The missing link between faces and names: Evidence from Alzheimer's disease patients

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ABSTRACT

Retrieval of proper names is a cause of concern and complaint among elderly adults and it is an early symptom of patients suffering from neurodegenerative diseases such as Alzheimer's disease (AD). While it is well established that AD patients have deficits of proper name retrieval, the nature of such impairment is not yet fully understood. Specifically, it is unknown whether this deficit is due to a degradation of the links between faces and proper names, or due to deficits in intentionally accessing and retrieving proper names from faces. Here, we aim to investigate the integrity of the links between famous faces and proper names in AD while minimizing the impact of the explicit retrieval.

We compare the performances of AD patients and elderly controls in a face-name priming task. We assess the integrity of the link between faces and names at two different levels: identity level – the name and face belong to the same person; and semantic level – the name and face belong to the same category (e.g., politicians).

Our results reveal that AD patients compared with controls show intact semantic priming but reduced priming for person identity.

This suggests that the deficits in intentionally retrieving proper names in AD are the result of a partial disruption of the network at the identity level, i.e., the links between known faces and proper names.

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1. Introduction

When presented with a known face sometimes one may experience difficulties in retrieving specific information about that person's identity. The face may look familiar but one is not able to recall the person's name, profession, nationality, etc. Although these failures sometimes lead to socially awkward situations, in normal individuals they often resolve spontaneously and the correct name comes to mind (think of, for example, the last time you had the name of an actor at 'the tip of your tongue'). Hence, these problems appear to reveal transitory deficits in retrieving intact specific semantic representations from a known face. The same problem, although to a much greater degree, has been reported in elderly people (Evrard, 2002; Facal-Mayo, Juncos-Rabadan, Alvarez, Pereiro-Rozas, & Diaz-Fernandez, 2006; Fogler & James, 2007; Gale, Irvine, Laws, & Ferrissey, 2009; Langlois, Fontaine, Hamel, & Joubert, 2009) and especially in patients suffering from neurodegenerative diseases, such as Alzheimer's disease (AD) (e.g., Delazer, Semenza, Reiner, Hofer, & Benke, 2003; Semenza, Borgo, Mondini, Pasini, & Sgaramella, 2000) in which it is one of the cognitive symptoms that appears at an early stage of the disease (Semenza, Mondini, Borgo, Pasini, & Sgaramella 2003). In the case of patients, however, the question arises of to what extent the retrieval failures are uniquely due to temporary difficulties in accessing known information about a face, rather than reflecting semantic memory deterioration and/or access deficits associated with the disease.

The goal of the present article is to explore the deficits in retrieving specific information from a known face in individuals suffering from AD. In particular, the aim is to address whether the presentation of known faces can elicit automatic access to a

person's identity using proper names as a proxy for such information. This was done by using a priming technique that minimizes the participant's need of explicitly retrieving information about the face (Calabria, Miniussi, Bisiacchi, Zanetti, & Cotelli, 2009; Calder & Young, 1996). This combines the presentation of a known face as a prime with the presentation of a known proper name as a target. The participant's task is to categorize the printed proper name according to profession (artist vs. politician). Crucially, the target (e.g., Bill Clinton) can be preceded by: (a) the corresponding face (e.g., Bill Clinton), (b) a face corresponding to a known person from the same profession (e.g., Barack Obama), or (c) a face corresponding to a known person from a different profession (e.g., Tom Cruise). These different conditions allow for exploring two effects of priming, namely the semantic and identity priming effects. First, when the prime and the target are semantically related (Bill Clinton's face – Barak Obama's name) the recognition of the target is sped up as compared to when the two items are unrelated (Bill Clinton's face – George Clooney's name), the so-called *semantic* priming effect (Vitkovitch, Potton, Bakogianni, & Kinch, 2006). This is assumed to occur due to spreading activation from the prime representation to other representations that belong to the same semantic category (e.g., politician). Second, when the prime and the target correspond to the same semantic representation (e.g., Bill Clinton's face and Bill Clinton's name), the recognition of the target is sped up as compared to when the two items are unrelated, the so-called *identity* priming effect. This is due to the activation of each proper name associated to the corresponding face. Identity priming is usually larger than semantic priming because it works as 'repetition' priming, that is, the prime and target are two instances of the same identity.

The use of the priming technique allows for reducing the potential impact that explicit, semantic memory-retrieval deficits associated to AD can have when accessing information from known faces. In fact, although AD is characterized by a deficit of semantic memory (Henry, Crawford, & Phillips, 2004; Hodges, Patterson, Graham, & Dawson, 1996; Hodges, Salmon, & Butters, 1992; Lambon Ralph, Patterson, & Hodges, 1997; Laws, Adlington, Gale, Moreno-Martinez, & Sartori, 2007; Rogers & Friedman, 2008), AD patients also show problems with other cognitive abilities related to executive control (EC) that are crucially involved in accessing semantic information, irrespective of whether such information is degraded or not (Buckner, 2004; Collette, Van der Linden, & Salmon, 1999; Collette et al., 2007; Duke & Kaszniak, 2000; Perry & Hodges, 1999). Thus, in AD the failure to intentionally retrieve the proper name (or any sort of information) associated to a known face could be due to semantic memory degeneration and/or to difficulties in EC processes.

Most of the studies addressing the processing of known faces and proper names in AD patients have made use of tasks involving explicit measures of semantic memory (Delazer et al., 2003; Greene & Hodges, 1996; Hodges & Greene, 1998; Semenza et al., 2000, 2003). For example, in Greene and Hodges (1996), AD patients and elderly matched controls were presented with a set of famous faces and they were required to produce the corresponding proper names and to provide specific information about them. AD patients were considerably impaired in both of these tasks as compared to controls, but to a lesser extent in person-knowledge retrieval than in retrieving the corresponding proper names (for similar results see also Snowden, Thompson, & Neary, 2004). All in all, these results suggest that AD patients are impaired in explicit, semantic retrieval compared to controls. Hence, to advance knowledge of the extent to which semantic memory is deteriorated in these patients, it is useful to use a technique that minimizes the impact of explicit memory retrieval, as is the case when using the priming technique.

Previous studies have already used the semantic priming technique to assess the relative contribution of actual semantic memory degradation and retrieval deficits typically observed in AD (Giffard, Desgranges, & Eustache, 2005; Giffard et al., 2001, 2002; Hernández et al., 2008; Martins & Lloyd-Jones, 2006; Nebes, 1989, 1994; Nebes, Brady, & Huff, 1989; Ober, Shenaut, Jagust, & Stillman, 1991; Perri, Zannino, Caltagirone, & Carlesimo, 2011; Perri et al., 2003). Unfortunately, these studies offered mixed results. While some studies revealed similar priming effects in AD patients and controls (Nebes et al., 1989; Ober et al., 1991) suggesting intact semantic representations regardless of the patients' ability to explicitly retrieve those representations, other studies showed abnormal priming effects in AD patients as compared to controls (Giffard et al., 2001, 2002, 2005; Perri et al., 2011), revealing a deterioration of the semantic memory system (Giffard et al., 2001; Nebes et al., 1989). However, there is no evidence of priming for proper names in the context of AD.

An exception to this lack of evidence is a recent paper by Brambati, Benoit, Monetta, Belleville, & Joubert (2012) in which the integrity of proper name representations was tested in patients with Mild Cognitive Impairment (MCI), the pre-clinical stage of AD. Brambati, Peters, Belleville, and Joubert (2012) had participants make familiarity judgements on proper names. Before the presentation of a target, a prime (proper name) was presented that could be: (a) the same proper name (identity condition), (b) a proper name of a different famous person with the same profession (semantic condition), or (c) a proper name of an unknown person (unrelated condition). The identity priming effect (measured by percentage) was calculated by dividing the difference between the RTs of the identity and the unrelated conditions by the RTs of the unrelated condition. The semantic priming effect was calculated by dividing the difference between the RTs of the semantic and the unrelated conditions by the RTs of the unrelated condition. The identity effect was of a similar magnitude for MCI and control participants. The integrity of the effect in AD might partially be explained by the fact that the prime and target were the same word. Interestingly, the semantic effect was present in controls but not in MCI patients. The absence of the semantic priming effect in MCI compared to controls led the authors to conclude that in the pre-clinical stage of AD the access to a person's specific information is due to a degradation of the semantic memory system.

The current study aimed to extend these observations to AD patients but using a cross-modal (face-name) priming where the semantic information is primed by the presentation of a famous face.

2. The present study

As advanced above, we explore whether the difficulties shown by AD patients when accessing proper names from known faces is actually due to the degradation of the semantic memory, or whether it is the result of semantic memory access deficits. This is tested by means of the face-name priming paradigm by comparing the performances of AD patients to that of healthy older adults on the semantic and identity effects of priming.

The general hypothesis for both effects is that if the deficits shown by AD patients are mostly due to semantic memory access deficits, then one should expect the same priming effects in these individuals as compared to controls. Instead, if such deficits arise because of a genuine deterioration of the information stored in semantic memory, then one should observe abnormal priming effects.

Two direct measures of semantic memory were also added by asking participants to retrieve the proper name and biographic information (occupation) of famous people according to their faces. These direct measures of semantic memory are useful for quantifying the anomia for proper names and the semantic deficits of person-knowledge in AD patients when explicitly retrieving this information.