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# Anosognosia, autobiographical memory and self knowledge in Alzheimer's disease

Robin G. Morris\* and Daniel C. Mograbi

King's College Institute of Psychiatry, London, UK

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## ABSTRACT

This article explores the relationship between lack of awareness of neuropsychological deficit, also termed anosognosia, and loss of self knowledge in Alzheimer's disease (AD). Specifically, it considers the hypothesis that anosognosia in AD can in part be explained by a loss of mnemonic ability in which knowledge about self-ability is degraded. To ground this hypothesis, we review evidence suggesting failure to update personal knowledge concerning task efficacy, loss of recollection with relative amplification of semanticization processes and loss of an updated representation of the self. We present a theoretical formulation as to how the features of memory impairment in AD may contribute to anosognosia, incorporating these notions in a reformulation of the Cognitive Awareness Model.

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## 1. Introduction

Lack of awareness about cognitive deficits or illness is a conspicuous feature of Alzheimer's disease (AD) and can be considered to be a direct result of the disease process (Hannesdottir and Morris, 2007), although moderated by psychosocial factors (Clare et al., 2012a, 2012b). Hence, in the context of a neurobiologically determined disorder, loss of awareness in AD can reasonably be given the term 'anosognosia' following Babinski's (1914) original application in relation to lack of knowledge of neurological disease. Anosognosia in AD has been shown to affect multiple facets of cognition and behaviour, including not only perceptions of illness but awareness of deficit relating to cognitive functions, such as memory, executive functioning, language and social

cognition, and also judgements about behavioural efficacy, including self care ability, social interaction, driving and instrumental activities of daily living (Clare et al., 2012a; Morris and Hannesdottir, 2004; Nelis et al., 2011). In other words, unlike some other forms of anosognosia, such as that found for example in cortical blindness (Anton, 1898) or hemiparesis (Babinski, 1914), the main feature in AD is the lack of specificity of anosognosia in relation to overall function. People with AD almost universally underestimate the presence of neuropsychological deficit, for example, minimising difficulties or attributing changes to normal ageing.

Techniques for measuring anosognosia in AD have enabled quantification of severity levels, which in turn have proved useful for experimental investigation. One approach is directly appraising levels of awareness of illness or cognitive deficit by

\* Corresponding author. Institute of Psychiatry, King's College London, PO Box 078, De Crespigny Park, London SE5 8AF, UK.

E-mail address: [robin.morris@kcl.ac.uk](mailto:robin.morris@kcl.ac.uk) (R.G. Morris).

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interviewing the person with AD (e.g., Hannesdottir and Morris, 2007; McGlone et al., 1991; Reed et al., 1993). This approach can explore, for example, beliefs about illness status, which can be independent of awareness of neuropsychological impairment. A second approach is to use a questionnaire (or structured interview) in which the person with dementia rates their everyday abilities or symptoms and this is compared to a parallel informant rating. In this case, the questionnaire can be used to target particular aspects of awareness, for example, memory functioning (Morris and Hannesdottir, 2004). Although subjective memory complaints concerning cognitive dysfunction, including memory, are relatively common in older people (Jonker et al., 2000), a main finding in AD, even in the early stages, is the tendency to overestimate ability in comparison to informants; discrepancies between the two sources of information, termed the *subjective rating discrepancy* (SRD) (Hannesdottir and Morris, 2007), or lack of correlation quantifies the extent of anosognosia. Finally, experimental studies can be conducted in which the person with AD is provided with a task likely to result in failure and have to judge their performance, either by making a prediction or estimating performance on completion. The difference between performance and judgement gives rise to an *objective-judgement discrepancy* (OJD) measure. This approach measures the more immediate response to failure, and is potentially useful in determining the extent to which online error detection is compromised in AD.

Of note, whatever method is used, group studies of AD detect overall loss of awareness of illness or deficit, even if the results from the different techniques are not necessarily highly correlated (Hannesdottir and Morris, 2007). Such approaches have shown that anosognosia occurs in the early stages of AD (Clare et al., 2012b), and even in the prodromal stages, as in mild cognitive impairment (MCI), although there is evidence for variability in the latter group, with some patients showing overestimation of subjective memory complaints, and other evidence for underestimation of memory impairment (Jungwirth et al., 2004; Roberts et al., 2009; Tremont and Alosco, 2011; Vogel et al., 2004), such that reliance on subjective complaints of symptoms may be suspect with regards to diagnosis. Longitudinal studies suggest that in early AD levels of anosognosia are relatively stable (Clare et al., 2012b), with evidence that with further increases in the severity of dementia anosognosia becomes more prominent but in a non-linear fashion (e.g., Aalten et al., 2006; Mograbi et al., 2012a).

Theoretical accounts of anosognosia in AD are likely to be complex and take into account the different processes associated with awareness. These include, for example, monitoring the level of success or failure on everyday tasks, translating the outcome of monitoring into decisions about current function and then further abstraction relevant information into more permanent 'self-belief.' With AD, different accounts have been produced, including those suggesting that lack of awareness is due to a failure of monitoring and control processes (e.g., Cosentino et al., 2007; Souchay, 2007), the effects of emotional dysregulation when engaging in self-monitoring (Rosen, 2011), impaired decision-making processes (e.g., Agnew and Morris, 1998; Morris and Hannesdottir, 2004), or due to the inability to consolidate

new personal information (Morris and Hannesdottir, 2004). Recently, the 'Petrified Self' hypothesis has been developed by Mograbi et al. (2009) in which it has been proposed that unawareness in AD may be differentially associated with specific aspects of memory function, tapping into episodic/semantic and remote/recent memory distinctions.

In this paper we propose an elaboration of the hypothesis in which anosognosia is caused primarily by a decline in specific mnemonic processes leading to a loss of personal knowledge. Central to this hypothesis is the notion that consolidation of personal information is a pre-requisite for the development of self-identity over the lifespan. Here, awareness of functional ability is considered to be a special case of personal trait judgement that concerns personal efficacy. Furthermore, it is proposed that awareness involves the shaping of individual knowledge and behaviour, with continual modification to maximise personal efficacy and minimise experience of failure (Morris and Hannesdottir, 2004). In other words, the mechanisms that facilitate awareness of functional ability should be considered *developmentally*, invoking memory and acquired representation, and *teleonomically*, invoking purposefulness.

As a cause of anosognosia, impairments in specific aspects of memory function may prevent the updating of the self-concept and result in the person not consolidating information concerning their reduction in neuropsychological function (Mograbi et al., 2009). In connection with this, Conway (e.g., Conway, 2005; Conway and Pleydell-Pearce, 2000) suggests the existence of a "working self", which modulates encoding of new information based on goals and self-image. Here, memory provides continuity to the experience of selfhood by allowing storage of past information and the ability to project future scenarios (Addis and Tippett, 2004). It constrains what the self is, has been and can be (Conway, 2005). Evidence from the study of brain damaged patients has suggested that profound impairment in mnemonic function clearly result in alterations in identity and selfhood, but with relatively preserved personality (Corkin, 2002; Klein and Nicols, in press; Rosenbaum et al., 2005; Tulving, 1999).

Such research indicates that different forms of memory give specific contributions to the formation of a self-concept. For example, there is substantial evidence that trait judgements about self or others are based on semantic knowledge extracted from episodes or life experiences (Klein et al., 2002a, 2008). Furthermore, semanticized traits facilitate more rapid access than if judgements were to be made on the basis of episodic memory. Nevertheless, there is evidence that trait summaries are updated in an accumulative fashion, with updating associated with each new episode. The nature of trait judgement may depend on the amount of experience of a person, with cursory judgement based on recent behavioural examples and more extensive experience leading to more abstracted trait summaries (Sherman and Klein, 1994). In relation to the development of self knowledge, the long time span of experience suggests self trait summaries are not only strongly semanticized as personal semantic knowledge but through a lengthy neural consolidation process (Tulving, 1985a, 1985b; Tulving et al., 1988). Nevertheless, episodic memory also contributes to a sense of self, allowing autoecic consciousness, time and travel and re-experiencing of details.

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