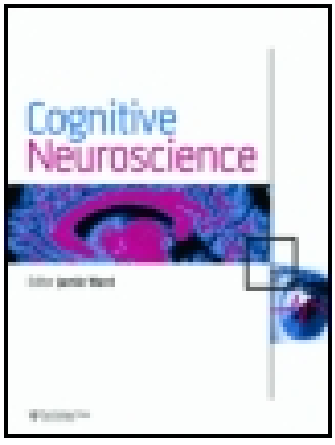


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# How does the 'rest-self overlap' mediate the qualitative and automatic features of self-reference?

Georg Northoff[abcde]
[a] Institute of Mental Health Research, University of Ottawa, Ottawa, Canada
[b] Center for Cognition and Brain Disorders, Hangzhou Normal University, Hangzhou, China
[c] Center for Brain and Consciousness, Departments of Radiology and Psychiatry, Sheng Ho Hospital, Taipeh Medical University (TMU), Taipeh, Taiwan
[d] College for Humanities and Medicine, Taipeh Medical University (TMU), Taipeh, Taiwan
[e] ITAB, University of Chieti, Chieti, Italy
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# Commentary

## How does the 'rest-self overlap' mediate the qualitative and automatic features of self-reference?

**Georg Northoff**
Institute of Mental Health Research, University of Ottawa, Ottawa, Canada
Center for Cognition and Brain Disorders, Hangzhou Normal University, Hangzhou, China
Center for Brain and Consciousness, Departments of Radiology and Psychiatry, Sheng Ho Hospital, Taipeh Medical University (TMU), Taipeh, Taiwan
College for Humanities and Medicine, Taipeh Medical University (TMU), Taipeh, Taiwan
ITAB, University of Chieti, Chieti, Italy
E-mail: georg.northoff@theroyal.ca

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**Abstract:** The target article points out the qualitative and automatic features of self-reference while leaving open the underlying neural mechanisms. Based on empirical evidence about rest-self overlap and rest-stimulus interaction being special for self-related stimuli, I postulate that the resting state shows self-specific organization. The resting state's self-specific organization may be encoded by activity balances between different networks which in turn predispose the qualitative features of subsequent self-related stimulus-induced activity in, for instance, SAN as well as the automatic features of self-reference effects.

Humphrey and Sui (2015) point out two central features of the self-reference effects, its qualitative and automatic features. There is qualitative difference between self and non-self: There is a continuum of effects from familiar to non-familiar persons while there is no continuum between self-related and familiar stimuli in psychological processing. Moreover, they emphasize the pre-attentive features of self-reference effects entailing their automatic features.

What are the neural mechanisms underlying the apparently qualitative and automatic features of the self-reference effect? Without explicitly referring to these two features in the later part of the paper, they assume the self-attention network (SAN) to be central for that which consists of three nodes, VMPFC, DLPFC and IPS, and pSTS.

How now must neural activity be like in order to allow for the qualitative and automatic features of the self-reference effect as mediated by SAN? Empirical data show substantial neural overlap between the levels of resting state activity and self-related stimulus-induced activity in, especially, the cortical midline structures (CMS) as core of the default-mode network (DMN). Using H20 PET, D'Argembeau et al. (2005) early reported no activity change in VMPFC during self-related stimuli when compared to resting state activity levels in the same regions. Schneider et al. (2008) observed that preceding self-related stimuli modulated subsequent resting state activity (i.e., intertrial intervals) to a much higher degree than non-self-related activity. Whitfield-Gabrieli et al. (2011) reported self-related activity in the same regions of CMS that also showed high degrees of resting state functional connectivity. Qin and Northoff (2011) conducted a meta-analysis of both resting state and self-reference studies and showed substantial neural overlap between both, amounting to what I call the 'rest-self overlap'.

What exactly is meant by 'rest-self overlap'? The rest-self overlap only describes regional overlap but does by itself not imply anything about the relationship between resting state activity and self-related stimulus-induced activity, i.e., rest-stimulus interaction (Northoff, Qin, & Nakao, 2010). Going beyond mere rest-self overlap, one requires a special form of rest-stimulus interaction between resting state and self-related stimuli to account for the qualitative and automatic features of self-reference.

No potential conflict of interest was reported by the author.

Qin et al. (2013) investigated the impact of two different resting state activity levels in auditory cortex, eyes closed (low levels) and open (higher levels), on own, familiar, and stranger names. Presupposing a purely additive model of rest-stimulus interaction, one would expect that higher levels of auditory cortical resting state activity as during eyes open lead to higher levels of stimulus-induced activity. This was indeed the case for both familiar and stranger names.

This pattern was not observed for the own name, however. The own name already elicited high levels of stimulus-induced activity during the low level of resting state activity, i.e., eyes closed, which was as high as the one during the high level of resting state activity, i.e., eyes open. This suggests non-additive interaction between resting state and self-related stimuli that is qualitatively different from the additive interaction of familiar and stranger names.

Does the resting state impact the degree to which self-reference is attributed to a stimulus? Bai et al. (2015) observed in an EEG study that the level of pre-stimulus alpha power (i.e., −600 to 400 ms) predicted the degree of self-reference (i.e., high or low) subjects attributed to subsequent emotional and neutral stimuli. Moreover, the degree of pre-stimulus alpha power was predicted by the resting state concentration of Glutamate in VMPFC. These data show the resting state level, i.e., pre-stimulus alpha power and Glutamate, to impact stimulus-induced activity including the degree to which stimuli are perceived as self-related.

Taken together with other data, these data suggest the resting state activity to exert significant impact on subsequent stimulus-induced activity and its perception as self-related. Though central, such special rest-stimulus interaction does not seem to be limited to the CMS as part of DMN but may rather concern their balance to other networks like CEN (with DLPFC and IPL) and sensorimotor networks (see, Nakao, Bai, Nashiwa, & Northoff, 2013; Nakao, Ohira, & Northoff, 2012; Vanhaudenhuyse et al., 2011). The activity balance between different networks may encode a certain degree of self-specificity in the resting state that therefore exhibits self-specific organization (Northoff, 2014a, 2014b).

Depending on its lower or higher degrees of encoded self-specific organization, the resting state may then react differently to subsequent stimuli: The resting state may for instance react qualitatively different to those stimuli, e.g., self-related, that it already knows due to its own encoded self-specific organization (higher resting state's self-specific organization should lead to higher degrees of qualitative self-reference). Hence, one predicts the following: Higher degrees in the resting state's self-specific organization, i.e., the balances between different networks, may lead to higher degrees of self-specificity attributed to external stimuli and higher automatic self-reference effects as mediated by the stimulus-induced neural balances within SAN as so well described by Humphrey and Sui (2015).

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