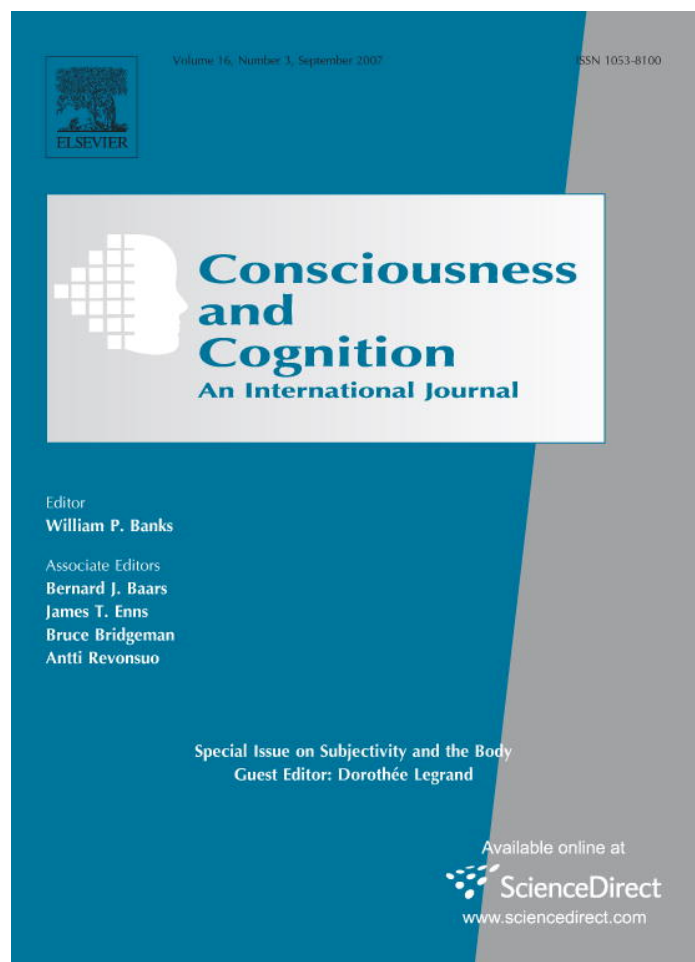


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Commentary

Neurophenomenology and the study of self-consciousness [☆]

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In this special issue on self-consciousness, Petitmengin et al. discuss the possible contribution of research on epileptic seizure anticipation to the study of subjective experience. The authors investigate the neural and phenomenal signatures of prodromes, the warning symptoms prior to seizure onset, as a case study of self-consciousness. As some epileptic patients also report the ability to abort or prevent seizures, this line of research provides, in addition, an opportunity to investigate the regulatory role of self-consciousness. A potential long-term outcome of the research would be the development of a non-pharmacological therapeutic intervention. In essence, this programmatic essay aims to provide an illustration of a “neurophenomenological approach” to the neuroscientific study of epilepsy. It shows nicely the potential of this methodology and presents some encouraging preliminary data.

Central to neurophenomenology is the combination of quantitative measures of large-scale neural activity with detailed first-person descriptions of the categorical features of experience. Accordingly, as a guide for their neurodynamic analysis, the authors focus on the role of integrative neural mechanisms such as neural phase synchrony in epileptic seizures, and on the collection of refined first-person descriptions of preictal states. Here, I will briefly comment on three aspects of this approach.

First, I will attempt to provide perspective on the neurodynamic approach to characterizing self-consciousness by contrasting it against more common neuroanatomical approaches. Secondly, I aim to put this study in the broader context of brain research on clinical therapies and will discuss its possible contribution.

1. Dynamicist versus neuroanatomical approaches to epilepsy

Prodromes are premonitory feelings or sensations that precede seizure onset. In general, feelings are theorized by many as high-order neural representations of the physiological condition of the body (Damasio, 2000; De Preester, 2007). In neuroanatomical models, the perception of internal bodily responses, or interoception, relies on metarepresentations in the brain of homeostatic afferent activity (i.e. temperature change, pain) and plays an important role in engendering feelings (Craig, 2002; Damasio, 2000). Evidence from anatomical and neuroimaging studies suggest that these metarepresentations are subserved in particular by the anterior insula and the anterior cingulate cortices (Craig, 2002; Damasio, 2000; De Preester, 2007).

Without downplaying the critical role of this circuitry, it is worth noting that the authors’s analysis of prodromic symptoms revealed not only bodily feelings, such as “the feeling of heat inside my body” (Section 3.2.3), but also a sense of “decrease of energy, a lack of concentration, of words, of physical balance” (Section

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3.2.3). The latter of these symptoms are more related to the pre-reflexive form of self-consciousness and are likely to involve a broad range of brain circuitries critical in speech, movement, voluntary attention (e.g. motor or attention regions, brain stem...).

The authors conclude that prodromic symptoms seem to have “no localization value” (Section 3.2) in contrast to auras, which have well localized epileptogenic zones. Thus they choose to study these preictal states as changes in the dynamic and systemic *mode* of interaction of the whole brain, rather than attempting to localize first-person features. Their analysis made possible the discovery of a “preictal state” characterized by a desynchronization of the neuronal assemblies related to the epileptogenic focus up to several hours before the seizure onset (Le Van Quyen, Soss et al., 2005). This dynamicist model (illustrated in their figure 1) not only provides a representation of a dynamic mode, or signature, compatible with the phenomenology of the state, it allows the making of explicit predictions about the probability of the occurrence of the crisis (Le Van Quyen, 2005).

Dynamic analysis of preictal states (Le Van Quyen, Soss et al., 2005) further supports the dynamicist way of thinking about top–down influence. Again, a standard neuroanatomical prediction would be that some form of top–down influence, typically from prefrontal regions, are likely to be involved in seizure avoidance. For example, the ventral prefrontal cortex (PFC) is known to have an inhibitory influence on limbic responses, such as amygdala activity, during emotion regulation (Ochsner & Gross, 2005; Urry, van Reekum et al., 2006). Yet, while such neuroanatomical frameworks offer one way of understanding the self-conscious processes underlying prodromic warnings and seizure regulation, some of the countermeasures described in this essay are clearly different from standard emotional or attention regulatory strategies (Ochsner & Gross, 2005), and so invite us to think differently.

A patient relates an amusing example of this when he says “when a seizure is arriving, my friend tells me funny stories. For little seizures, it always works” (Section 3.2.3). Such countermeasures seem to reflect the idiosyncrasies of a particular epileptic seizure, rather than active top–down control. Yet, the fact that this strategy has some regulatory effect makes some sense in the dynamicist conception of top–down influence. From the dynamicist view of top–down control (Engel, Fries et al., 2001), large-scale coherent neuronal ensembles can influence local neuronal processes by “enslaving” local ensembles. This form of top–down modulation occurs for instance with some forms of perceptual priming (Engel, Fries et al., 2001) and does not necessarily involve a processing hierarchy, as the dynamic ‘enslaving’ of neurons into a larger assemblies could take place between areas at the same processing level or within one area (Engel, Fries et al., 2001). In the model discussed in this paper, the authors propose that the critical regulatory mechanism in avoiding the crisis may have to do with the capacity of large-scale dynamics of the brain to prevent the epileptogenic zone from becoming dynamically isolated.

In concluding the first part of the paper, Petitmengin et al. present original first-person and third-person data and theoretical proposals that underline the need to characterize self-conscious processes and their regulatory influences within dynamic neurological and phenomenological frameworks.

2. Neurophenomenology and reflexive awareness

A central theme of this volume is the study of the “pre-reflexive” dimension of consciousness. The term pre-reflective, or pre-reflexive, in this essay denotes “the part of our lived experience which, although “lived through” subjectively, is not immediately accessible to consciousness, introspection or verbal report” (note 2). The epileptic patient is coached with second person interview methods to become aware of his pre-reflective experience by re-living the preictal period prior to the seizure. The interview techniques are said to lead to the “detection of the pre-reflective dynamic microstructure of the corresponding subjective experience”. This technique allows the experimentalist to look for “one-to-one mappings, between the preictal neurodynamic and phenodynamic structures” (Section 3.3.2.2).

The attempt to develop a methodology that might help a patient to notice prodromic syndromes, a pre-reflexive aspect of experience, has some overlap with existing therapeutic interventions, like mindfulness-based stress reduction (MBSR) and mindfulness-based cognitive therapy (MBCT) (Engel, Fries et al., 2001; Kabat-Zinn, Massion et al., 1992; Teasdale, Segal et al., 2000). In same way that MBSR or MBCT interventions help addicted patients become aware of craving cues that automatically lead to relapse, Petitmengin et al.’s

interview technique helps epileptic patients become aware of prodromic syndromes that preceded seizure (Davis, Fleming et al., 2007). In both cases, these approaches aim to cultivate, either through mental training (MBSR, MBCT) or coaching (open interviews as in Petitmengin et al.), a type of “reflexive” awareness. Such awareness grants one access not to the content of one moment of experience, but rather to the *subjective features* of the moment, such as the degree of phenomenal intensity, attentional stability, emotional tone, cognitive schema present in the moment, associations that are taking place, and so on (e.g. the content of the interview of patient 5, Section 3.2.3). In general, these approaches aim to cultivate the ability to reflexively monitor one’s experience with the purpose of self-regulating features of experience, such as emotional reactivity or rumination. Similar to findings of decreases of relapse in addicted (Davis, Fleming et al., 2007) or depressed (Teasdale, Segal et al., 2000) patients reported in clinical studies of MBSR and MBCT, Petitmengin, et al. report that five of the nine patients spontaneously developed countermeasures of a physical or mental nature (Section 4.1) as a consequence of the awareness of their prodromes.

Neurophenomenological approaches like these could be useful tools in the identification of neuronal correlates of therapeutic countermeasures by differentiating pre-reflexively lived through preictal states, from actively and reflexively experienced preictal states (Section 4.2). The data can also be collected within a longitudinal design, allowing for data collection from subjects both prior to and following the intervention. A critical question would then be to test whether accompanying neurophenomenological signatures are able to differentially predict, via statistical inference, behavior that precedes the onset of an epileptic seizure. Because the study of epilepsy gives access to intra-cortical measurements, it provides a unique window into the brain mechanisms that underlay reflexive awareness. Neurophenomenological research on epilepsy has potential applications in the future development of a general neurophysiological model for non-pharmacological therapeutic interventions.

Overall, the research program on the neurophenomenology of epilepsy proposed by the authors promises to offer important empirical data on the nature of the neurodynamic processes, that could have direct clinical consequences, involved in self-consciousness. Their methodological and theoretical considerations also offer inspiring new insights into ways of understanding and studying the explanatory gap between phenomenal consciousness and neurophysiological processes.

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