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23

SUBJECTIVITY IN PHILOSOPHY, PSYCHOANALYSIS AND NEUROSCIENCE

Neuro-ecological Self and Its Point of View

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Introduction

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Concept of Self: Gap Between Philosophy and Neuroscience

What is the self? The concept of self has long been discussed in philosophy and psychoanalysis, more recently, in neuroscience. Since at least the beginning of modernity, the concept of self has been conceived to be the placeholder of the basic subjectivity of human man. This is also the role or place of the concept of self (or ego, using a yet different term) in psychoanalysis (Milrod 2002, 22–23; Solms 2015).

There is a gap between philosophy/psychoanalysis and neuroscience, though, as both are not talking about exactly the same kind of self. Philosophy focuses predominantly on the self as placeholder of subjectivity: why and how is it possible that there is something as subjective like the self in a seemingly purely objective world? In contrast, neuroscience, following the conceptual split of subjective ("I") versus objective self ("me"; James 1890; Northoff 2016), focuses more on the objective aspects of self (i.e., the objective self or the me), as those can be measured and observed (Sui and Humphreys 2015).

That leaves us with a gap between the subjectivity of self in philosophy/psychoanalysis and the objectivity of self in neuroscience. Closing this gap by introducing three key concepts – world-brain relation, neuro-ecological self, and point of view – is the goal of this chapter. This will allow taking into view how the self is intrinsically situated and embedded within the world, accounting for what philosophically has been described as "being in the world" (Heidegger 1927/2008; Gallagher and Daly 2018, 3n3).

Question, Aim, Argument, and Approach

How can we account for the subjectivity of self in neuroscientific terms without reducing or losing its essential subjectivity, as seems to be the case in current neuroscience? This is the key question guiding my chapter that, methodologically, relies on a non-reductive (rather than reductive) approach to neurophilosophy (Northoff 2014, 2018) and neuropsychoanalysis (Northoff 2011;

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Boeker et al. 2019). My main aim is to converge the philosophical concept of point of view as placeholder of a most basic subjectivity (Nagel 1974) with recent neuroscientific results on how the self is shaped by its respective environmental context through the brain. This leads me to speak of a neuro-ecological self, which ultimately is based on what I described in recent work as world-brain relation (Northoff 2014, 2018).

My main argument is that such neuro-ecological self is based ontologically on a point of view (below for details) that, through world-brain relation, grounds the self in an intrinsically subjective (rather than objective) way in the world. The present characterization of the self as neuro-ecological and intrinsically subjective by a point of view is an elaboration of the basis model of self-specificity (BMSS) I postulated in 2016 (Northoff 2016). In a nutshell, the BMSS states that the self is a fundamental or basis function of the brain's spontaneous activity and its temporo-spatial structure rather than being primarily a higher-order cognitive function (Northoff 2016). Relying on both recent empirical evidence and conceptual determination of the point of view, I here extend the BMSS with regard to the spontaneous activity's neuro-ecological dimension and what that implies for the self and, specifically, its subjective nature.

While on the philosophical side, the present approach follows the recently developed concept of world-brain relation (Northoff 2018), which is here applied to the specific case of subjectivity and self. Specifically, I here aim to provide a neurophilosophical account of the self that conceives the brain at the junction of world, body, and brain (Gallagher and Daly 2018, 2n2) and can account for what philosophically has been described as "being in the world" (Heidegger 1927/2008; Gallagher and Daly 2018, 3n3). I briefly sketch in the conclusion how the convergence of the three key concepts of world-brain relation, neuro-ecological self, and point of view can address the question for subjectivity in philosophy and neuropsychoanalysis in a non-reductive neuroscientific way. Future work will be necessary to connect the three key concepts to the psychoanalytic (and neuropsychoanalytic) concepts and debates on the nature of self in a more detailed way.

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Part I: The Neuro-ecological Self and Its World-Brain Relation

How is our self shaped by its environment? I here present three lines of empirical evidence for how the environment, through the brain, shapes the self; this, on a more conceptual level, leads me to speak of "world-brain relation" as the brain aligns its own activity to the world (Northoff 2014, 2016, 2018). The first line concerns the impact of early childhood traumatic experience on the self through the brain's resting state (i.e., its spontaneous activity).

The second line takes a more general view by showing how the brain's spontaneous activity continuously matches and compares its own temporo-spatial structure with the one of the environment in a way that extends beyond specific scales or ranges in time and space (i.e., scale-free), and how that shapes the self. Finally, the third line considers the phenomenological implications of the brain's alignment to the world (i.e., world-brain relation) by conceiving the experience of connectedness of the self to the world in hallucinogenic states and meditation.

The Neuro-ecological Self I: Traumatic Life Experience Shapes the Brain's Spontaneous Activity

We all experience adverse life events in both childhood and adulthood which shape our self. How can especially early traumatic childhood experiences shape our self in adulthood? Various brain imaging studies showed that early traumatic childhood experiences impact

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the spontaneous activity's temporo-spatial dynamics during adulthood. For instance, one fMRI study by Lu et al. (2017) demonstrated changes in both intra- and inter-regional synchronization (regional homogeneity, functional connectivity) in regions of the default-mode network (DMN) and salience network (SN; like the insula) in subjects suffering from early traumatic experiences. Somewhat analogous resting-state functional connectivity in insula and related regions of the salience network were also observed in another study by Gupta et al. (2017).

The impact of traumatic life experiences on the brain's spontaneous activity is further confirmed by various results in post-traumatic stress disorder (PTSD; Disner et al. 2018; Koch et al. 2016). One recent large-scale meta-analysis showed that here, too, regions of the DMN like the inferior parietal lobule (IPL) and the salience network such as the amygdala and the caudate exhibit decreased resting state activity; that is, intra-regional synchronization and neural variability in subjects suffering from PTSD (Disner et al. 2018). Focusing more on inter-regional (rather than intra-regional) changes (i.e., functional connectivity), a meta-analysis by Koch et al. (2016) observed dysbalance between decreased resting state functional connectivity in DMN and increased resting state functional connectivity in SN.

Yet other studies show how early traumatic experience do not only impact the resting state but that the latter, in turn, shapes the adult subject's task-related activity during for instance aversive stimuli. One fMRI study by Duncan et al. (2015) first measured entropy (i.e., the degree of disorder) in the resting state in adult subjects suffering from early traumatic childhood experiences. They observed that the degree of resting state entropy in a region of the DMN (anterior cingulate cortex) directly correlated with the degree of early life experience: the more subjects experience early traumatic experience, the higher their entropy (i.e., disorder) in resting state activity during adulthood (Duncan et al. 2015).

In a second step, the same study also investigated task-related activity applying an aversive stimulus (i.e., inducing pain by prick stimulus). They observed that subjects with high early traumatic experience exhibited reduced activity to the anticipation of aversive stimulus in specifically somatomotor cortex and insula which was directly related to (i.e., modulated by) increased entropy in DMN (i.e., anterior cingulate cortex).

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The Neuro-ecological Self II: Traumatic Experiences Changes Brain and Self

Yet another study by Nakao et al. (2013), using near infrared spectroscopy (fNIRS) demonstrated that especially power in the very low infraslow frequency ranges (<0.04 Hz) was negatively related to early traumatic life experience in anterior DMN (i.e., medial prefrontal cortex): the higher the degree of early traumatic experiences, the less power in specifically infraslow frequency ranges in medial prefrontal cortex during adulthood.

They also included two tasks, one task involving the self (i.e., colour preference judgment) and one task not involving the self (i.e., colour similarity judgment). Interestingly, the degree of early traumatic life experience only correlated with infraslow frequency power in medial prefrontal cortex during the self-related task (i.e., colour preference judgment) but not the non-self task: the less infraslow frequency power and the more similar judgments during the colour preference task, the higher the degree of early traumatic experiences.

Together, these studies clearly demonstrate that early traumatic experience strongly shape both resting state and task-related activity during adulthood. This concerns those regions in the brain like the ones of the DMN (medial prefrontal cortex, anterior cingulate, posterior cingulate) and SN (insula, amygdala) that have been shown to be strongly involved in processing self-specificity (Qin and Northoff 2011; Qin et al. 2020).

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We consequently can assume on solid empirical grounds that the self in adulthood is strongly shaped by its respective environmental context (i.e., the world) through the brain's spontaneous activity and its temporo-spatial dynamics in a long-term way, that is, across different time scales including short and long. Putting this in more conceptual terms, there is strong empirical support for (1) world-brain relation; (2) the world-brain relation shaping the self in a neuro-ecological way; and (3) such neuro-ecological shaping operating in a scale-free way across different time scales. We now need to better understand the scale-free nature of the self's neuro-ecological shaping – that shall be the focus in the next sections.

The Scale-Free Self I: Scale-Free Temporal Structure of the Brain's Spontaneous Activity

The brain's spontaneous neural activity can be characterized by different frequencies ranging from infraslow (0.01–0.1 Hz) over slow (0.1–1 Hz) and fast (1–40 Hz) to ultrafast (40–180 Hz) frequencies (Buzsaki 2006). Power is strongest in the infraslow range with decreasing degrees of power in slow, fast, and ultrafast ranges following power law distribution (see below for details; He 2014; He et al. 2010; Huang et al. 2016). Together, the different frequencies and their distinct degrees of power constitute a complex temporal structure in the brain's spontaneous activity which, in large parts, can be featured by the balance between slower (0.01 to 7 Hz) and faster (8 to 240 Hz) frequencies.

The relationship between slow and fast frequencies operates at different temporal (and spatial) scales and can therefore be characterized by what is described "scale-free dynamics" (He et al. 2010; He 2014; Linkenkaer-Hansen et al. 2001). Roughly, scale-free activity describes the fractal (i.e., self-similar) organisation and thus temporal nestedness in the relationship of the power between the different frequencies: the longer and more powerful slower frequencies nest and contain the shorter and less powerful faster frequencies – this amounts to long-range temporal correlation (LRTC) which operates across different time scales (i.e., frequencies; Northoff and Huang 2017; Linkenkaer-Hansen et al. 2001; He 2014; He et al. 2010).

The LRTC can be described as scale-free or scale-invariant which can be measured and expressed by $P \propto 1/f^{\dagger}$ (where P is power, f is frequency, and β is the power-law exponent (PLE); He 2014). A high PLE value indicates relatively stronger power in slow frequencies and relatively less power in the faster ones, whereas the opposite is the case in a low PLE value. Alternative to the PLE that, operating in the frequency domain, accounts for the power relationship across the different frequencies, one can also probe the LRTC in the time domain by measuring the fluctuations in the amplitude of the oscillations using detrended fluctuation analysis (DFA; Linkenkaer-Hansen et al. 2001; He et al. 2010; Palva et al. 2013).

Independent of their differences (see below for more discussion), both PLE and DFA measure neural activity across different time scales and thus in a scale-free or scale-invariant activity. That makes possible to assess the degree to which past neuronal patterns to exert their influence on future dynamics and thus to account for LRTC (Linkenkaer-Hansen et al. 2001; Northoff and Huang 2017). High values in PLE/DFA indicate high degrees of LRTC with long stretches over which past, present, and future states correlate with each other – this reflects the relatively stronger impact of slower frequencies with their longer cycles. The opposite is the case in low PLE/DFA values, where only the most recent time intervals exert impact on present and future ones – this reflects the relatively stronger impact of faster frequencies with their short cycles.

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The Scale-Free Self II: Temporal Nestedness and LRTC on Neuronal and Mental Levels

Recent studies showed that the brain's scale-free activity as measured with either PLE or DFA is related to mental features like self (Huang et al. 2016; Wolff et al. 2019; Scalabrini et al. 2017, 2019). These studies show that the degree of resting state PLE directly predicts the (1) degree of self-consciousness (Huang et al. 2016; Wolff et al. 2019), (2) task-related activity during self-specific stimuli (Scalabrini et al. 2019), and (3) the degree of temporal integration on a psychological level of self-specificity (Kolvoort et al. 2020). Hence, resting state scale-freeness seems to be central in mediating distinct components of self-specificity like self-consciousness, task-related activity, and temporal integration. Moreover, other studies demonstrated that scale-free activity is central in mediating other mental features like consciousness (Northoff and Huang 2017; Zhang et al. 2018) and mental abnormalities in psychiatric disorders like autism (Damiani et al. 2019) and schizophrenia (Northoff et al. 2020).

Taken together, these findings suggest that the brain's scale-free properties are central for mental features and thus, more generally, the mind including self and consciousness. Mental features like self and consciousness seem to operate across different time scales by integrating and nesting them within each other – one can speak of a scale-free self characterized by temporal nestedness and similarity across different time scales. Applying the above used terms, the self is scale-free and therefore featured by temporal nestedness and LRTCs on a mental level which seem to find their analogues on the neuronal level in the brain's spontaneous activity.

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The Scale-Free Self III: Nature and World Exhibit Scale-Free Temporal Structure

What do brain, weather, seismic earth waves, and stock markets have in common? At first glance, you will say that they do not share anything. Brain is a gray matter consisting of a bunch of neurons. Nothing of that can be observed in the others. Hence, brain is brain. While brain is neither weather, seismic earth waves, or a stock market.

Despite these differences on the surface, they nevertheless share some similarity on a deeper level. They all fluctuate in their activity with these fluctuations exhibiting the same structure, that is, scale-free structure with temporal nestedness and LRTC. One of the most interesting appeals of scale-free activity is its universality. Scale-free activity is not only present in the brain but ubiquitous in nature, that is, it occurs in various systems like climate, whether, seismic earth waves, sandpiles, magnetic fields, stock markets, and so on (Cocchi et al. 2017; He et al. 2010). Basically, one can say that wherever it fluctuates in a seemingly irregular way, LRTC and scale-free activity may provide some structure to what appears to me mere noise and purely random. There is "structure to irregularity", and that seems to hold across different systems in nature – "structure to irregularity" seems to be a unifying principle and key feature of nature.

For instance, He et al. (2010) investigated in her paper not only the scale-free dynamics of the brain's neural activity and its nested frequencies using electrocorticography (ECoG). She also investigated time series of activities from spontaneous earth seismic waves (collected within a time span of four months, as relevant for predicting earthquakes) and fluctuations in the Dow Jones index indicating stock market fluctuations (collected within a time span of 80 years). Time series from both earth seismic waves and stock market fluctuations followed power-law distribution in their temporal power spectrum. Interestingly, their power-law exponent (1.99 for seismic waves and 1.95 for stock market) came close to the one of the brain's intrinsic activity as measured in ECoG during wakefulness (mean of 2.2 for <0.1 Hz). Most interestingly, the time

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series in both earth seismic waves and stock market fluctuations contained nested frequencies with higher frequency fluctuations nesting in lower frequency fluctuations, just like in the case of the brain's intrinsic activity.

The Scale-Free Self IV: Self Is Nested Within the W orld Through the Brain's LRTC

If both environment and brain exhibit scale-free structure, one would expect their interaction. Specifically, one would exhibit that the LRTC of the environmental structures are contained and nested within the ones of the brain's spontaneous activity – both ecological and neuronal LRTC would be assumed to match with each other. Such "complexity matching" (Borges et al. 2018) has indeed been shown in recent studies on language and music. Borges et al. (2018) demonstrated how the degree of scale-freeness in the brain in different frequency bands tracks and follows the variations in the scale-free envelope of speech and how their degree of correspondence impacts speech comprehension. Analogously, Teixeira Borges et al. (2019) show how the scale-free structure of brain and music adapts to each other with the brain's neural activity somewhat rescaling the musical structure – the degree of their mutual adaptation predicted the subjects' degree of pleasure during music listening.

Taken together, scale-free activity is not a unique feature of the brain but ubiquitous in nature (i.e., the world). That allows the brain to compare and match its own self-free nestedness and LRTC with the ones of its respective environment with the degree of their matching shaping mental features like perception. Unfortunately, no studies have yet been reported that investigate whether the degree of matching between world and brain LRTC is related to the self and how one perceives one's own self to be part of the world (i.e., ecological neuro-ecological self), as we say.

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However, given the fact that the scale-freeness of the brain is directly related to the self (see above), one would assume that the self is connected and integrated within the world's scale-free structure through temporal nestedness and LRTC: like one smaller Russian doll is integrated within the next larger one and so forth and ultimately the most largest one, the self is integrated and nested within the brain which, in turn, is nested and integrated within the yet largest and most comprehensive temporal scale, the world. What connects the self through the brain to the world is its scale-freeness featured by temporal nestedness and LRTC.

Put into more conceptual terms, we can say that the (1) world-brain relation is scale-free characterized by temporal nestedness and LRTC such that the brain's smaller scale is nested and contained within the world's larger scale; (2) the scale-free nature of world-brain relation may be key in shaping and constituting the self; (3) the self is neuro-ecological and scale-free; and (4) the self intrinsically integrated within the world through the temporal nestedness and LRTC of world-brain relation.

Part II: Point of View Between World and Brain: Subjectivity in an Objective World

Point of View: Mental Surface Layer and Ecological Depth Layer

What is a point of view (PV)? The notion of PV is extensively used in literature and theatre with different persons or actors expressing different points of view on one and the same subject matter. Painting and photography rely on a slightly different notion of PV as providing access to events or objects and ultimately the world. The same applies to movies where the same event

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or object can be documented from different angles or PVs. Architecture and design provide yet another feature of PV as a multitude of perspectives can co-occur in a building like Gehry buildings (as the famous Guggenheim Museum in Bilbao).

Despite the extensive usage of PV in ordinary language and different disciplines, the concept of PV has rather been neglected in philosophy, as there is no established theory (see Campos and Gutierrez 2015, for a notable exception). Here I follow their account of PV although only to some degree. My main argument will be that the concept of PV can provide an intrinsic connection of world and self by providing the most basic and fundamental ground of subjectivity within the world.

According to Campos and Gutierrez, PV can be determined by two main features, reference to mental life including subject and access to something beyond itself (i.e., the world). Following their footpath, I will determine and rename these two features as deeper and surface layer of PV: the PV's reference to the subject and mental life is the surface layer of PV – I speak of a "mental surface layer". On the other hand, the PV's access to the world is primarily ecological and operates in the depth of the PV – I therefore speak of an "ecological depth layer".

The mental surface layer of PV refers to a subject with personal and mental features where it is manifest in terms like "opinion", "belief", "attitude", "feeling", "sentiments", "thoughts", "view", and so on of a particular subject or person (Campos and Gutierrez 2015, 2). Here PV is connected to the subject and its mental features in a necessary way:

> In that variety of uses, the notion of point of view may have two distinct meanings. In one of them, points of view are part of a mental life. They are connected to the mental life of some subjects with a personal character. In that sense, the expression "point of view" is interchangeable with words like "view", "opinion", "belief", "attitude", "feeling", "sentiment", "thought", etc. Points of view in that sense could not exist without a subject with quite a rich mental life.
>
> *(Campos and Gutierrez 2015, 2).*

In contrast, the ecological depth layer of PV is characterized by providing access to something that lies beyond the PV itself, namely the world – this pertains to what I describe as ecological depth layer of PV. Rather than on mental states within the subject itself (i.e., intra-subjectively), the focus is here on how the subject connects and relates to the world. Intra-subjectivity is replaced by inter-subjectivity, and isolation is replaced by relation:"

> There is another quite important meaning in the ordinary notion of point of view. In that second sense, points of view could exist without any actual subject exemplifying them. Here, points of view explicitly have a strong relational and modal, especially subjunctive, character. Points of view offer possibilities of having access to the world. They offer possibilities of seeing things (hearing them, touching them, etc.), possibilities of thinking about them (considering them, imagining them, etc.), and possibilities of valuing them (assessing them, pondering them, etc.).
>
> *(Campos and Gutierrez 2015, 3)*

Ecological Depth Layer of PV I: Relational Hub or Node

My main focus in this chapter is on the ecological depth layer of PV as it, as I argue, provides the ontological ground of subjectivity and ultimately also of the self, which is usually associated with the mental surface layer of PV. The key feature of the ecological depth layer of PV is its relational

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character as it relates and connects the self to and within the world. Relation means that the PV is connected and related to something beyond itself. Put into the context of ecological psychology, that "something beyond itself" is the world and specifically the environment that provides information. Such information includes natural, social, and cultural as well as descriptive and normative aspects (see below) – for the sake of simplicity, we will here lump them all together under the notion of ecological information understood in a broad way.

The ecological depth layer of PV shares ecological information with the world. That sharing is not total sharing though as the ecological depth layer of PV only offers the possibility of relating to certain kinds of ecological information of the world. For instance, the bat can access ultrasonar information in the world (Nagel 1974), which we as humans cannot do as related to distinct biophysical features based ultimately on different temporal and spatial scales or ranges. This leads us back to scale-free activity: the more different ranges or scales of time (and space) are covered by the ecological depth layer of its PV, the more extensively and better the self can relate to the world and its ecological information. We consequently assume that the ecological depth layer of PV is nested and contained within the world and its ecological information in a scale-free world.

Scale-free nesting of the ecological depth layer of PV within the world means that there are LRTC between world and self: the world's much longer timescales are correlated with the self's shorter time scales, as the former nest and contain the latter in a self-similar (or self-affine) way, just like the larger Russian doll contains the smaller ones. Accordingly, what empirically is described as scale-free activity featured by temporal nestedness and LRTC can now on the conceptual side be associated with the ecological depth layer of PV as the relational basis and fundament of the self.

We saw that the relation of self and scale-free activity is mediated by the brain's scale-free activity and how it relates to the world's scale-free (i.e., world-brain) relation. Putting all together, we now postulate that the ecological depth layer of PV is ontologically based on the world-brain relation through scale-free activity featured by temporal nestedness and LRTC: the more world and brain are temporally (and spatially) nested within each other exhibiting LRTC between them, the more the temporal (and spatial) range of the ecological depth layer of PV and ultimately its self can relate to and be extended towards and within the world. If, in contrast, the temporal range of the ecological depth layer of PV is more limited meaning low degrees of temporal nestedness and LRTC with the world, the more restricted and isolated the self will be in its relation to the world. We tentatively assume that the latter holds in case of a self suffering from early childhood trauma.

Campos and Gutierrez describe the PV is a "relational entity". However, the concept of entity means that something is somewhat clearly distinguished with clearly defined borders from that what surrounds it. That is not compatible with the intrinsically relational and scale-free nature of the ecological depth layer of PV though. Given the scale-free integration of the ecological depth layer of PV within the world and its scale-free features, one may better describe PV as "relational hub or node". Much like hubs or nodes are constituted by their relation or connectivity to the rest of the network, PV's are characterized by their relation or connection to the rest of the world's temporo-spatial networks. Taken as relational hub or node, the ecological depth layer of PV provides "structure to irregularity", namely it structures the world's various temporal scales for the self in such way that the latter can access the former (i.e., ecological information).

Ecological Depth Layer of PV II: Time as Intrinsic Rather Than as Add-On

What is a point of view? Traditionally, the point of view has been associated with a fixed entity like mental or physical substances or properties. Taken in such sense, the point of view is static and atemporal. That distinguishes the traditional concept of the point of view from our characterization of the ecological depth layer of PV that, rather than being static and fixed, is highly dynamic and flexible and therefore intrinsically temporal rather than atemporal.

Scale-free activity provides "structure to irregularity": even if, for instance, the activity of different regions or the power of single frequencies change in an irregular way, they can still maintain their overall structure. Hence, being susceptible to change as distinct from non-change, scale-free activity is neither purely irregular and 100% dynamic nor completely regular and 100% static – it operates beyond or, more precisely, on a continuum between the conceptual extremes of dynamic and static, flexible and fixed (see also Northoff and Tumati 2019).

This points a core feature of the ecological depth layer of PV, namely its intrinsically temporal nature as entailed by its scale-free features. That converges with Campos and Gutierrez (2015), who also characterize PV as intrinsically temporally.

> Let us say understand temporal points of view as follows: A temporal point of view is a point of view identifying some differences in non-conceptual contents (qualitative, phenomenal, experiential contents) as "changes" of content. The identification can be either conceptual or not conceptual. This is a very important point. Subjects without conceptual capacities could be capable of adopting temporal points of view. In any case, in a temporal point of view certain differences in non-conceptual content count as a "change": something future becoming present, or something present becoming past. The idea behind that characterisation of temporal points of view is very simple. Temporal points of view take some differences in the non-conceptual contents of experience as being temporal differences entailing a "change". This is the crucial point.
>
> *(Campos and Gutierrez 2015, 93)*

Where is the time of the ecological depth layer of PV coming from? We suppose that the intrinsically temporal nature of the ecological depth layer of PV is ultimately coming from and originates within the world itself (i.e., world-based time; Northoff and Chen 2019). By connecting and relating to the world in a scale-free way, the ecological depth layer of PV participates and integrates with the ongoing time of the world such that both share one and the same time in a scale-free way, that is, across their different ranges or scales of time. As its scale or range is much larger, the world's time nests and contains the time of the ecological depth layer of PV – the world emplaces PV within itself.

Interlude About World and PV: Emplacement World and Perspectival World

The intrinsically temporal and scale-free emplacement of the ecological depth layer of PV within the world specifies and converges well with the concept of "emplacement world" as proposed by Campos and Gutierrez (2015, 13–14, 40). They distinguish two concepts of world: "emplacement world" and "perspectival world". The emplacement world is the world within which PV is situated (i.e., emplaced), while the perspectival world is the one that one perceives and cognizes from a certain PV. Without going into much philosophical detail, I here use these two concepts of world to further characterize the two layers of PV.

The emplacement world reflects the deeper ecological layer of PV, it is the world within which PV is situated (i.e., emplaced), allowing its direct contact and relation with existence and reality of the world. PV is emplaced in the temporal (and spatial) structures and regularities of the world that signify the world prior to and independent of PV itself. Without going into full detail, we characterize the emplacement world as intrinsically temporal and scale-free between itself and its various parts like subjects or selves that, through temporal nestedness and LRTC,

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are nested and contained within the world in a temporal way. Taken in such sense, the concept of the emplacement world is an ontological concept as it refers to the existence and reality of the world as whole and its parts, like selves or subjects.

In contrast, the concept of perspectival world is primarily an epistemological (rather than ontological) concept as it refers to the surface cognitive layer of PV, that is, the world we as subjects perceive and cognize in a perspectival way in the terms of first-, second-, or third-person perspective (FPP, SPP, TPP). The self is typically associated with FPP, which is designated as subjective as distinguished from the more objective TPP. While not elaborating on this association, we here argue that all three perspectives characterize only the mental surface layer of PV but not the ecological depth layer of PV that remains pre-perspectival rather than being perspectival by itself. Let us illustrate that by the notion of pre-reflective self-consciousness as developed in phenomenology.

Ecological Depth Layer of PV III: Pre-perspectival and Pre-phenomenal

We experience our own self and the world in first-person perspective (FPP). FPP is conceived as the hallmark feature of both subjectivity and consciousness in phenomenology, as both are conjoint in what is described as pre-reflective self-consciousness (Zahavi 2005; Gallagher and Zahavi 2019). In a nutshell, pre-reflective self-consciousness describes the immediate and first-personal givenness of experiences that is always already there prior to and independent of any reflection, as in introspection, attention, or recognition. Even when I am conscious of an event or object in the world, I am already conscious of myself in the pre-reflective mode. Pre-reflective self-consciousness signifies the intrinsically subjective nature of consciousness featured by its first-person perspective and its phenomenal (rather than non-phenomenal) character.

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How does pre-reflective self-consciousness stand in relation to PV? FPP is often equated with PV: the first-person perspective is supposed to be based on a specific point of view which marks FPP subjective, perspectival, and phenomenal. PV is taken here as intra-subjective, mental or phenomenal, and isolated. That pertains only to the mental surface layer of PV, whereas it does not apply to the ecological depth layer of PV that is inter-subjective, ecological, and relational. This is, for instance, reflected in the following quote by Thomas Nagel from his famous paper "What It Is Like to Be a Bat": "I am not advertising here to the alleged privacy of experience to its possessor. The point of view in question is not one accessible only to a single individual. Rather it is a type" (Nagel 1974, 441). (Note also that Nagel does not speak of FPP in this paper at all but only of a point of view that distinguishes bats' experience and subjectivity from the one of humans).

From that it follows that the ecological depth layer of PV can be characterized neither by FPP (nor by SPP and TPP, as those operate on the same level or layer as FPP) nor by pre-reflective self-consciousness. Characterizing the ecological depth layer of PV by FPP or pre-reflective self-consciousness would be to confuse the former with the mental (or phenomenal) surface layer of PV as their sufficient condition. We consequently need to characterize the ecological depth layer of PV in terms other than FPP (or SPP and TPP) and pre-reflective self-consciousness. At the same time, the ecological depth layer of PV must be somehow related to FPP and pre-reflective self-consciousness, as otherwise it could not serve as depth layer of PV but would remain unrelated to PV.

We propose that the ecological depth layer of PV can be conceived as "pre-perspectival" and "pre-phenomenal" (Northoff 2014, 2018) as it provides the necessary albeit non-sufficient condition of possible perspectives and phenomenality: rather than being actually perspectival and phenomenal by itself, the ecological depth layer of PV makes possible FPP and pre-reflective

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self-consciousness without actually realizing them yet as such. In other terms, the ecological depth layer of PV provides the ontological capacity or predisposition of perspectives and pre-reflective self-consciousness – it is an ontological predisposition of perspectives and pre-reflective self-consciousness that characterizes the mental surface layer of PV and its self (see Northoff 2018, chap. 10 for the concept of ontological predisposition).

In conclusion, we assume that the pre-perspectival and pre-phenomenal nature of the ecological depth layer of PV (as ontological predisposition of the perspectival and phenomenal nature of self) is based on its intrinsically temporal and scale-free nature that constitute its relation to and emplacement by the world (i.e., emplacement world). This marks the self as both neuro-ecological and pre-phenomenal, which first and foremost make possible the phenomenal, mental, and cognitive features of self as they can be associated with the mental surface layer of PV.

Conclusion

Subjectivity in Neuropsychoanalysis: Point of View and Psychoanalytic Concepts

One may now raise the question how the three key concepts – world-brain relation, neuro-ecological self, and point of view – stand in relation to psychoanalytic concepts of self and ego. Without being able to go into full detail, I make some hints in this direction.

The point of view is a temporo-spatial structure that, being intrinsically scale-free, operates across different spatial and temporal ranges or scales. That is exactly implied in Freud's original concept of the threefold structure of the ego that (as in id, ego, and super-ego) also operates in a scale-free way across different temporo-spatial scales. We may consequently want to extend the BMSS (Northoff 2016) in psychoanalytical terms, where id, ego, and super-ego can be conceived as distinct temporo-spatial layers that, as the Russian dolls or the different layers of an onion, are nested within each other. Future research may want to specify the temporo-spatial scales or ranges of id, ego, and super-ego on a psychological level and then associate them with corresponding scales on the neuronal level.

The point of view is based on continuous construction that, empirically, may be traced to the continuous relation of the brain's ongoing activity to the external environment's temporo-spatial scale-free structure. That very same relation of brain and environment has been described as self-related processing, as it constructs the self-specificity of otherwise non-self-specific events and objects (Northoff 2016). On the psychodynamic side, self-related processing may well correspond to what Winnicott 1975) described as "subjective relating" and Brockman (2002, 90) as "attachment" (see also Scalabrini et al. 2018) with the resulting self-specificity of particular events or objects corresponding to what Kohut described as "self-objects" (Kohut 1977; Northoff 2011).

Finally, as emphasized in psychoanalysis, the ego is threefold structure; similarly, the point of view is also determined by in a multi-layered way with deeper and surface layers that, as I assume, can be split into multiple layers in the future. Importantly, the distinct layers are nested within each other including showing LRTC. Analogously, one may assume that id, ego, and super-ego are all temporally nested within each other exhibiting LRTC which, for instance, would well explain the strong impact of the id on ego and super-ego. Due to its close neuro-ecological proximity to the environment with large extended temporo-spatial scales, one may not wonder that the id "knows more" (in an unconscious way) than both ego and super-ego which, being neuro-affective (Solms 2015) and neuro-cognitive, operate on more restricted temporo-spatial ranges than the Id.

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