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 doi:10.1016/j.tics.2011.02.007 Trends in Cognitive Sciences, May 2011, Vol. 15, No. 5

Letters

Self and brain: what is self-related processing?

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Christoff *et al.* focus specifically on the subjective side of the self and associate it with sensorimotor and homeostatic functions [1]. This raises several issues concerning the nature of the neuronal processes associated with self-related processing and how to best approach the brain and define the concept of subjectivity.

Christoff *et al.* argue that self-related processing describes ‘processing requiring one to evaluate or judge some feature in relation to one’s perceptual image or mental concept of oneself’. Such cognitive definition of

the self can account only for the objective self, the ‘Me’, and neglects the subjective self, the ‘I’. The subjective self is characterized by self-specifying processing as related to sensorimotor and homeostatic functions, which allows for the basic self versus non-self distinction.

What is self-related processing and how does it relate to the brain? Most studies presuppose a rather cognitive concept of the self when using self-reflective tasks. This requires cognitive functions and what we have called ‘self-referential processing’ [2,3], by means of which a person

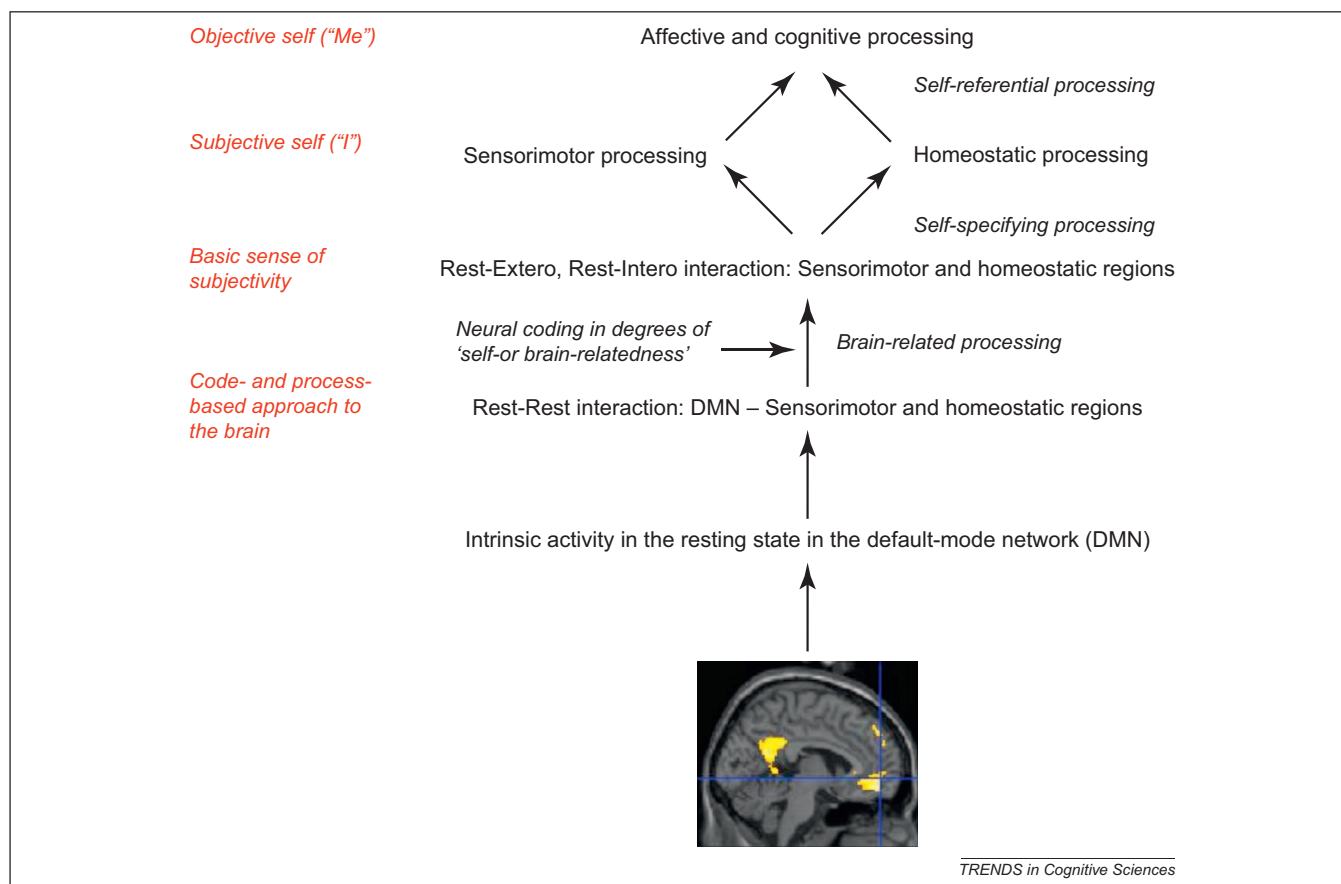


Figure 1. The intrinsic activity of the brain, neural coding, subjectivity and the self.

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becomes aware that specific contents are related to his or her own self. By contrast, self-related processing describes the basic relation between stimulus and organism independent of the person's awareness of whether the associated content of the stimulus is related to his or her self (or not).

Is this a purely conceptual issue? Let me describe what happens when an intero- or exteroceptive stimulus approaches the brain. The stimulus encounters the resting-state activity of the brain, with the rest-stimulus interaction determining the degree to which the stimulus becomes related to the neural activity of the brain [4]; therefore, a better might be brain-relatedness rather than self-relatedness. The degree of self- or brain-relatedness of a stimulus might in turn determine its processing in subsequent homeostatic, sensorimotor, affective and cognitive functions (Figure 1) [5,6]. This scenario is supported not only by results from recent investigations in healthy subjects [7,8], but also by observations in psychiatric disorders such as schizophrenia [9] and depression [10] in which resting-state abnormalities are associated with an abnormal self and disturbed subjectivity.

Self-related processing in this sense (i.e. as brain-relatedness) can no longer be characterized by specific functions and their respective contents, be they homeostatic, sensorimotor, affective or cognitive. Instead, self- or brain-related processing is better described as neural code, the formal mechanism whereby the relationship between brain and stimulus is realized in the neural activity of the brain. The focus here is on the type of neuronal coding and on neuronal processes such as rest-rest and rest-stimulus interactions. (It should be noted that the term process is understood here as purely neuronal process pertaining only to changes in brain neuronal activity during rest-rest, rest-stimulus and stimulus-rest interaction, independent of any psychological processes and functions associated with these purely neuronal processes.) This might be characterized as a code- and process-based approach to the brain rather than as the function- or content- and region-based approach presupposed by Christoff *et al.*

How should subjectivity be defined? Christoff *et al.* and many others associate subjectivity with the first-person

perspective (FPP) as distinguished from objectivity in the third-person perspective (TPP). Neural coding of rest-stimulus interaction in terms of self- or brain-relatedness might imply a more basic sense of subjectivity that is manifest before any homeostatic, sensorimotor, affective and cognitive functions, including their subsequent distinction between FPP and TPP. Such a more basic sense of subjectivity might come close to what the German philosopher Kant had in mind when arguing that we remain principally unable to access and know ourselves and the world independent of ourselves (e.g. our brain) and to consecutively obtain objective knowledge (in an absolute sense).

Acknowledgments

My work on the self is supported by the CIHR, the EJLB-CIHR Michael Smith Foundation, and the HDRF-ISAN.

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doi:10.1016/j.tics.2011.03.001 Trends in Cognitive Sciences, May 2011, Vol. 15, No. 5

Letters Response

Clarifying the self: Response to Northoff

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Northoff [1] raises three issues in response to our article [2]: (i) how to define self-related processing; (ii) the relation between self-related processing and brain activity; and (iii) the nature of subjectivity.

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Conceptual issues

We define self-related processing as 'processing requiring one to evaluate or judge some feature in relation to one's perceptual image or mental concept of oneself' [2]. This definition is based on the widespread experimental paradigm that requires subjects to assess specific stimuli in