction – one that at the same time serves to integrate the observations – can be made regarding the described experiential quality of the processual phases. Broadly speaking, we are dealing with an alternation of turning away from (Phases 1 and 2) and turning towards the stimulus (Phases 3 and 4). On closer analysis, our protocol shows that the first two phases include not only a renunciation of the previous percept, but also an acquisition of an alternative concept; this latter point could be understood as a productive and approaching gesture. Correspondingly, the last two phases are not exhausted in a stimulus-oriented mental movement, but also involve an opposing or receptive turn inasmuch as it is noticed that the conceptual variant, which up to this point was only thought by us, is really constitutive for a consistently perceived object of the outer world. Therefore, the turning away (from the stimulus, Phases 1 and 2) leads to a turning towards (a concept) and the turning towards (the stimulus, Phases 3 and 4) eventually results in the experiential opposition of subject and object, which appears as a dissociation again. Since *turning away* could be understood as a gesture of separation and *turning towards* as a gesture of integration, these collated introspective findings include an oscillating separation and integration between stimulus – conveyed and processed by the brain—and concept—actualized and oriented through conscious mental action. Therefore, this seems to be a first hint of a balanced relation of separation and integration of brain and consciousness. However, before pondering further over this hypothetical structure, we deemed it necessary to scrutinize our preliminary findings with an independent sample of participants in the main part of our study.

## Main Phase of the Study

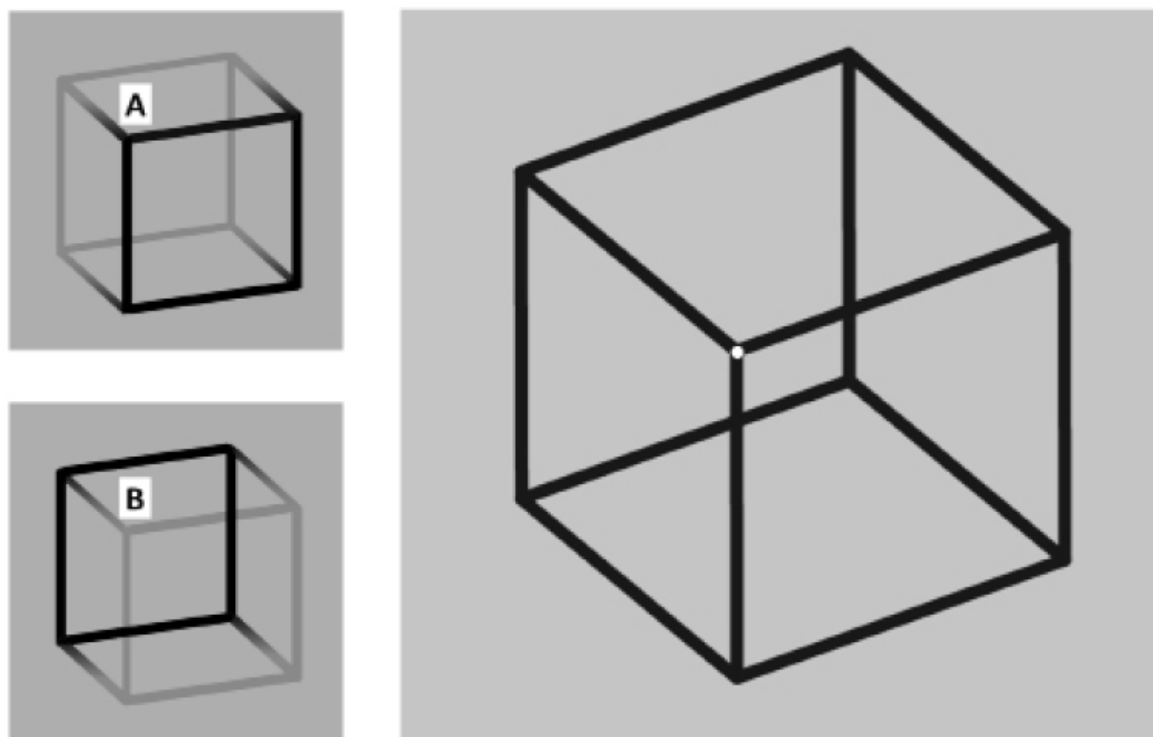
Twenty-nine female (26) and male (3) BA students (all attending a curative education training) between the ages of 21 and 50 years ( $M_{\text{age}} = 24$ ) took part in this 2-week longitudinal study in partial exchange for course credit. The study was embedded into a regular phenomenology seminar in which some other picture puzzles were considered and discussed beforehand, but not with regard to the hypothetical phases

of the reversal. The instructions were given orally, as well as in the form of an information sheet including a short introduction, the tasks, and three gray-scaled pictures of a Necker cube; two of these were smaller, disambiguated versions used for instruction purposes (see Figure 1). The third was the experimental stimulus proper, which was a bigger and—crucially—an ambiguous version. The tasks were formulated as follows: (a) Initially practice the reversal for some days until you can voluntarily perform it consecutively for several times; (b) Observe and describe how you perform the reversal (as far as possible under exclusion of physiological means). Try to distinguish different aspects or phases concerning the questions: What am I doing? What am I experiencing?

The data was collated in the form of written self-reports, which were analyzed in terms of whether they contained any indication that the participant identified one or more of the four phases: (a) turning away (from the stimulus), (b) producing (the mental coherence or representation of the alternative version), (c) turning towards (the stimulus), and (d) perceiving (the successfully changed version, see Table 1). Participants used a range of formulations to express their mental experience and performance regarding the task. At the same time, these individual expressions yielded clear indications of the phases described above. Of the 29 protocols, four were rejected because these participants did not (fully) comply with the instructions. The remaining 25 participants gave expression of one to four of the hypothesized phases. If only one phase could be detected, it always was the last phase – perceiving. Even if this phase was not named as such, it could be inferred,

in that the participants reported a successful reversal. Interestingly, two or more of the other phases were often condensed into different parts of one sentence. The production phase (Phase 2) and the turning towards phase (Phase 3) were reported almost twice as often as the turning away (Phase 1). To convey an impression of the protocols and variety of descriptions used in these, some examples are given in Table 2. A representation of all the participant's verbal expressions related to the four categories can be found in the Appendix (see Table A1).

Summarizing the findings, nine of the 25 participants (36%) were able to differentiate all four phases (see Table 3). Another eight (32%) could distinguish three phases and another four distinguished two or one phase, respectively (each 16%). The fact that more than one third of the non-expert participants independently differentiated the four phases was in support of our hypothesis. Obviously, this does not exclude the possibility of other, still more fine-grained conceptions of processual structuring. We can only infer that at least four processual phases can be introspectively differentiated in a perceptual reversal. We noted that the fact that 36% of our participants discovered the four phases is in support of our hypothesis. But might one not argue that the fact that nearly twice as many—64% of our participants—discovered only three or fewer phases is in disproof of our hypothesis? This is not the case, and the reason is that a more fine-grained description is typically superior to a less fine-grained description. As an analogy, consider the discovery of the chemical elements in the 19th century and their arrangement in the periodic table refining the theoretical basis for a precise investigation of chemical reactions. This development



**FIGURE 1.**

Disambiguated versions of the Necker cube (A/B) and the experimental stimulus.



led from the alchemistic doctrine of the four elements that could no longer adequately explain the subtle phenomena and measurements of chemical processes towards increasingly finer layers of description. There are few examples where a more fine-grained, differentiated description of a phenomenon would not also be more approximative to reality compared to a less fine-grained one. As a matter of fact, a single description of such a fine-grained form is already empirically sufficient; follow-up proofs, as provided by our nine participants, are largely a matter of convention.

**TABLE 1.**

Phases That Were Differentiated

Participant	(1) Turning away	(2) Producing	(3) Turning towards	(4) Perceiving
1	×	×	×	×
2	–	×	×	×
3	–	×	×	×
4	×	×	×	×
5	–	–	–	×
6	–	×	–	×
7	–	×	×	×
8	×	×	×	×
9	×	×	×	×
10	×	×	×	×
11	–	×	×	×
12	–	–	×	×
14	–	×	×	×
15	–	–	–	×
16	×	–	–	×
17	–	–	–	×
18	–	×	–	×
19	–	×	×	×
20	×	×	×	×
22	×	×	×	×
23	–	×	×	×
24	×	×	×	×
25	–	–	–	×
26	×	–	×	×
29	×	×	×	×

Furthermore, with regard to the encoding of the self-reports into the four categories, two problematic points should also be mentioned. Firstly, in some cases a clear assignment was difficult, particularly with regard to Phases 2 and 3, which both include certain aspects of conceptual meaning related to the different variants of the Necker cube. However, this ambiguity could be resolved in most cases by the crucial distinction of an imaginative activity being independent of any relation to the stimulus (Phase 2) on the one hand, and a stimulus-related activity which is oriented to the marked corner in the depiction serving as a starting point for a perceptual search movement (Phase 3) on the other. However, for Participant 26 a discrimination of these phases was not possible since the formulation seems to confuse the different meanings of the "fixpoint" (which remains unchanged as a stimulus-related one) and the perceptual Variants A and B (which are to be changed, see Table A1). Secondly, the order of the formulations assignable to the categories did not always correspond to the assumed diachronic

structure (see Participants 3, 9, 11, 14, 19, and 24 in Table A1). In the sense of the hypothetical structure, this could be explained by two approaches: For Participants 9, 11, and 19, this inversion can be reasoned by the sentence structure and is, therefore, irrelevant. For the others, it could be assumed that the process of realization and verbalization of the phases, for whatever reason, did not correspond to their original structure. So that remains open and would have to be examined in more detail in further investigations.

## TOWARDS A FUNCTIONAL IMAGE

In order to redirect the investigation from an exclusively first-person perspective towards an integration with the neuronal layer, we shall now discuss the above findings with regard to the mirror metaphor. Two of the metaphorical aspects, the law of reflection in the context of attentional redirection and the association of the light to be reflected with a fundamental mode of reality, have been initially discussed above. Some further issues will now have to be clarified before arriving at a functional image of the brain-consciousness relation.

Firstly, why does it generally make sense to speak about the mirror in a philosophical context? Does this not inevitably imply a representationalist model of reality in which pre-existing objects have to be simply "mirrored" by human cognition in order to bring about our knowledge about the world? Or put differently at the metaphorical level: Which types of objects would even require a mirror in order to become visible? While for any other object it would be sufficient to turn my eyes, my head, or my whole body into the corresponding direction to see it, my own face and especially my eyes, for their part, are not observable to me without a mirror. This means, in metaphorical terms, that the mirror starts to become interesting in view of qualities referring to subject-related aspects such as self-awareness or the

**TABLE 2.**

Example Excerpts From The Introspective Protocols

Participant	(1) Turning away	(2) Producing	(3) Turning towards	(4) Perceiving
1	...beginning to gaze like a cow	...I have to tell myself internally that I now wish to see the cube from above...	...it looks as if the lower plane flips upwards...	...and I am looking from down upwards on the cube
7	–	...imagining that, for variant A, I stand outside the cube, and, for variant B, I stand inside the cube	...in this way, I always switch the white point backwards and forwards	× (not explicitly described)
8	...the corner dissolves and the lines appear two-dimensional for a moment	...mentally, I orient myself on the side of the cube that can be seen either from downwards or from upwards	...subsequently, the former corner inverts backwards...	...and the new cube emerges
10	...when I wanted to change the perspective, the lines appear in a jumble	...I had to concentrate on the top plane referring to the other perspective	...noticed that I subconsciously played with the planes	× (not explicitly described)
29	...setting the remaining lines into vagueness	...I mentally shift the white point on the corner forwards or backwards	...thereby focusing the white point with my eyes	...possible to deliberately change the perception and to perceive the cube from two different perspectives

**TABLE 3.**

Summarized Results

Number of phases that were differentiated	4	3	2	1
Number of participants	9 (36%)	8 (32%)	4 (16%)	4 (16%)

individual attribution of meaning to sensorial stimuli. Remarkably, this seems to be consistent with Steiner's explanation that the inner mental life of human beings has to be reflected at a suitable medium—the physical body and particularly the nervous-sensorial processes—to become conscious as a subjective agent at all (Steiner, 1917/1983). Once the agent has become aware of himself and the world in the course of thinking and sensory perception, he can detach his attention from these results and apply it to the generation process itself in introspective observation. Hence, the danger of falling back into the fallacies of naïve realism or representationalism is warded off whilst the mirrored entity does not metaphorically refer to outer objects, but rather to mental properties or processes.

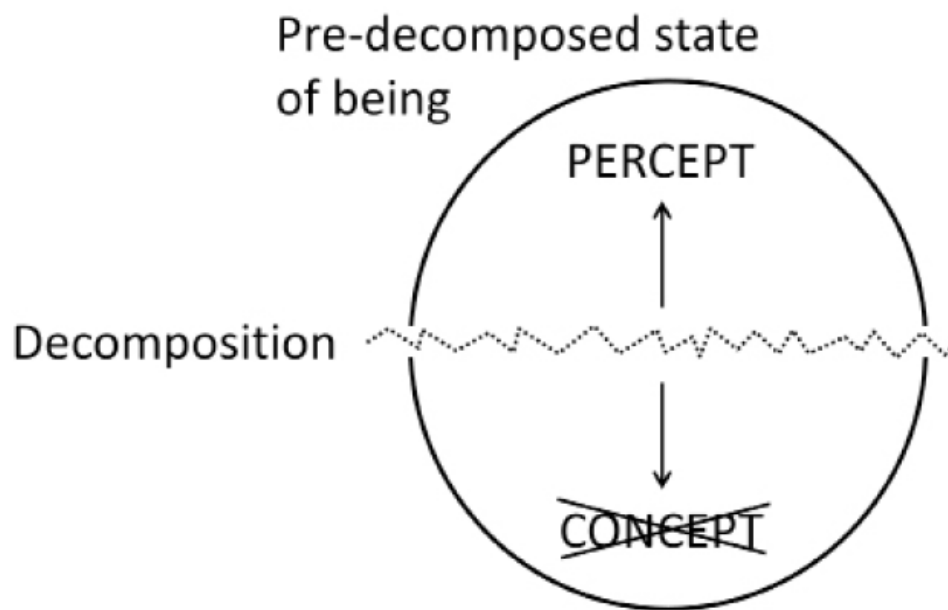
A related issue to be considered is the virtuality of mirror images, that is, the fact that the mirrored object is not located at the place where it optically seems to be. Metaphorically, this could be associated with the relationship between our everyday consciousness and its reified contents appearing as such at certain places with determined properties (Witzenmann, 1983). Even if individual mental activity is substantially involved in the completion of coherent perceptions, this participation normally remains pre-reflective. Only its results—all the things, beings, situations that furnish our everyday life—enter the stage of full awareness. In this sense, the seeming objectivity of perceptual contents occurring in an untrained everyday consciousness is as virtual as the deceitful images of an optical mirror, given the fact that the reflection as such has not yet been recognized. Reality, with respect to the optical layer of the metaphor, requires the empirical and theoretical clarification of the reflection, for example, an understanding of the beam path in terms of the law of reflection, and hence, the mechanism of the previous self-deception. Metaphorically speaking, reality must not be conceived as a transcendental state of existence which is allegedly inaccessible to human consciousness. Rather, according to Steiner and Witzenmann, only the empirical and theoretical insight into the mental participation in the perceptual process completes it to full reality in the proper sense. Such an experiential, self-referential, and processual mode of reality should also allow for a differentiation of the characteristic influences caused by the stimulus and by the mental meaning structure being merged into the objectivity of everyday consciousness.

At this point, it turns out that the demanded "epistemology of non-triviality" (von Foerster, 1991, p.71) calls for a sophisticated mirror metaphor which would be able to (a) relate more than only two components (an object to be mirrored and its mirror image) and (b)

to include the dynamic character of the perceptual process. The corresponding features of a refined mirror metaphor shall be developed in the following. As the findings of our introspective-empirical study have shown, different levels of conceptual permeation could be discerned with regard to the stimulus: During Phase 1 (turning away), the as yet stable percept blurs, becomes fragmented, and loses its former coherence. This experiential aspect of decomposition (Witzenmann, 1989, p. 16) could be associated with the philosophical issue of non-conceptual content of perception as discussed in various debates (e.g., Evans, 1982; Heck, 2000; Pylyshyn, 2009; Wagemann, 2018). In contrast, during Phase 4 (perceiving), the stimulus gains conceptual coherence resulting, again, in a stable percept that relies on the other variant. Altogether, this describes the transition from the raw, incoherent stimulus towards a stage of conceptual permeation. Intending a functional image of this transition, a metaphorical mirror must have, in the first step, the quality of semi-transparency in order to allow access to both areas before and behind the mirror. For a semi-transparent mirror is not only able to depict a certain object, but rather to merge it with visual contents from the other side of the mirror. Therefore, this metaphorical aspect could explain a separation as well as an integration of the processual components in question.

In the next step, a further feature must be added, which could illustrate the functional aspect of decomposition. As described, decomposition leads to the experience of a non-conceptual stage of perception as a necessary condition for the conceptual ambiguity of one and the same stimulus. At the optical level, the quality of a mirrored image depends on the surface quality of the mirror. In the case of a shattered mirror, the mirror image could not be regarded as a coherent whole but rather shows an aggregation of countless fragmented parts. In this way, no consistent object can be depicted. In the other extreme of an intact and perfectly polished mirror, the mirror image appears as complete and real as the original scenes and objects. Hence, the metaphorical mirror could be considered as a decomposing device whereby this function, according to the character of the other phases (2 to 4), has to be conceived as temporally revocable.

In sum, these two additional features, the semi-transparency and the suppressible function of decomposition, refine and complete Steiner's mirror metaphor and open up new perspectives on the intricate relation of brain and consciousness. Initially, since the structural relation between mirror and object is fully independent of the semantic content of the object, we can conclude that this content does not originate from the mirror. Accordingly, we cannot expect to find any mental phenomena (qualia, thoughts, feelings, etc.) or even their generative causation within the brain and its processes. And vice versa, from the other perspective, we do not perceive any sensorial or neuronal processes inside ourselves by introspecting our mental performance, but rather the experienced mental content. So where does the mental content come from, if not from a consciousness-related source as a primary dimension of reality? Or is this only a case of subjective self-deception? Analyzing the complex paths of the neuronal signals running from the sensory stimulus to the inner regions of the brain, we have to admit—according to the radical constructivist argument

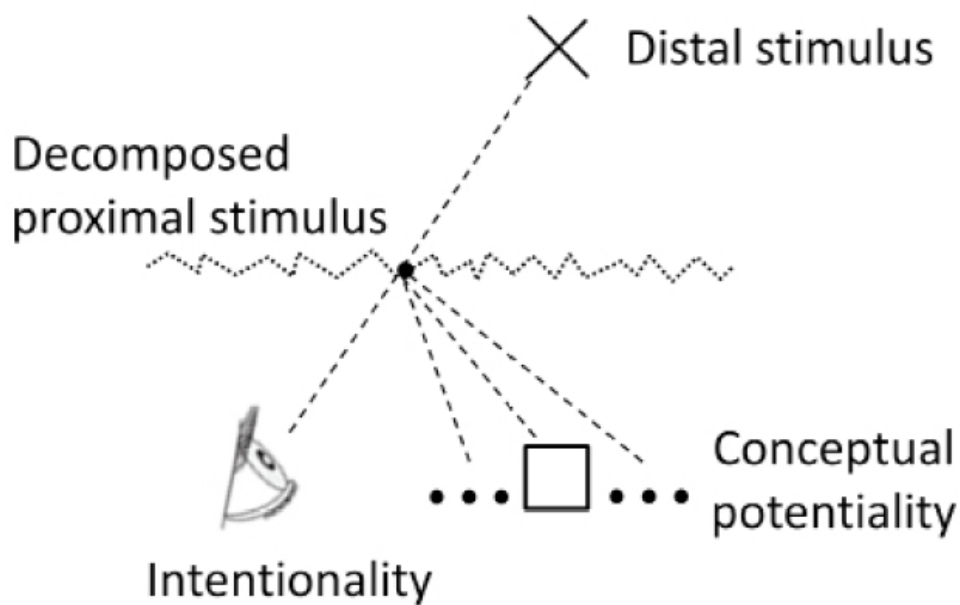
**FIGURE 2.**

Decomposition in neurophilosophical terms. A monistically conceived, pre-decomposed state of being is set through sensory-nervous activity into a separated state of percept and concept. Consequently, from the perspective of an intentional agent, the so far unquestioned coherence or meaning structure of an object or situation is no longer valid. Decomposition filters out any conceptual quality or contexts of phenomenal consciousness and, therefore, leads to epistemic crises.

of sensorial "perturbation" (Maturana & Varela, 1987, p. 106) and "un-specific coding" (von Foerster, 1998, p. 58)—that any coherent content of the distant stimulus (e.g., physical aspects such as electromagnetic or sonic waves, temperature differences, olfactorily effective molecules, etc.) is fully deconstructed in the transition to neuronal signal processing (Wagemann 2010, 2011, 2018; see also Laurence & Margolis, 2001).

If we assume that reality originates from a monistic state of being, which is neither mental nor material (neutral monism, cf. Hatfield, 2002) or equally mental and material (dual-aspect monism, cf. Atmanspacher, 2012), how, then, is this monistic state to be understood? Let us take a look at the development of individual consciousness. The first step must consist of a division of this primary state, because otherwise, there would be no differences, and thus, no challenge for cognition or perception (see Figure 2).<sup>7</sup> In an individual human agent, this division is performed by the above-mentioned function of neuronal decomposition, referring to the unitary, pre-decomposed state of being. According to Witzmann (1989), decomposition results in the separation of the structural components of concept and percept. Even though this split, as a transitional state in the microgenesis of consciousness, could be regarded as dualistic, it cannot be classified as reality in the common sense. This is because percept and concept do not "exist" on an equal footing, but rather, phenomenally appear in different forms. The percept appears as the non-conceptual relict of decomposition (referring to the proximal stimulus) and the concept, or more precisely, conceptual coherence appears as the potentiality—not yet the mentally performed reality—of recomposing the percept (see Figure 3).

Taking this into account, we can metaphorically associate one aspect of the brain, especially the processing of the sensory input signals, with a shattered mirror decomposing any coherence, whether conceived in physical or mental terms. From the intentional perspective, this is consistent with the general ambiguity of perception, which appears compellingly in perceptual reversals – but which also applies to any perceptual task (see Figure 3). Here, we recall our stimulus-related observations in Phases 1 ("loss of spatial structure," "impression of fragmented parts") and 3 ("defocused gaze," "blurred figure"). The corresponding mental actions of these phases (turning away – turning towards) are complemented by our concept-related observations in Phases 2 and 4, expressing actions of production and reception (or perception), respectively (see Figure 4). Altogether, these mental actions result in a rescission of the neuronal decomposition effect which could be metaphorically interpreted as an integration and smoothening of the fragmented mirror. Following this, the semi-transparency of the mirror enables an intertwining sight of the previously separated, pure components of concept and percept. This sight of a realized or reified object, however, does not necessarily include any awareness of the ongoing realization process. To the contrary, most often the results of the perceptual process veil our own participation in it and make us naïvely believe in an independently preformed or existing objectivity, which, in fact, is a remembrance of the separating and integrating processuality oscillating between the mental and the material phenomenal layers (Witzmann, 1983). The empirical and theoretical unveiling of this structural relation, as explored in this study, can lead to an enhanced conception of reality.

**FIGURE 3.**

Decomposition in terms of the mirror metaphor. Closer inspection shows, in the metaphorical context of a shattered, semi-transparent mirror, that at this stage no one-to-one relation between the proximal stimulus and a conceptual meaning structure could be established. In this context, ambiguity means, on the one hand, that the stimulus is conceptually too poor, whereas, on the other hand, the potentiality of corresponding concepts is too manifold.

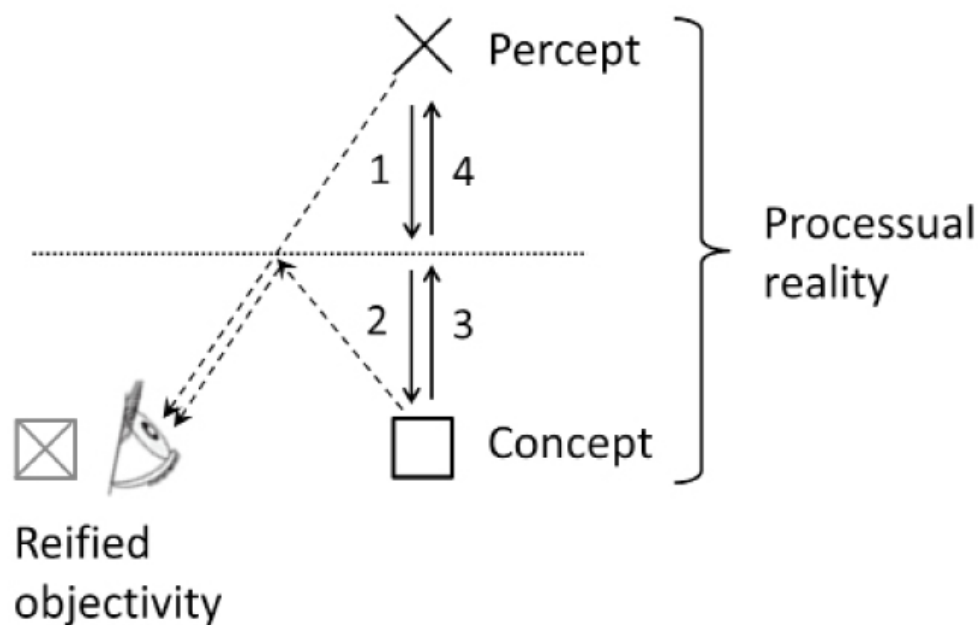
This functional image of a transcategorical relation between mind and brain would certainly not be complete without indicating the complementary aspect of neuronal decomposition. After the decomposition effect of neuronal action has taken place on the mental side, the process of mental recomposition starts. It leads, as described, to a consistent adaptation and specification of the wide-ranging conceptual potential to a single case of consistent perception. In order to enable this, the neuronal system provides its connective complexity, in which the manifold variety of conceptual individualizations could find a solid counterbearing (Wagemann, 2011). Both transcategorical aspects of neuronal action, decomposition, and the enabling (not causation) of recomposition, serve as necessary conditions of phenomenal consciousness. While decomposition points from the neuronal to the mental layer, recomposition runs in the opposite direction utilizing the determining possibilities of the neuronal system without, however, being qualitatively expressed by them.

Metaphorically, the recomposition effect could be understood in view of the other, non-optical—that means the physiological—side of the mirror. From this side, the specific restoration of the shattered mirror—during the recomposition process—could also be noticed—while the objects/images cannot, of course, be identified in the shattered back of the mirror. Obviously, this is the perspective of neuroscientists. Furthermore, this restoration leads to more or less sustainable modifications of the mirroring system—the neuronal connectivity of the brain—representing the physiological consequences of the mental process. In this way, the effect of mental recomposition on the physiological side can be regarded as a holistic interpretation of *synaptic*

*plasticity* that is defined as the phenomenon in synapses to strengthen or weaken over time in response to an increase or decrease in their activity (e.g., Hughes, 1958). Complementary to this, the decomposition effect on the mental side caused by deconstructive neuronal processing could serve as an interpretation of the smaller and larger mental crises through which we permanently pass in our conscious lives (e.g., Oevermann, 2006). Overall, this shows a functional image of the brain-consciousness correlation consistent with the empirical results of the introspective study on the one hand, and with the theoretical implications illustrated by an enhanced mirror metaphor on the other. This conception takes into account both descriptive layers, the mental and the physical, with equal phenomenal precision and emphasis. It offers a transcategorical explanation embracing the separation and integration of both layers.

## SUMMARY AND DISCUSSION

In this study, we have approached the brain-consciousness problem from two perspectives, a theoretical or metaphorical one and an empirical one in the sense of introspective first-person research. The initial considerations led us to von Foerster's ideas of non-trivial systems and a non-trivial epistemology. Now, in the combination of our introspective findings with Steiner's refined mirror metaphor, we can substantiate the idea of a non-trivial system as a physical organ—our brain—by initially putting its conscious user into an epistemic state of deficiency with the consequence of perceptual ambiguity—like a shattered

**FIGURE 4.**

Recomposition and processual versus reified reality. Recomposition means that the decomposing mirror is restored and smoothened by mental and conceptual activity (Phases 1-4). From the heteronomous view of normal consciousness, the permeation of concept and percept unnoticedly results in reified objectivity. Full reality, in a processual sense, could be reached by consciously performing the phases of the basic structure what could be denoted as autonomous observation.

tered mirror conveying a decomposed stimulus. But this momentary state of decomposition can be overcome (and is normally overcome) by originary mental activity of the individual. This means that the condition of neuronal decomposition is necessary for conscious perception but, at the same time, cannot functionally prevail, since it always has to be surmounted by the sufficient condition of mental activity in connection with conceptual coherence—resulting in a mended mirror representing a stable percept.

As a revision and extension of Weger and Edelhauser's (2014) study, this interpretation of Steiner's mirror metaphor includes the explicit turn from a functionally static and rigid mirror—associated with naïve forms of realism or representationalism—to a dynamically transformative one. The basis of this interpretation is not philosophical argumentation; rather, it is rooted in the introspective observation of mental dynamics. The non-trivial system of the "brain-mirror" changes its consistency concomitant to the specific forms of mental action, which occurs usually pre-reflexive and is accessible through a non-trivial epistemology of introspective or meditative observation.<sup>8</sup> In this way, brain and consciousness can be comprehensively conceptualized by integrating their phenomenological distinctions and their functional and ontological relations – without reducing one to the other and without establishing a problematic substance dualism. Rather, both realms—brain and consciousness—are closely entangled and, nevertheless, functionally clearly discernable from each other.

Dualism, however, remains relevant in a certain sense, for the stage of decomposition as well as for the subject-object split as a result of recomposition—wherefore both cases appear as transitional stages referring to the process of realization. This process can be regarded as

integrating the following dimensions: The "inner dimension" of brain (oscillatory signal processing) refers to the "outer dimension" of consciousness (decomposition effect), which means that our mental life is again and again confronted with incoherent fragments, irritations, and ambiguous crises from the outside, emerging without an active mental contribution on our part. The inner dimension of consciousness (genuine mental activity and experientiality, structural recomposition) refers to the outer dimension of the brain (synaptic plasticity according to mental recomposition), which means that the specific changes in neural connectivity have to be understood as a transcategorical effect coming from "the other side of the mirror" which can only be identified in consciousness.

This draft of a transcategorical correlation between brain and consciousness can be further elaborated to a functional trichotomy of the human being comprising the following phenomenological dimensions or layers: (a) bodily behavior (neuronal activity in the narrower sense), (b) mental action and experientiality, and (c) effective conceptuality accessible to mental activity and serving as the binding medium for neuronal activity as well as for the processual coherence of the three dimensions (Wagemann, 2011; Weger & Wagemann 2015b). In view of the close processual permeation of these functional regions, we can alternatively speak of an anthropological *tri-perichoresis* or of an *osmotic relation* within the functional stratification (Wagemann 2011, p. 198). In the metaphorical context, a semi-permeable layer being necessary for osmosis could be associated with the semi-transparency of the mirror. Although this account, which could be denoted as a functional layer theory (FLT), is initially based on first-person observation, it can be additionally contextualized by several philosophical accounts such



as Nicolai Hartmann's (1954) theory of *ontological stratification*, Karl Popper's (1978) *three worlds* concept, Gotthard Günther's (1978) *three-valued logic*, or a gradual version of *panpsychism* (Skrbina, 2005). Also other metaphorical accounts could be found and compared with the present conception, as will be briefly indicated in the following.

For example, William James' approach to the mind-brain correlation issue, as he developed it in *Human Immortality* (1898), allows to interpret neuronal decomposition as an effective "threshold" against the whole context of a pre-decomposed state of reality (James, 1898, p. 23). By illustrating this threshold through several metaphors such as coloured glass, a prism, or a pipe organ, James tries to reason that the brain could not produce consciousness – just as the light or airstream permeating these devices is not engendered by them. Individual consciousness, according to this metaphor, emerges insofar as the brain permits a restrictive transmission of "the one infinite Thought which is the sole reality into those millions of finite streams of consciousness" (James, 1898, p. 15). Therefore, the lowering of the threshold, metaphorically referring to the transparency of the glass or the pressing of the organ keys, could be associated with recomposition leading to the individual perception of an object, for instance.

However, speaking of a "psycho-physical movement" (James, 1898, p. 23) or "sense-action" (p. 26), the precise type and origin of mechanism necessary for lowering the threshold remain unclear in James' conception. In contrast, by means of a refined mirror metaphor, the specific roles and contributions of mental and neuronal action could be clarified and, regarding the former, differentiated into four characteristic phases, as described in the previous sections. In performing these actions, we are mentally lowering the threshold of decomposing brain action to permit a recomposition. This can be associated with a smoothed, semitransparent mirror plane making a high-quality reflection as well as transition of light possible. Nevertheless, James' approach could equally be considered as a metaphorical expression of a three-valued or three-layered relation referring to a comprehensive conceptual potential standing in opposition to inhibiting or enabling physical conditions, together leading to individual consciousness (see also van Lommel, 2010).

Finally, as two examples of contemporary philosophical approaches, the accounts of Walter J. Freeman and Thomas Fuchs shall be briefly discussed with regard to the motif of separation and integration of functional layers. In both approaches, the idea of a "circular causality" that connects the individual and its environment plays a decisive role (Freeman, 1999, p. 143; Fuchs, 2011, p. 215), which can be traced back to V. von Weizsäcker's *Gestaltkreis* (1940/1986) and which is retrieved today, for example, in the context of enactivism. While Freeman focuses on the hypotheses of self-organized neuronal activity and the supposed supervenience of awareness and consciousness through neuronal refference, Fuchs' intention is to describe the brain as only one, albeit central, part of the entire organism which, in turn, stands in constant exchange with a physical and social environment. As a consequence, however, both draw the conclusion that there is no causal agency on the brain or consciousness side, even if they give different reasons for this. Freeman, on the one hand, considers agency,

particularly in its form of linear causality, as a mere anthropomorphism, or a cognitive metaphor stimulated by the underlying neuronal processes when their circularity breaks into a forward (microscopic) and a recurrent (macroscopic) limb. Fuchs, on the other hand, brings back the neuronal as well as the mental and social phenomena to a comprehensive life process that is "inherently meaningful and 'mindful' from the beginning" (Fuchs, 2011, p. 218).

In summary, both approaches are closer together than their different arguments suggest. Another characteristic of this relationship is the fact that both answer the question of how mental coherence and meaning arise through a theory of neuronal abstraction from outer objects (Freeman, 1999, p. 150; Fuchs, 2011, p. 214), which remains speculative and seems to be inadequate in light of the above discussions about unspecific coding and non-conceptual content in relation to neuronal decomposition. For how should the simplest mental uniformities, which are conceptual in nature, be derived from dequalified, and hence incoherent, stimuli or regularities consistent only with regard to neuronal rhythmicity? In comparison with our account of an introspectively informed FLT, the crucial point is that both approaches under discussion, although they seem more appropriate and moderate than eliminative physicalism, are more likely to derive consciousness from non-consciousness, be it from physiological-functional or vital principles. In contrast, our FLT account differentiates and integrates the different levels of description functionally, instead of infiltrating the mental layer from below (physical, vital) or from above (cognitive, social) inadmissibly, and thus, gives a voluntarily guided and introspectively observable mental activity a new significance in consciousness research.

Against the background of this discussion and the remaining open questions further research will be needed to allow for more fine-grained explorations concerning particular aspects of this approach at a theoretical as well as an empirical level. Possible perspectives lie, for example, in further and more elaborated tests of the experiential four-phase structure and an even finer resolution of perceptual reversals at this level. Such empirical-introspective studies could then be combined with brain-physiological studies according to the neurophenomenological method in order to concretize the different aspects of the mirror metaphor in this direction. In this context, for example, the hypothesis of a specific correlation, on the one hand, between stimulus-averted phases (1 and 2) and global brainstates and, on the other, between stimulus-oriented phases (3 and 4) and local brain activity could come into the field of exploration (Wagemann, 2010, 2011).

## FOOTNOTES

<sup>1</sup> "I can see three strategies that are currently applied to alleviate this situation: ignore the problem; trivialize the world; develop an epistemology of non-triviality" (von Foerster, 1991, p.71).

<sup>2</sup> This dictum, quoted from Weyl (1949), is frequently attributed to Galileo but, on closer inspection, cannot be explicitly traced back to him (Kleinert, 2009).

<sup>3</sup> In addition, it can be interpreted as "normal science," that is, the mode of science that, according to T. S. Kuhn (1968), inevitably precedes scientific crises.

<sup>4</sup> Speaking philosophically, this does not necessarily imply a substance-dualistic homunculus model. Rather, the analysis of the mirror metaphor serves here as a phenomenological, in-depth approach which, at most, could suggest a property dualism. Some remarks on further philosophical consequences will be made in the last section.

<sup>5</sup> Incidentally, this methodological turn can remind us of how in Plato's cave allegory, the freed prisoner turns from the perception of the shadow images on the cave wall to the recognition of the fire as the light source and the things and puppets carried in front of the fire.

<sup>6</sup> These observable phases can be associated with the experience of "acategorical" states occurring in the transition between different categorical representations described by Atmanspacher and Fach (2005).

<sup>7</sup> See Brown (1969/1997): "Draw a distinction" (p. 3).

<sup>8</sup> Here we can refer to the movie *Matrix* (1999) in which Neo, just before waking up from his lifelong simulation dream and learning the truth about the matrix, sits beside a broken mirror showing a fragmented (decomposed) image of his face. In the next moment, the mirror is magically smoothed and Neo sees his true, complete face in it. When he touches the mirror with his hand it turns out to be liquid and begins to take possession of his whole body, which means that his virtual existence is being disintegrated. As a real human being he is freed from the illusion of the matrix.

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## APPENDIX

**TABLE A1.**

All Encoded Excerpts From the Introspective Protocols

Participant	(1) Turning away	(2) Producing	(3) Turning towards	(4) Perceiving
1	...beginning to gaze like a cow	...I have to tell myself internally that I now wish to see the cube from above...	...it looks as if the lower plane flips upwards...	...and I am looking from down upwards on the cube
2	-	...inner movement with the concepts "back" and "front"...	...mentally pushing the white point through the cube...	× (not explicitly described)
3	-	(2) ...and now imagine, however, that the... surfaces fold forward...	(1) ...so I stay with my attention on the point...	Now I can see the point as backwards
4	...the difficulty is to turn away from the normal cube...	...trying to bring the point into another context...	...focusing the point while scanning the environment	...then you see that the white point is no longer in front, but in the back corner...
5	-	-	-	× (not explicitly described)
6	-	say to me inwardly: "now you see..."	-	× (not explicitly described)
7	-	...imagining that I stand outside the cube at cube A, at cube B... inside the cube	...so I always move the white point from front to back and back again...	× (not explicitly described)
8	...the corner dissolves and the lines appear two-dimensional for a moment	...mentally, I orient myself on the side of the cube that can be seen either from downwards or from upwards	...subsequently, the former corner inverts backwards...	...and the new cube emerges
9	I get dizzy because the rest of the cube moves/displaces.	(2)...which should "step out" to the front	(1) I always concentrate on the corner,...	...it is just as if the corner were stepping forward or falling down
10	...when I wanted to change the perspective, the lines appear in a jumble	...I had to concentrate on the top plane referring to the other perspective	...noticed that I subconsciously played with the planes	× (not explicitly described)
11	-	(2)...who is to come forward	(1) ...concentrated on the corner point...	× (not explicitly described)
12	-	-	...focusing the point...	× (not explicitly described)
14	-	(2) ...and then decide to look at the cube either from above or from below	(1) I fix the white point...	× (not explicitly described)
15	-	-	-	× (not explicitly described)
16	...how I fell into a strained gaze and everything around the cube faded...	-	-	× (not explicitly described)
17	-	-	-	× (not explicitly described)
18	-	...that you always see the view you want to see	-	× (not explicitly described)
19	-	(2) ...depending on which view I wanted to see	(1) by either optically drawing the white point towards me or pushing it away from me through deliberate effort...	× (not explicitly described)
20	...an interim stage in which I could not see a three-dimensional object, ... phases of a blurry view, phases of "seeing" missing lines	(1) I want to deliberately change to cube No. 2	(2) thereby, I try to push the white point backwards	× (not explicitly described)



22	...but often it helps me to close one eye or to make my eyes very small.	Since I already know which side I want to switch to...	...I just look exactly at the side, between the four corners, where my new front side should be	× (not explicitly described)
23	-	I imagined the white dot once in the foreground and once in the background ...	... this idea was then transferred to the cube by letting go and tensing the muscles around both lenses.	× (not explicitly described)
24	(1) I deliberately decide upon a reversal... (4) the outer area of the image blurs and the outlines soften up	(3) ...and concentrating on giving him another depth	(2) ...by focusing further on the white point	× (not explicitly described)
25	-	-	-	× (not explicitly described)
26	...that with cube number two (B) the lines to the left and right of it sometimes became weaker or even disappeared	It really required my cognitive powers to focus on one fixpoint (A) and then the other (B).		× (not explicitly described)
29	...setting the remaining lines into vagueness	...I imaginatively move the white point on the corner forwards or backwards	...thereby focusing it with my eyes	...possible to deliberately change the perception and to perceive the cube from two different perspectives