Published in final edited form as:
Trends Cogn Sci. 2016 July ; 20(7): 482–483. doi:10.1016/j.tics.2016.04.005.

Self-reference acts as a golden thread in binding

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Abstract

In a recent article in this journal, Glyn Humphreys and I proposed a model of how self-reference enhances binding in perception and cognition [1]. We showed that self-reference changes particular functional processes – notably, self-reference increases binding between the features of stimuli and between different stages of processing. Lane and colleagues [2] provide an interesting comment on our article that suggests our theory of self-reference is compatible with Dennett's philosophical perspective on the narrative nature of the self. Although the nature of the self has attracted the attention of both philosophers and scientists, the two disciplines have generated different perspectives on the functions of the self, largely due to their different methodologies. For example, Dennett argues that the self is an abstraction -- like a center of gravity – which is developed over time to make sense of experiences and, crucially one's own responses to them. [3]. By contrast, work from psychologists and cognitive neuroscientists focus on the functional and neural mechanisms of self-reference.

Hermeneutical interpretations vs. mechanistic evidence on the integrative self

The traditional argument of the narrative self in philosophy emphasizes its dependence on narrative and agency (selves are primarily agents, and agents are understood best in narrative rather than naturalistic terms), although some philosophers are in favor of a binding function for the self. We focus on the mechanistic profile of self: that the self plays the special role of enhancing the binding of information and psychological processes in human beings. The binding function can be parameterized using mathematical models as well as empirical manipulations. For example, when individuals perceive multiple external stimuli associated with themselves, the capacity of information processing can be measured using a capacity coefficient (C(t)), indexing how one responds to the whole configuration of all stimuli rather than the sum of the parts [4]. We argue that self-reference operates as a perceptual glue to bind external stimuli together when facing a complex environment.

Self-reference acts as a golden thread in the brain and mind

Lane and colleagues [2] argue that, on a practical level, Dennett and psychologists like us treat self as an artifact of social processes. Indeed, the mechanistic perspective of self-reference has been supported by evidence collected when people make reference to the self

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within the task that they are performing. One virtue of these manipulations is that they allowed us to test if there is a specific neural circuit in the brain to support self-reference relative to other-reference. This line of research could provide valuable insight into whether the self is an illusion. Substantial evidence shows that thinking in relation to the self strongly activates the ventral medial prefrontal cortex (vmPFC) [5]. As we discuss in the article, researchers claim that the vmPFC is associated with self-representation in the brain [1]. We argue that it is not the vmPFC alone that determines the functional role of this activity, but rather it interacts with other brain regions, which together control human behavior in the presence of self-related processing [6]. Prior research has shown that activity in the vmPFC downregulates activity in the left superior temporal sulcus, which is thought to reflect social attention. In particular, the strengths of neural coupling between the two regions can predict the magnitude of response biases towards self-related stimuli in perceptual matching [7]. In parallel, neuropsychological studies have shown that brain damage over the vmPFC abolishes self-biases in memory, whereas brain damage in the dorsal attentional control network that spares the vmPFC generates abnormally large biases toward self-related information, due to an exaggerated effect of strong attentional signals [8]. The evidence indicates that self-reference acts as a golden thread linking the vmPFC to other regions to create a specific neural circuit in the brain to support self-reference.

Lane and colleagues [2] propose that recording task-irrelevant resting state and pre-stimulus activity would yield insights into how the self performs its functions by identifying the trajectory of the self with little experimental control. Such approaches do contribute to assessing the continuity of consciousness of the self, a topic that has been extensively discussed in cognitive neuroscience [9] as well as philosophy [3]. However, these methods alone are unlikely to pinpoint specific cognitive and neural responses associated with self-reference. By contrast, empirical manipulation provides a way to link self-processing to specific functional or neural processes [10]. For example, the function of self-reference in perception may be targeted by manipulating luminance of stimuli while controlling other factors. Researchers reported that reduction of stimulus luminance was less detrimental to perceptual sensitivity of shapes associated with the self than shapes associated with others, suggesting that self-reference can enhance perception [11]. In our view, using various approaches (e.g., empirical manipulation or neural analysis during resting state) within one study would provide us with a better understanding the functions of self-reference that are intrinsic to perception and cognition over time [12].

Acknowledgments

This paper is dedicated to the memory of Glyn W. Humphreys (1954–2016), especially Glyn’s invaluable contribution to the theory of self-reference. It was an honor and a privilege to work with him. This work was supported by grants from the Wellcome Trust (WT 106164MA), the Economic and Social Research Council (ES/K013424/1) and the National Science Foundation (31371017).

References

1. Sui J, Humphreys GW. The integrative self: How self-reference integrates perception and memory. Trend Cogn Sci. 2015; 19:719–728.
2. Lane T, et al. The trajectory of self. Trends Cogn Sci. 2016

3. Dennett D. The self as a responding-and responsible-artifact. Annals of New York Academy of Sciences. 2003; 1001:39–50. The Self from Soul to Brain.
4. Sui J, et al. Super-capacity and violations of race independence for self- but not for reward-associated stimuli. J Exp Psychol Hum Percept Perform. 2015; 41:441–452. [PubMed: 25602970]
5. Northoff G, et al. Self-referential processing in our brain – a meta-analsis of imaging studies on the self. NeuroImage. 2006; 31:440–457. [PubMed: 16466680]
6. Humphreys GW, Sui J. Attentional control and the self: The Self-Attention Network (SAN). Cogn Neurosci. 2015; doi: 10.1080/17588928.2015.1044427
7. Sui J, et al. Coupling social attention to the self forms a network for personal significance. Proc Natl Acad Sci U S A. 2013; 110:7607–7612. [PubMed: 23610386]
8. Sui J, et al. Dissociating hyper- and hypo-self biases to a core self-representation. Cortex. 2015; 70:202–212. [PubMed: 26050220]
9. Mason MF, et al. Wandering minds: the default network and stimulus-independent thought. Science. 2010; 315:393–395.
10. Cummingham SJ, et al. Yours or mine? Ownership and memory. Conscious Cogn. 2008; 17:312–318. [PubMed: 17543540]
11. Sui J, et al. Perceptual effects of social salience: Evidence from self-prioritization effects on perceptual matching. J Exp Psychol Hum Percept Perform. 2012; 38:1105–1117. [PubMed: 22963229]
12. Northoff G, et al. Rest-stimulus interaction in the brain: a review. Trends Neurosci. 2010; 33:277–284. [PubMed: 20226543]

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