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Episodic autobiographical memory in normal aging and mild cognitive impairment: A population-based study

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ABSTRACT

While episodic memory impairment has been extensively studied in normal and pathological aging, studies investigating age-related episodic autobiographical memory among representative samples are scarce. We therefore investigated episodic autobiographical memory in a sample of 395 participants of a population-based prospective study of aging. Three groups were compared, consisting of 194 middle-aged participants, 138 healthy old-aged participants and 63 patients with mild cognitive impairment (MCI). Results showed a significant impairment of episodic autobiographical memory performance associated with MCI, but not with normal aging. These deficits were significantly correlated with verbal memory performances, but not with measures of executive functions.

1. Introduction

Autobiographical memory (AM) is an essential component of human memory. It comprises episodic and semantic components according to the nature of the retrieved material (Tulving, 2002; Wheeler et al., 1997). Episodic memory involves recollection of context-rich autobiographical events with a distinct sense of personal re-experiencing, whereas semantic memory involves knowledge that is devoid of the context in which the information was acquired. Conway and Pleydell-Pearce (2000) proposed that autobiographical memories are transitory mental constructions generated from an autobiographical knowledge base where knowledge is held at different levels of specificity. According to their model, episodic autobiographical memories of past personal events can be formed when highly specific details (such as sensory-perceptual details, images, emotions and thoughts) are accessed in the autobiographical knowledge base (Conway, 2009). In contrast, when more generic abstract knowledge is accessed, general non-specific autobiographical memories are generated which correspond to general events or knowledge related to life themes and life periods (Conway and Pleydell-Pearce, 2000).

This episodic-semantic distinction within the AM is paralleled by a distinct pattern of underlying brain regions (Maguire, 2001; Levine et al., 2004) which are differentially affected by normal and pathological aging. While personal semantic memory is usually preserved in normal aging (Addis et al., 2008; Levine et al., 2002; Piolino et al., 2002, 2006, 2010; St. Jacques and Levine, 2007) and incipient dementia (Leyhe et al., 2009; Murphy et al., 2008; but see Irish et al., 2010), and later deteriorates gradually with disease progression (Greene and Hodges, 1996; Greene et al., 1995; Hou et al., 2005; Piolino et al., 2003; Seidl et al., 2011), the episodic component of AM is impaired early in the course of the disease. Moreover, several studies have also shown episodic AM impairment in normal aging. Most of these studies have compared old to young participants (below the age of 35 years) (Addis et al., 2008; Bluck et al., 1999; Fromholt et al., 2003; Levine et al., 2002; Piolino et al., 2010; St. Jacques and Levine, 2007), but other authors (Irish et al., 2011; Fromholt et al., 2003; Piolino et al., 2002, 2006) also compared participants aged between 50 and 100 years and demonstrated a gradual decline of episodic AM with age. Overall, older participants produced fewer, less detailed and less autonoetically consciously remembered memories than younger participants. Interestingly, the study by Piolino et al. (2002) demonstrated that episodic AM decline becomes apparent after the age of 60 years. This finding is in line with other studies showing that cognition in general, but also more specifically episodic (non-autobiographical) memory remains relatively preserved in healthy people until the age of

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55–60 years (for review, Hedden and Gabrieli, 2004; Nilsson, 2003). However, Howes and Katz (1992) failed to find significant difference between middle-aged (M=48.11; S.D.=4.64) and old-aged (M=68.23; S.D.=2.69) participants with regard to their ability to report specific autobiographical memories. Hence this issue of the age at which changes in episodic AM can be observed remains debated. Studying further groups of middle-aged and old-aged people could help us answer this question.

Regarding pathological aging, more recent clinical studies have demonstrated episodic AM impairments in patients with amnestic mild cognitive impairment (MCI). Focusing on patients with amnestic, but also multi domain MCI is important when studying memory in aging due to the high risk of converting to Alzheimer's disease, which is higher than that of patients with non-amnestic MCI (Mitchell and Shiri-Feshki, 2009). Patients' memories were more semanticized, i.e. they were less specific and less detailed compared to healthy controls (Donix et al., 2010a; Irish et al., 2010; Leyhe et al., 2009) and comprised a lower proportion of internal details (related to the main memory event) vs. external details (comprising extraneous information not specifically related to the main memory event) (Gamboz et al., 2010; Murphy et al., 2008). In these studies, all patients presented with an amnestic MCI i.e., with at least one objective memory impairment supporting their memory complaint (Petersen, 2004). However, all these studies included rather small groups of participants ($n \leq 20$).

Numerous clinical and naturalistic studies based on large and representative samples of participants have investigated episodic memory in normal and pathological aging (Nilsson, 2003; Rönnlund et al., 2005), but similar studies on AM are scarce (Dreyfus et al., 2010). Exploring together AM and other cognitive functions in a population-based sample of aged people offers the possibility to get new insight on their differential age vulnerability. For instance, it remains unknown whether verbal memory as measured in clinical settings is more prone to age-related changes than the more ecological episodic AM tasks. Typically, memories of personally experienced past events are much more complex and emotional than verbal non-autobiographical items and contain information intimately connected to the self (Conway et al., 2004; Conway, 2005). Several studies have shown that emotions are mostly not impaired in normal (Kensinger, 2009) and pathological aging (Irish et al., 2011). Similarly, other studies have demonstrated that autobiographical memories strongly linked to the self or self-concerns as self-defining memories (Singer and Moffitt, 1991) remain unchanged in normal aging (Martinelli and Piolino, 2009; Singer et al., 2007) and in patients with Alzheimer's disease (Addis and Tippett, 2004). Therefore, one should expect that memories of past personal events should be longer preserved than verbal memory in aged people, in that they relate on emotions and self concepts which are little affected by aging.

The investigation of AM and of the different phenomenological aspects of autobiographical memories is complex (Piolino et al., 2002). The administration of AM questionnaires often requires several hours and these reasons might have contributed to limit their use in studies with large samples. In the present study, we therefore used a simplified AM questionnaire (Ahlsdorf, 2009) to investigate the episodic component of AM and more specifically to address memory details. This questionnaire was easy to administer and suitable to assess AM in a large sample.

The sample of this study corresponded to a population-based sample of participants involved in a German prospective study of aging. In this sample, we investigated three groups of participants: healthy middle-aged, healthy old-aged and old-aged participants with MCI. Based on the previous aforementioned studies, we hypothesized that patients with MCI would exhibit lower AM performance than both groups of healthy participants. We did not make firm assumptions on the comparison between performance of old-aged and middle-aged participants given the discrepancies found in the previous studies exploring people at ages comparable to those of our participants (Piolino et al., 2002; Howes and Katz, 1992). As mentioned before, we also hypothesized that verbal memory is gradually impaired across groups (from middle-aged to old-aged with MCI) and will be impaired earlier than AM. We expected verbal memory and executive function decline to parallel AM decline once the latter becomes apparent.

2. Method

2.1. Participants

The subjects were participants of the Interdisciplinary Longitudinal Study on Adult Development and Aging (ILSE). This prospective study is based on two birth cohorts born during 1930–1932 and 1950–1952. The subjects were randomly identified and recruited according to community registers. In both cohorts, five hundred subjects living in the urban regions of Leipzig (Saxony) or Heidelberg/Mannheim (Palatine) participated (Martin and Martin, 2000). The study was approved by the ethical committee of the University of Heidelberg. After complete description of the study to the subjects, written informed consent was obtained. The participants were carefully screened for physical and mental health by extensive clinical interviews, physical examinations, and laboratory tests. The German version of the Structured Clinical Interview for the DSM-III-R was applied and any psychiatric disorder was classified accordingly (Wittchen et al., 1991). The first examinations took place between December 1993 and January 1996. Data of the present study correspond to the third examination wave which was performed between 2005 and 2008, i.e. more than ten years after the initiation of the longitudinal study. At this time, 381 participants of the 1930–1932 cohort and 408 participants of the 1950–1952 — corresponding to more than 75% and 80%, respectively, of the original cohorts — could be reinvestigated. The investigation consisted of an extensive clinical interview and comprised several questionnaires addressing a broad range of demographic, educational, social, juridical, and medical variables. Investigations also included a thorough assessment of neuropsychological functioning and AM.

People with current diagnosis of dementia (according to DSM-III-R criteria) or psychiatric disorder (e.g., substance abuse, depression or anxiety disorder according to DSM-III-R criteria) were excluded from the analyses. In addition, participants with incomplete AM assessment were excluded. Hence, a sample of 417 participants was available for analyses comprising 216 participants of the 1950–1952 cohort and 201 participants of the 1930–1932 cohort.

The criteria for mild cognitive impairment (MCI) initially proposed by Petersen et al. (2001) specify (1) the presence of a subjective memory complaint, (2) preserved general intellectual functioning, (3) demonstration of a memory impairment by cognitive testing, (4) intact ability to perform activities of daily living, and (5) absence of dementia but have been extended to the concept of multi domain MCI recently (Winblad et al., 2004). Accordingly, we identified multi domain MCI patients by using the aging-associated cognitive decline (AACD) criteria which have been applied during the first two waves of examinations (see Kuzma et al., 2011; Sattler et al., 2011; Sattler et al., in press; Schönknecht et al., 2005). Initially, the concept of MCI as introduced by Flicker et al. (1991) was highly similar to that of AACD and both correspond to the current concept of multi domain MCI (Winblad et al., 2004). Importantly, the construct validity of the AACD concept is supported by a variety of studies demonstrating an increased risk of developing Alzheimer's disease (Ritchie et al., 2001; Schönknecht et al., 2005; Schröder and Pantel, 2010). In detail, diagnostic criteria for AACD which have been proposed by the International Psychogeriatric Association (Levy, 1994) include (1) subjective impairment: a report by the individual (or a reliable informant) that cognitive function has declined and (2) objective impairment: difficulties in any of the following cognitive domains, as indicated by a neuropsychological test performance of at least one standard deviation below normal age and educational levels: memory and learning, attention and concentration, abstract thinking (problem solving, abstraction), language, and visuospatial functioning. In our investigation, the diagnosis of MCI was assigned if a mild cognitive deficit according to the two criteria for AACD was present, but a history and/or an objective examination revealed evidence for a cerebral and/or systemic disorder that was sufficient to cause cerebral dysfunction (exclusion criterion for aging-associated cognitive decline).

Cognitive impairments were objectified by difficulties in any of the following cognitive domains, as indicated by a neuropsychological test performance of at least one standard deviation below normal age and educational levels: memory and learning (Nürnberger-Alters-Inventar (NAI); Oswald and Fleischmann, 1991), attention and concentration (Aufmerksamkeits-Belastungs-Test; Brickenkamp,