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Phenomenal Depth

A Common Phenomenological Dimension in Depression and Depersonalization

Abstract: *Describing, understanding, and explaining subjective experience in depression is a great challenge for psychopathology. Attempts to uncover neurobiological mechanisms of those experiences are in need of theoretical concepts that are able to bridge phenomenological descriptions and neurocognitive approaches, which allow us to measure indicators of those experiences in quantitative terms. Based on our own ongoing work with patients who suffer from depersonalization disorder (DPD) and describe their experience as flat and detached from self, body, and world, we introduce the idea of phenomenal depth as such a concept. Phenomenal depth is conceptualized as a dimension inherent to all experiences, describing the relatedness of one's self with one's mental processes, body, and the world. More precisely, it captures the experience of this relatedness and embeddedness of one's experiences, and it is thus a meta- or second-order experience. The psychopathology of DPD patients can be understood very generally as an instance of reduced phenomenal depth. We will argue that similar experiences in depression can also be understood as a reduction in phenomenal depth. We relate those ideas to neurocognitive studies of perception, emotion regulation, and the idea of predictive coding. Finally, we will speculate about possible*

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Journal of Consciousness Studies, **20**, No. 7–8, 2013, pp. 269–91

neurobiological underpinnings of the dimension of phenomenal depth.

Patients suffering from depersonalization disorder report alterations in their sensory, self-referential, and emotional processing that can be described as a lack of *relatedness* in combination with reduced experiential richness. Similarly, patients suffering from certain types of depression can be characterized as experiencing alienation from both their surroundings and their emotional experience. Building on these phenomenological observations and clinical characteristics, we propose the conceptualization of a common dimension underlying these and similar clinical phenomena. This dimension, which we call 'phenomenal depth', cuts across diagnostic boundaries, potentially allows for quantification, and may thus facilitate neurocognitive investigation. The experience of phenomenal depth can be altered severely in psychological disorders. Based on our clinical observations, we assume that all objects of experience (including one's own or others' feelings, one's body, and objects of the outside world) have adherent to them a sense of depth of that experience. The degree of this subjective richness or experiential vividness, which we consider a structural feature of consciousness (*cf.* Fuchs, 2002; 2010; Seth, 2009), can be captured along the dimension of phenomenal depth. Its impairment is a common feature in depression and depersonalization disorder.

In the following, we review pathological constraints of phenomenal depth in certain types of depression and in depersonalization disorder in order to extract commonalities.[1] We thereby wish to put forward the idea that different experiential qualities can be related to the dimension of phenomenal depth, spanning sensory and self-related or emotional processes.

Alterations of phenomenal depth find their expression in altered sensory perception (visual 'flatness' or lack of three-dimensionality, increased perceived distance from acoustic sources, etc.) but also in altered self-related and self-referential processes (such as emotional experience, meta-cognition, and alienation from thought processes). Thus, phenomenal depth does not only tie together alterations in sensory and self-related or emotional processing but may also enable us to locate different clinical conditions on a common phenomenological dimension. We thereby build on earlier work by Church (2003) and

[1] While qualitatively similar experiences are also regularly reported by anxiety patients as occurring during panic attacks or post-traumatic dissociation, they typically last only a few minutes in these patients. Here, we will focus on depression and depersonalization disorder, that is, disorders in which such symptoms are typically chronic.

Kunzendorf *et al.* (2010) who characterized the phenomenal world of a depressed person as 'meaner and grayer', 'thin and dry' (Church, 2003, p. 175; cited from Ingmar Bergman's *Scenes from a Marriage*), 'undifferentiated', 'flat' (Church, 2003, p. 179), and 'lacking depth' (*ibid.*, p. 177) compared with a healthy person's world of experience. What Church calls 'perceptual failures' (*ibid.*, p. 175) does not refer to deficits in attention or to distortions of sensory systems at a low level (like impaired stereopsis). Describing a lack of differentiation that affects all senses, she points out that there is a 'difference between being preoccupied or absent-minded, where very little is noticed, and being depressed, where what is noticed seems deficient' (*ibid.*, p. 175). Using a combination of self-report questionnaires and measures of the perception of visuo-spatially ambiguous shapes, Kunzendorf *et al.* (2010) also show empirically that depression is associated with a 'flatter' self-perception and a 'flatter' phenomenal world (pp. 447, 455).

Importantly, phenomenal depth is a meta-cognitive or meta-affective experience, that is, it is not about the intensity of (deep) feelings but about the feeling of depth. This conception aims at capturing the degree of experiential immersion or embeddedness of an individual in his or her environment.[2]

As we will detail below, the experience of limited phenomenal depth in certain types of depression and in depersonalization disorder entails more than a shift in sensory perception. Although phenomenal depth is certainly related to visuo-spatial depth perception, the two are not identical and should not be confused. A classical phenomenological treatise of the dimension of (visuo-spatial) depth states that 'it is, so to speak, the most "existential" of all dimensions, because… it is not impressed upon the object itself, it quite clearly belongs to the perspective and not to things' (Merleau-Ponty, 1945/1962, p. 298). The wider scope of the term *depth* already implied in Merleau-Ponty's observation supports that we extend it beyond the visuo-spatial domain. Therefore, the notion of phenomenal depth explicitly includes more extensive experiential alterations with respect to oneself and the world in broader sensory, affective, and cognitive domains and we consider it suitable to capture the pervasive disconnectedness as it occurs in depersonalization and other psychopathological states. Phenomenal depth is also not identical with the intensity of a particular experience: experiences that have a particu-

[2] A related notion of experiential vividness, called *gradual presence*, and its potential bodily constitution in a sensorimotor or enactivist framework has recently been discussed by Fingerhut (2012).

larly high or low phenomenal depth are not just more or less intense but qualitatively different. As a phenomenological concept, phenomenal depth is meant to focus not on the content but on the form and structure of experience (*cf.* Fuchs, 2002; 2010). While the focus of this article lies on the decrease in phenomenal depth as it occurs in certain psychiatric diseases, the concept can potentially be extended towards increases in phenomenal depth as they may occur in other psychopathological states (e.g. in mania), after drug use, or in otherwise altered states of consciousness, for example through meditative practices. We assume that phenomenal depth also varies within a normal range in our daily life, even though these variations need not always be fully conscious.

Understanding the fundamental changes similarly appearing in certain types of depression and in depersonalization disorder as alterations along the common dimension of phenomenal depth may thus provide a handle for the experimental manipulation and measurement of subjective emotional experience and alterations thereof.

In what follows, we will first describe depersonalization in more detail, both as a symptom and as a syndrome, often overseen by psychiatrists. Then, we will give a short historical and conceptual overview of the (phenomenological) overlap of depersonalization and depression. Thereafter, we will discuss how conceptualizing both depersonalization and depression (and potentially other psychopathologies) as alterations along the shared phenomenological dimension of phenomenal depth may be useful for their neurocognitive investigation and will relate it to the idea of the brain as a prediction machine.

1. Phenomenal Depth in Depersonalization (Disorder)

Patient reports of depersonalization in the literature and in our own studies, as well as the most commonly used specific self-report questionnaire, the Cambridge Depersonalization Scale (CDS; Sierra and Berrios, 2000), lead us to understand depersonalization and derealization as involving a loss or reduction of phenomenal depth. Particularly the aspects of detachment from self and world together with a persistent emotional numbing and 'flat or lifeless' perception (CDS item 2) provide hints for this connection.

Although phenomena reminiscent of depersonalization have been described at least since the early nineteenth century, the term only appeared in 1898 when it was introduced into the medical realm by French psychiatrist Ludovic Dugas using an expression he encoun-

tered in the personal diaries of French-Swiss philosopher H.F. Amiel (*cf.* Sierra and Berrios, 1997).

While depersonalization is often reduced to *feelings of unreality* (e.g. Radovic and Radovic, 2002), the term has been used to describe a much broader but phenomenologically stable (Sierra and Berrios, 2001) cluster of mental disturbances, centring around a felt disconnectedness from one's own mental processes, emotions, and body.

In addition, these subjective experiences of estrangement or detachment from oneself are frequently accompanied by derealization, the sense that one's surroundings are unfamiliar or that the world appears unreal.

Around three quarters of the general population experience mild or transient depersonalization-derealization symptoms at least once in their lives (Hunter, Sierra and David, 2004). Such symptoms can, for example, be induced by hypnosis (Röder *et al.*, 2007), fatigue (Mayer-Gross, 1935), jet lag and sleep deprivation (Bliss, Clark and West, 1959), sensory deprivation (Reed and Sedman, 1964). They may appear after persistent stress or drug use (such as cannabis or hallucinogenic substances; e.g. Mathew *et al.*, 1999), but also spontaneously during fMRI experiments (Michal *et al.*, 2005) and in reaction to traumatic incidents (Daniels *et al.*, 2012). Up to 56% of psychiatric inpatients report current experiences of depersonalization (Davidson, 1966), and it has been suggested that in the context of mood and anxiety disorders the presence of depersonalization symptoms correlates with higher disease severity and poorer response to treatment (Mula, Pini and Cassano, 2007).

Under certain conditions, depersonalization can also be considered a pleasant experience and there certainly are culturally approved religious or ritual activities which explicitly evoke or seek these phenomena. In this line, a transcultural approach found that reported depersonalization experiences are susceptible to cultural variation in that the prevalence of depersonalization in psychiatric inpatients (Sierra *et al.*, 2006) and the frequency of depersonalization during panic (Sierra-Siegert and David, 2007) was found to be significantly lower in non-western and more collectivistic countries as compared to more individualistic societies.

In some people, however, these phenomena become persistent and interfere with their individual and social functioning, thus reaching the threshold for diagnosis of a mental illness.

2. Depersonalization as Syndrome: Depersonalization Disorder

While depersonalization and derealization frequently occur as co-morbid symptoms in other psychiatric disorders, they can amount to a chronic mental illness in their own right: the ICD-10 (WHO, 2007) classifies the 'depersonalization-derealization syndrome' as an independent neurotic illness (F48.1), while the DSM-IV (APA, 1994) distinguishes between 'depersonalization disorder' (DPD), considered a dissociative disorder (300.6), and 'derealization' (without depersonalization), which is separately listed in examples of a 'dissociative disorder — not otherwise specified' (DDNOS, 300.15).[3] The diagnostic criteria in both ICD-10 and DSM-IV comprise loss of emotion with feelings of estrangement/detachment from one's thinking, body, or surroundings. They also mention a perceived spontaneous change of experiential quality (ICD-10: 'unreal, remote, or automatized'; DSM-IV: 'as if… in a dream', 'external world as strange or unreal', 'other people seem unfamiliar or mechanical') with normal sensorium and the retained capacity of emotional expression. Importantly, both diagnostic manuals require patients to show intact reality testing, that is, to be free of delusions.

Studies from different countries in North America and Europe have repeatedly found a lifetime prevalence in the range of 1–2% (Hunter, Sierra and David, 2004; Michal *et al.*, 2009). Although this prevalence rate is comparable to that of other psychiatric disorders such as schizophrenia or obsessive-compulsive disorder (OCD), DPD is much less frequently diagnosed.

Several more general assessment tools exist for dissociative experiences which include phenomena of depersonalization (e.g. the Dissociative Experiences Scale, DES; Bernstein and Putnam, 1986). However, as mentioned above, with the CDS there is also an established self-report questionnaire to specifically measure depersonalization-derealization symptoms. It captures the frequency and duration of depersonalization experiences, exists both in a state (CDS-22) and a trait (CDS-30) version, and has been translated into several other languages (e.g. Michal *et al.*, 2004; Molina Castillo *et al.*, 2006).

[3] In line with patient reports, the vast majority of cases in the literature, the view of the ICD-10 as well as current recommendations for the revision of the diagnostic criteria in DSM-5 (Spiegel *et al.*, 2011), we will not explicitly distinguish between depersonalization and derealization in this text. We rather take *depersonalization* as shorthand for *depersonalization-derealization*.

Several items of the CDS pertain to experiential *depth*: while some items of the CDS-30 describe an alteration in the experience of sensory input (item 2: 'What I see looks "flat" and "lifeless", as if I were looking at a picture'; item 19: 'Objects around me seem to look smaller or further away'; item 11: 'Familiar voices (including my own) sound remote and unreal'), others pertain to the feeling of disconnectedness from the outside world (item 1: 'Out of the blue, I feel strange, as if I were not real or as if I were cut off from the world'; item 13: 'My surroundings feel detached or unreal, as if there were a veil between me and the outside world'; item 26: 'I feel so detached from my thoughts that they seem to have a "life" of their own') or one's own bodily actions (item 3: 'Parts of my body feel as if they didn't belong to me'; item 6: 'Whilst doing something I have the feeling of being a "detached observer" of myself'; item 8: 'My body feels very light, as if it were floating on air'; item 24: 'When I move it doesn't feel as if I were in charge of the movements, so that I feel "automatic" and mechanical as if I were a "robot"').

Factor analyses on CDS scores from two large and independent cohorts extracted four (Sierra *et al.*, 2005) and five (Simeon *et al.*, 2008) factors constituting the syndrome. Both studies converge on the core factors of *emotional numbing*, *unreality of self/anomalous body experience + perceptual alterations*, and *alienation from/unreality of surroundings*, and only differ on one remaining factor each: while Sierra *et al.* (2005) focus on anomalous memory disturbances, Simeon *et al.* (2008) emphasize alterations in the temporal domain for their characterization of depersonalization.

DPD typically has its onset in adolescence or early adulthood (Sierra, 2009, p. 50) and it is thought to affect both sexes equally. The initial development can be sudden or gradual and has been reported to occur spontaneously after medical or illicit drug use or during a stressful life period (Simeon *et al.*, 2003; Baker *et al.*, 2003). Specifically, there is recent evidence for an onset of DPD in adolescence after consuming cannabis (Hürlimann, Kupferschmid and Simon, 2012). Depersonalization also occurs in neurological conditions such as migraine (Cahill and Murphy, 2004; Reutens, Nielsen and Sachdev, 2010, for review) or temporal lobe epilepsy (e.g. Lambert and Sierra, 2002). Emotional neglect by parents (Michal *et al.*, 2007; Simeon *et al.*, 2001) as well as increased anxiety during childhood (Lee *et al.*, 2010) emerged as the most significant psychosocial predictors for the development of depersonalization symptoms and a diagnosis of DPD.

Both in its common transient form and in its pathological chronic manifestation, depersonalization refers to a cluster of experiential

alterations. Although its symptom descriptions vary in their details, depersonalization exhibits a comprehensive disconnectedness from oneself and the world, which pervades all sensory, affective, and cognitive aspects of experience.

In order to extract the fundamental character of this cluster of disturbances we introduce the underlying dimension of phenomenal depth, understanding depersonalization as involving a reduction in phenomenal depth.

3. History and Concepts of Depersonalization in Depression

Similar alterations, which can be interpreted along the continuum of phenomenal depth, have previously been described in patients with depression. Kraus (2002; 2008) differentiates two conceptually and clinically interesting forms of depersonalization that occur in severe major depression and that have historically been described: consciously experienced depersonalization and pre-reflectively lived depersonalization. In the former, alienation-depression, the patients have insight into the disorder and consciously experience the alienation from their own selves and from the surrounding world, while in the latter, melancholic depression, the patients *live* the alienation without reflecting upon it (as described by von Gebsattel, 1937). While consciously experienced depersonalization may also be secondarily present in otherwise typical cases of major depression, in the following, only those subtypes of depression shall be considered where one form of depersonalization is *formative* for the clinical picture.

Alienation-Depression

The type of severe depression in which consciously experienced depersonalization plays a dominant role has been described by Petrilowitsch (1956) as alienation-depression (*Entfremdungsdepression*). The characteristic, consciously experienced alienation from oneself and from the outside world is accompanied by a loss of feeling towards oneself, other persons, and objects of the world (*cf.* Johnson, 1935), which may be considered a loss of basic 'existential feelings' (Kraus, 2002; *cf.* also Ratcliffe, 2008; 2009, for a related notion). In the description by Petrilowitsch (1956), patients typically complain about low mood or a general inability to experience emotions, reduced physical and intellectual capacities, and a distorted sense of time. At the same time, objective measures or observable symptoms provide little evidence

for their condition: they seem only slightly depressed and sometimes taciturn, with, if at all, mildly to moderately impaired psychomotoric and intellectual performance. In addition, patients report a marked lack of drive, a loss of spontaneity, a feeling of acting like an automaton, and an inability to vividly imagine things. However, during conversation they are able to respond adequately and sometimes even appear to be energetic. Frequent coexisting symptoms are disturbed bodily sensations and hypochondriac anxieties related to these experiences of somatopsychic alienation as well as obsessions and compulsions. According to Petrilowitsch (1956) delusions do usually not occur in this type of depression and, in contrast to typical major depression and also to melancholic depression (*cf.* Kraus, 2002; Fuchs, 2010), patients suffering from alienation-depression do not experience excessive feelings of guilt. Instead, recognizing their own impairments in certain domains leads to feelings of insufficiency without regarding this insufficiency as their own fault. Comparing expectations or norms to deficient actualities is a central feature of alienation-depression and Petrilowitsch (1956) attempts a psychodynamic explanation along these lines: on the one hand, the discrepancy between the experienced existential significance of the psychopathological deficits and the low severity of the observable symptoms is a determining characteristic of alienation-depression. On the other hand, Petrilowitsch (1956) postulates that while the *motivational component* of the patient's personality or temperament ('*Antriebsseite der Persönlichkeit*', p. 294) is impaired, the *core personality* (encompassing inherent or acquired dispositions, attitudes, and morals) remains intact. This means that the patients still have certain expectations how they should behave and feel. However, their manifest emotions are always weaker than they should be according to the expectations stemming from their intact *core* personality and the expectations are never met — which culminates in the agonizing experience of having lost all feelings ('*das qualvolle Erlebnis des Gefühls der Gefühllosigkeit*'; *ibid.*, p. 297).

The apparent paradox of reduced emotional experience in combination with high subjective distress has also been addressed more recently with respect to depersonalization disorder: quoting Ackner (1954), Medford proposes an attentional imbalance in which 'sufferers tend to focus attention on inner sensations and concerns, at the expense of attending to the external world' (Medford, 2012, p. 141).

While Petrilowitsch's '*Entfremdungsdepression*' was originally conceptualized as a type of depression, the consciously experienced depersonalization phenomena prevail and there is a high overlap with

depersonalization disorder. We therefore propose that the symptomatology of alienation-depression, such as the loss of feeling, the impression of acting like an automaton, or the inability to vividly imagine things, can similarly be understood as expressions of reduced phenomenal depth.

Particularly, an imbalance or tension between expectation and actual (affective) experience or behaviour is supposed to play a crucial role in the aetiology or maintenance of the symptoms. We follow Petrilowitsch in assuming that it is this subjectively experienced tension which is felt as reduced phenomenal depth in the case of alienation-depression. Understanding alienation-depression as originating from a reduction in phenomenal depth thus suggests the involvement of a matching or calibration component which may provide hints for a neurobiological conceptualization in the predictive coding framework (*cf.* below).

Melancholic Depersonalization

The type of severe depression in which pre-reflectively lived depersonalization plays a dominant role has been described as *melancholia* or *melancholic depersonalization* by Kraus (2002; 2008). He explicitly uses the older term 'melancholia' (Kraus, 2002, p. 169; 2008, p. 243) in order to distinguish it from mood disorders as they are described in ICD-10 and DSM-IV. Drawing on a continuous tradition (ranging from Heinroth to Schilder, von Gebsattel, von Ditfurth, Hutter, and Schulte) Kraus sees lived depersonalization as the basic disturbance underlying melancholia and thus introduces the more precise term 'melancholic depersonalization' (Kraus, 2008, p. 243), which is characterized by melancholic mood, an inhibition of drive, an altered relation to oneself, a lack of both self-transcendence and of being directed to the world (Griesinger, 1867; von Gebsattel, 1937), delusions, local and somatic dysaesthesia, and complaints about being unable to speak, move, or eat (in the absence of any bodily impairments).

According to Kraus (2002; 2008), the melancholic mood alteration is not just experienced as a particularly high degree of sadness but as something qualitatively different from normal moods such as non-pathological sadness or happiness. Kraus thus considers it insufficient to specify additional somatic or psychotic symptoms — as is done in the ICD-10 — for capturing the difference between melancholia and typical major depression. Although melancholic patients are usually able to differentiate between a melancholic mood alteration and non-

pathological low mood, this difference is often difficult for them to describe. The patients experience the melancholic mood alteration as something strange that is forced upon them and takes complete hold of the person while at the same time remaining inaccessible. It is thus impossible for the patients to identify with their own mood and they experience themselves as alienated, empty, and lifeless.

Kraus (2002; 2008) compares this to what Freud (1967) describes as *the emptiness of the I*. The melancholic mood cannot be modulated, which makes it virtually impossible for the patient to experience other emotions, resulting in a loss of feelings. As the condition appears to be unmotivated and inexplicable, it is difficult for others to empathize with the patient about it. Melancholic depersonalization may sometimes be preceded or followed by normal low mood, but this is not at the core of the melancholic mood alteration.

This loss of feelings, the altered experience of oneself, and the lack of both self-transcendence and of being directed to the world, along with the inhibition of drive, can again be understood as signs of reduced phenomenal depth. However, it remains unknown what this descriptive similarity between alienation-depression and melancholic depersonalization means with regard to underlying mechanisms.

In Kraus's framework, a deficient structure of the self is identified as the cause of lived depersonalization underlying melancholia. The capability of self-reference is assumed to be greatly reduced in lived depersonalization. While the *me*, defined by Mead (1934) as the socialized aspect of the person, remains intact, the *I*, the active and creative aspect of the person that brings about a sense of freedom and initiative (*ibid.*), transcending the *me* and being directed towards the future, is severely impaired in melancholic depersonalization. The relation to oneself is disturbed and the capability to 'take a position towards oneself' (Kraus, 2002, p. 169) or towards one's own feelings is diminished, resulting in the above-described symptomatology.

In melancholic depersonalization the reduction or loss of phenomenal depth thus may have different causes than in alienation-depression. Whereas in the latter reduced phenomenal depth results from the experienced tension between expected and actual (affective) experiences, in the former it may result from a deficient structure of the self.

4. The Dimension of Phenomenal Depth in Depression

What should have become apparent in the clinical descriptions presented above is also visible in the statistics of the high co-morbidity

between depersonalization and depression (also mentioned above). While historically '[a]n association between depression and depersonalization has been known for a long time' (Sierra, 2009, p. 75), also more recent studies recognize their diagnostic overlap: Mula and colleagues (2010) extracted two distinct but closely related psychopathological dimensions in patients with major depression and bipolar disorder: *anhedonia*, the diminished or abolished capacity to experience pleasant emotions, and *affective depersonalization*, an experienced emotional numbing which generally applies to all emotions.

A more theoretical treatise by Church (2003) describes the phenomenal world of a depressed person as 'lacking depth, both in space and in time' (p. 177) and as 'an undifferentiated and flat sort of place' (p. 179) because '[a]s one's capacity to imagine alternative perspectives on the world diminishes, so too does the experienced depth of that world' (pp. 179f). In contrast, a normal person's experience includes 'a world "behind" the flat surface of appearances' (*ibid.*, p. 180), 'a world of many possibilities' (p. 184). Church thus relates experiential depth to the 'space of possibilities' as it has been repeatedly conceptualized in phenomenological philosophy, for example in Husserl's and Merleau-Ponty's *horizons* or, more recently, in Ratcliffe's (2008; 2012) formulation of existential feelings as 'configuration[s] of the possibility space [i.e. the sense of possibilities for perceptual and practical accessibility] that shapes all experience, thought and activity' (Ratcliffe, 2012, p. 44). Ratcliffe explicitly denies that these configurations of the possibility space differ in depth (*ibid.*), but acknowledges that changes in the configurations of this possibility space do.[4]

Based on Church's conception of phenomenal flatness and on previous studies indicating that 'depressed persons generate imagery more slowly (Cocude, Charlot and Michel, 1997), generate less vivid imagery (Sacco and Ruggieri, 1997), generate less positive fantasies (Starker and Singer, 1975), and imagine positive future events less vividly than negative future events (Holmes *et al.*, 2008)', Kunzendorf *et al.* (2010, p. 455) set out to empirically investigate the relationship between depressive symptomatology and perceptual flatness. Their study combined established self-report questionnaires

[4] In the same chapter, Ratcliffe (2012) develops the concept of 'affective depth' which is only marginally related to the dimension of phenomenal depth as we propose it. For Ratcliffe, the more severe the effect of limiting the possibility space of the patient, the 'deeper' the change in existential feeling. We suggest that experiential depth is flattened or reduced in psychopathologies that involve a detachment from self and world like depersonalization disorder and certain types of depression.

assessing depressive and anxious traits with new measures of 'flat versus deep' self, person, and object perception. While self and others had to be explicitly rated with pairs of adjectives, semantically spanning the space between flat and deep, object perception was assessed implicitly: the bigger of two ambiguous shapes, an equilateral four-sided and a circular shape, needed to be identified on a graded scale. When perceiving the object as a flat, two-dimensional plane, the area of the circle would be bigger than the one of the square, while a bias towards deeper perception would rather tend towards identifying the three-dimensional volume of the cube as bigger than the one of the sphere. The results demonstrate that a tendency for depressive symptoms (but not for normal sadness) is associated with a *flatter self, person, and object perception* and hence a generally *flatter phenomenal world*.

The study by Kunzendorf *et al.* (2010) can be seen as an initial attempt to relate the concept of experiential or phenomenal depth to psychological traits or tendencies and its results indicate the applicability of phenomenal depth to neurocognitive investigation. Owing to our own research background, we wish to propose the phenomenological dimension of phenomenal depth for clinical investigation, where it aims to capture the level of felt depth of subjective experience across diagnostic boundaries. Accordingly, we suggest that although they are regarded as different syndromes, DPD and certain types of depression share a common core element in that both conditions are characterized by a reduction in phenomenal depth. Our prediction would be that the visuo-spatial bias observed by Kunzendorf *et al.* (2010) can also be found in DPD or in experimentally induced transient depersonalization.

5. The Neurobiology of Phenomenal Depth

Proposing phenomenal depth or a sense of experiential depth and subjective richness as a structural feature of consciousness and its reduction as a common dimension in depression and depersonalization disorder potentially allows for a quantification of phenomenal depth and may thus facilitate neurocognitive investigation.[5]

[5] Furthermore, the concept of phenomenal depth also avoids the recourse to the binary and negative definition as it is commonly used in descriptions of depersonalization disorder (e.g. '*un*-reality' or a lack of felt presence), which only has poor explanatory value (*cf.* Sierra and David, 2010). More specifically, the positive formulation of phenomenal depth avoids the paradoxical situation in which a sense of reality or felt depth is only implied through double negation: for example, according to the ICD-10, DPD patients report that

As phenomenal depth is assumed to constitute a felt aspect of *all* experience, its biological implementation may similarly relate to or feed into structures that generally process the inside and the outside world.

Phenomenal Depth and the Inner Milieu

Hints for a physiological implementation of a basal dimension such as phenomenal depth originate in research on animals and specifically non-human primates (Denton, 2006; Panksepp, 1998), the results of which have recently been extended to humans. These works describe basal bodily feelings in the shape of *homeostatic emotions* (e.g. Craig, 2008), *primal emotions* (Denton, 2006), or *primordial feelings* (Damasio, 2010), which provide information about the internal state of the organism (*interoception*) and influence mechanisms of life regulation (*homeostasis*). In homeostasis, changes in the mechanical, thermal, or chemical state of the internal milieu are registered and dynamically regulated on the basis of the perceived physiological condition of the body as it is conveyed through interoception, a process related to the autonomic nervous system.

Nuclei in the brainstem thereby modulate regulation processes, thus ensuring a basic level of feeling, but simultaneously also forward interoceptive information to cortical areas, of which specifically the insular cortex and the anterior cingulate contribute to a more differentiated affective consciousness and the subjective element of instinctive behaviour (*cf.* Craig, 2009; Medford and Critchley, 2010; Damasio, 2010).

Relevant relays in ascending homeostatic projections are, for example, the solitary and parabrachial nuclei, the periaqueductal grey, as well as the inferior and superior colliculi, in which coarse maps of the body are created and integrated before they are forwarded to cortical areas via thalamic relays (*cf.* Craig, 2002; Denton, 2006; Merker, 2007; Panksepp, 1998; for further physiological details).

One of the most important properties of the brain is its extensive structural and functional feedback which is strongly present intracortically but becomes particularly relevant in mutual connections between cortex and specific thalamic nuclei (reticularis and intralaminares) or the brainstem. Particularly thalamo-cortico-thalamic loops have been ascribed a role in the formation of subjective experi-

'objects, people and/or surrounding seem unreal' while necessarily being 'aware of the unreality of the change [namely, the unreality feelings]' (Sierra and David, 2010). In this understanding of the psychopathology, awareness of the 'unreality of the unreality' thus indirectly implies reality, hence 'normal/healthy' subjective experience.

ence (e.g. Edelman and Tononi, 2000; Laureys and Tononi, 2008; Llinás, 2002), but recent approaches extend the focus further in the caudal direction and assume that an integration of brainstem-based body representations with cognitive structures at the level of the cortex is of central importance for phenomenal experience (Damasio, 2010; Merker, 2007; Northoff and Panksepp, 2008; Panksepp and Northoff, 2009).

In particular, a recent model by Seth and colleagues (2012) captures this cascading flow of interoceptive information and emphasizes its generative aspects by linking subjective experience to theories of predictive coding. They suggest a neural comparator mechanism predicting informative interoceptive signals in a top-down fashion. A match between top-down prediction and bottom-up internal informative signals leads to the sense of presence, while interoceptive inference in the form of a prediction error is considered 'the constitutive basis of emotion' (Seth, Suzuki and Critchley, 2012, p. 11).

Phenomenal Depth and the Outside World

The approach by Seth and colleagues (2012) is inspired by the *comparator model* of sensorimotor interaction (e.g. Wolpert and Ghahramani, 2000) in which it is assumed that the brain predicts consequences of current actions and compares these predictions to actual outcomes. In the comparator model, a sense of *agency*, similar to the sense of presence for the inner milieu, indicates the successful prediction of consequences in the outer world. Larger theoretical frameworks of brain function (most notably Friston's ideas about *predictive coding* and the *free-energy principle*; e.g. Friston, 2005; 2010) propose that this mechanism is not restricted to the motor domain but rather constitutes a general or global processing principle of the brain. Therefore, it is reasonable to assume that similar mechanisms act on the inner milieu. If predictive coding were a global principle of brain function, and phenomenological depth could be understood as describing experiences connected to the matching of such predictions, the latter would be related to a very basic neurocognitive mechanism.

In their model, Seth, Suzuki and Critchley (2012) propose that external predictive coding (related to agency) and internal predictive coding (related to presence) interact in order to generate full-blown subjective experience. Accordingly, it may be proposed that the phenomenological dimension of phenomenal depth relates to both agency as well as presence, integrating the outer world and the inner self through the principle of predictive coding. Predictive coding might

therefore be a formal feature of the neurobiological implementation of phenomenal depth, which we have described as a central quality of all experience — being diminished in both depersonalization and the above-characterized types of depression.

6. Towards a Neurophenomenology of Phenomenal Depth

Neurophenomenology generally investigates how subjective experience is embodied in the physical world. Phenomenological approaches in neuropsychiatry create an '*intermediate level* that relates the level of molecular dysfunctions… to the molar level of descriptive psychopathology and its nosological syndromes' (Fuchs, 2010, p. 548, italics in the original). The dimension of phenomenal depth may provide a useful concept for this research programme as its reduction is a central feature of psychopathologies such as depersonalization disorder and certain types of depression. In addition, as we suggested above, phenomenal depth can be linked to the neurobiology of embodiment via neurocognitive and neurocomputational models.

As with every neurophenomenological enterprise there are two important challenges: first, how can we measure subjective experience, and second, what are the measures to which we want to link those subjective components? Capturing subjective experience usually involves self-reports, for example through questionnaires or structured interviews. Explicit neurophenomenological questionnaires could be developed that assess phenomenal depth in different domains of experience (see Kunzendorf *et al.*, 2010, for a first cut in this direction). Another approach would be to explicitly consider subjective experience as a dependent variable and to experimentally adjust the independent variable in order to measure different degrees of phenomenal depth. While the implicit measures of visuo-spatial bias by Kunzendorf and colleagues (2010) are a start, in more complex set-ups such as multisensory virtual realities, indirect subjective judgments may be assessed, which do not require putting them into explicit propositions as in the case of self-reports (e.g. Ehrsson, 2007).

On the neuro-side there is a whole range of possible approaches including behavioural measures related to the brain and the inner milieu as well as direct and indirect measures of brain activity like EEG/fMRI or brain stimulation methods. These methods can be used to understand how higher-order properties emerge from their neural basis (Walter, 1998; Walter *et al.*, 2009a).

An open question worth investigating is whether the experience of phenomenal depth can be deliberately varied similarly to the experience of emotions. For example, certain types of emotion regulation that aim for a disconnection between the self and the affective dimension of the external world, called *detachment* or *distancing*, can be investigated in healthy subjects (Walter *et al.*, 2009b) but also in patients with depression (Erk *et al.*, 2010) using neuroimaging methods like fMRI. In these studies it has been found that a network comprising the right prefrontal cortex and a region near the right temporo-parietal junction is implied in detaching from affective experience. Accordingly, these regions might be involved in a neurocognitive mechanism that is either directly related to phenomenal depth or that influences connections between the cortex and the brainstem — possibly via the VMPFC — which are likely to regulate experiential depth. Alternatively, the observed activations might also be related to the self-reflective conscious properties of phenomenal depth which is, as described, a meta-cognitive or meta-affective experience.

As has already become apparent, one can also employ psychopathological models of chronically altered phenomenal depth by investigating, for example, subjects with DPD or depression (*cf.* Walter and Michal, in press). This approach has the advantage that phenomena that are typically quite labile and easily influenceable by framing or expectation effects in healthy subjects are more stable and unyielding in patients and therefore easier to correlate with neurobiological measures. On the other side, there are also many confounds in patient studies, and investigations of both healthy subjects and patients will provide complementary clues towards a neurophenomenology of phenomenal depth.

Based on the considerations above, there are several predictions that can be made with respect to an empirical investigation of phenomenal depth: one is that at the level of the central nervous system the experience of phenomenal depth relates to the interaction of brainstem, thalamus, and cortical areas. Another one is that prediction errors should play an important role in modulating phenomenal depth. At this point these are approximations, but as demonstrated by Seth *et al.*'s (2012) approach, they can be transformed into more precise hypotheses concerning, for example, the role of particular brain regions like the anterior cingulate (ACC) and the insular cortex. Our point in this paper is thus to suggest a dimension of experience along which an investigation of complex phenomena may become feasible or easier.

Certainly, a challenge for a neurophenomenological account of phenomenal depth is how this dimension can be included into more theoretical or neurophilosophical models of phenomenal experience. We suggest that phenomenal depth might be a formal feature of such models relating to the integration of world-informative body representations into a self-model as it has been formulated and extensively described by Metzinger (e.g. 1999; 2003). Phenomenal depth may be directly related to the property of *transparency* (Metzinger, 2003, p. 163), that is, to the degree to which the representations of bodily states and thus emotions are becoming attentionally transparent to self-reflection or to the degree that they are experienced. From a representational point of view, this would mean that the representational format of the self-model and of external objects are so similar or so interconnected that it virtually becomes impossible to disentangle them by higher-order cognitive processes — something Metzinger calls 'convolved holism' (*ibid.*, pp. 143–50). In contrast, in conditions of low phenomenal depth the formats of representation may be quite dissimilar so that they become opaque and are experienced as different: 'full blown global opacity leads to a "derealization" on the level of phenomenal experience' (*ibid.*, p. 538). If this is the case then it follows that the neuroscientific basis of altered phenomenal depth in psychiatric disorders like DPD or depression has a connection to altered self-representation, as is also suggested in the symptom descriptions by Petrilowitsch (1956) and Kraus (2002; 2008). Therefore, we propose to include some measures of self and selfhood into neurophenomenological investigations of those conditions whenever possible.

We hope that our reflection will motivate investigators to consider phenomenal depth a relevant and useful dimension in neurophenomenological research in psychiatry — but also in general cognitive-affective neuroscience — as it may prove to be a simple way to elucidate complex phenomena. In particular, it can serve as a link in understanding symptoms observed in different psychopathologies, as we have shown for the cases of depersonalization disorder and certain types of depression.

Acknowledgment

This work was supported by a grant from the VolkswagenStiftung (II/84 051).

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