



Research report

Henry, where have you lost your Self?

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ABSTRACT

The Self is a complex construct encompassing distinct components, including episodic and semantic autobiographical memory, the Self-concept, and the subjective sense of Self, which highest level consists of Self-awareness. The neuro-anatomical correlates are complex, and it is debated as to whether a common region could support these different components of the Self, with a particular interest for the cortical midline structures and the medial prefrontal cortex (MPFC). Alzheimer's disease (AD) constitutes an interesting model for the study of Self as autobiographical memory typically deteriorates as the disease progresses. Here, we report the unexpected case of Henry, a patient with MCI due to AD who was unable to produce any personal autobiographical memories, nor describe his Self-concept, had a poor personal semantic memory, and disclosed unusual anosognosia for this stage of the disease. His cognitive performance was compared to a group of matched AD patients and a group of healthy controls confirming that the main components of his Self were degraded. We hypothesized that it was due to a marked atrophy within the cortical midline, as visually assessed on his MRI. We further elucidated these findings through Voxel-based morphometry analysis, which confirmed a significant atrophy of the MPFC that was specific to this patient. Moreover, this revealed significant atrophy within the bilateral insular cortex. Given the stage of the disease, the degradation of the Self is unlikely to be accounted for by deficient mnemonic processes, especially as the presence of discrete temporal atrophy was noted. We suggest that this specific pattern of MPFC and insular atrophy is responsible for the systematic collapse of the patient's Self, through the breakdown of the subjective sense of Self, which is proposed as a prerequisite to all other components, according to the model proposed by Prebble, Addis, and Tippett (2013).

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1. Introduction

1.1. Theoretical aspects of Self

At the level of an individual, the Self is comprised of various personal representations which answer the question “Who am I?” This concept is inherently complex, belonging to the field of consciousness and personal identity, involving notions such as unity and continuity (J. Locke, E. Erikson), multiplicity (Klein, 2010), and a sense agency and objectivity (‘I-Self’, ‘Me-Self’, W. James). Different models of the Self have been proposed (Conway & Pleydell-Pearce, 2000; Klein & Gangi, 2010; Prebble, Addis, & Tippett, 2013), wherein the link between autobiographical memory and the ‘Self’ is well-established. Importantly, there is a reciprocal relationship between the Self and autobiographical memory: the sense of Self stands as a pillar of autobiographical memory (Self-Memory-System, Conway & Pleydell-Pearce, 2000), autobiographical memory gives to the Self a sense of continuity, provides a background to personal traits and allows for the updating of self-knowledge (Conway, 2005; Klein, 2010). Recently, Prebble et al. (2013) proposed a comprehensive model of the Self, based upon a hierarchical organization according to two main dimensions: the subjective (‘I-Self’) versus objective (‘Me-Self’) and the present (‘synchronic Self’) versus temporally-extended Self (‘diachronic Self’). Extrapolating from this idea, four resulting components are derived: (i) the *subjective sense of Self* in the present moment, including the notion of a ‘prereflective Self’, which gives to an individual a sense of unity, ownership and agency, on the one hand, and the notion of ‘Self-awareness’ at a higher level, which can be viewed as a metarepresentational ability (Klein & Gangi, 2010), on the other hand; (ii) the temporally-extended subjective sense of Self which gives rise to the *phenomenological continuity* and refers to the auto-noetic consciousness (Tulving, 1985, 2002); (iii) the *Self-concept* which correspond to the objective Self at the present moment, including personal self-knowledge such as personality traits; (iv) the temporally-extended objective Self which gives rise to the *semantic continuity*, based upon content such as personal semantic memory. In this hierarchical model, the subjective sense of Self would constitute a prerequisite to all other components, and the Self-concept a prerequisite to the semantic continuity, though the relation between these different components has, to date, never been investigated in conjunction.

1.2. Self in clinical population

Case reports of amnesic patients provide an opportunity to study links between autobiographical memory and the Self. The majority favours an independence of the Self-concept (Klein, 2010; Klein & Gangi, 2010), forming a separate semantic memory system, suggesting that knowledge, such as individual personality traits, does not rely on illustrative autobiographical memories. Access to the personality traits might be preserved despite episodic autobiographical memory loss and updated without conscious recollection of representative events (WJ in Klein, Loftus, & Kihlstrom, 1996; DB in Klein, Loftus, & Kihlstrom, 2002; KC in Tulving, 1993).

The Self-concept also appears independent from the semantic component of autobiographical memory and other forms of semantic knowledge (Klein, 2010), for example personal semantics, or the knowledge of a relative's personality traits and general semantic knowledge (Klein & Lax, 2010). Dissociations have also been described within the Self-concept depending on the remoteness of the representation (Tulving, 1993). Interestingly, while the subjective sense of Self seems preserved in patients with severe retrograde amnesia consecutive to medial temporal lobe lesion (HM in Corkin, 2002; KC in Tulving, 2005; CW in Wilson, Kopelman, & Kapur, 2008), both episodic autobiographical memory and the subjective sense of Self appear to be altered in patients with prefrontal lesions (Levine, Freedman, Dawson, Black, & Stuss, 1999; Stuss & Levine, 2002). As to the subjective sense of Self, it is seldom studied in the present moment of an individual but rather regarding their past, using a R/K paradigm. Prebble et al. (2013) have proposed that an altered subjective sense of Self at the present moment due to prefrontal lesion leads to a deficit in auto-noetic consciousness and therefore a deficit in episodic autobiographical memory.

Alzheimer's disease (AD), which is characterized by personal changes that are frequently reported by the relatives of the patient, and by a deficit in autobiographical memory (e.g., Addis, Moscovitch, Crawley, & McAndrews, 2004; Addis, Sacchetti, Ally, Budson, & Schacter, 2009; Gilboa et al., 2005; Irish, Lawlor, O'Mara, & Coen, 2011; Philippi et al., 2012; Piolino et al., 2003), presents an opportunity to study the link between the different components of the Self. Case studies of patients with AD have highlighted the existence of a deficit in updating mechanisms of the Self-concept, due to the loss of recent memories with preserved personal knowledge from the past (Hehman, German, & Klein, 2005; Klein, Cosmides, & Costabile, 2003). Group studies using quantitative methods have not led to consensual conclusions, as some have emphasized a deterioration of conceptual Self-knowledge (Addis & Tippett, 2004; Naylor & Clare, 2008) while others have reported relative preservation (Harrison, Therrien, & Giordani, 2005; Rankin, Baldwin, Pace-Savitsky, Kramer, & Miller, 2005; Ruby et al., 2009). Qualitative studies have more often highlighted the preservation of Self when tackled as a unitary construct (Caddell & Clare, 2011; Cohen-Mansfield, Parpura-Gill, & Golander, 2006). Conversely, some aspects of Self-awareness appear to be altered during the course of the disease, specifically due to a lack of awareness of the disease or anosognosia, as well as a lack of awareness of the memory deficits or metacognition (Clare, 2003; Michon, Deweer, Pillon, Agid, & Dubois, 1994; Morris & Mograbi, 2013; Rosen, 2011; Souchay, 2007; Starkstein, 2014). Finally, more basic forms of subjective sense of Self such as self-recognition or the use of the personal pronoun (Biringier & Anderson, 1992; Fazio & Mitchell, 2009), appears to be preserved until the last stages of the disease. Interestingly, Addis and Tippett (2004) found the loss of Self-concept, as evaluated by the Twenty Statement Test (TST, Kuhn & McPartland, 1954; Rhee, Uleman, Lee, & Roman, 1995) and the Tennessee Self Concept Scale (TSCS, Fitts & Warren, 1996), to be correlated to the loss of autobiographical memories from early life, a result that has not yet been reproduced (Martinelli, Anssens, Sperduti, & Piolino, 2012; Naylor & Clare, 2008). Finally, Self-defining memories

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