



Does Sex Matter? High Semantic Autobiographical Retrieval in Women and Men With Alzheimer's Disease

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Short title: Sex and autobiographical specificity in AD

Does sex matter?

high semantic autobiographical retrieval in women and men with Alzheimer's
disease

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The decline of autobiographical memory in Alzheimer's disease (AD) is mainly characterized by overgenerality. While there is a large body of research on autobiographical overgenerality in AD, this research has mainly assessed retrieval with a dichotomy between specific vs. general retrieval. To go beyond this dichotomy, we assessed several degrees of autobiographical specificity in patients with AD, namely, we assessed specific vs. categoric vs. extended vs. semantic retrieval. We also assessed sex differences regarding these degrees of autobiographical specificity. We invited patients with mild AD and control participants to complete sentences (e. g., "When I think back to/of...") with autobiographical memories. Memories were categorized into specific, categoric, extended, or semantic memories. Results demonstrated more semantic than specific, categoric or extended memories in men and women with AD. In control participants, analysis demonstrated more specific than categoric, extended, and semantic memories in men and women. Also, no significant differences were observed between women and men with AD, or between control women and men, regarding specific, categoric, extended, and semantic memories. This study offers not only a nuanced analysis of autobiographical specificity in patients with mild AD, but also an original analysis regarding this specificity by sex.

Keywords: Alzheimer's disease; autobiographical memory; autobiographical specificity; sex; sex differences.

Alzheimer's disease (AD) is an irreversible neurodegenerative disorder characterized by the accumulation of two proteins: amyloid beta and hyperphosphorylated tau. The accumulation of amyloid beta and hyperphosphorylated tau leads to neural loss and shrinkage in brain volume (McKhann et al., 2011; Moloney et al., 2021). This accumulation in the vast majority of patients occurs in areas important for memory, hence the earliest and main cognitive symptomatology of AD is memory impairment (McKhann et al., 2011). A large amount of research has assessed and demonstrated the features of memory decline in AD. Within this research, a distinction can be made between quantitative and qualitative approaches. While the quantitative approach has assessed the amount of information that patients with AD may forget, such as the number of forgotten words on a word-list, the qualitative approach has focused on the characteristics of memory (dys)function in AD. Within this qualitative approach, research on autobiographical memory has assessed how AD weakens the ability of patients to retrieve specific autobiographical memories (i.e., personal events situated in time and space) and even how patients with AD suffer difficulties in retrieving specific autobiographical memories to construct their life story and to support their sense of self. In line with this qualitative approach, the present study aimed to investigate the ability of patients with AD to construct specific autobiographical memories using a methodology that has not yet been tested in AD. To situate our aim into the current literature, we briefly discuss below the typical tests of autobiographical memory in AD. We also summarize recent research on the effects of sex differences on autobiographical specificity in AD, which motivated us to assess sex differences.

Autobiographical memory can be assessed with tests such as the Autobiographical Memory Interview (Kopelman et al., 1989) which is a semi-structured interview assessing general autobiographical information such as the date and place of birth as well as specific autobiographical events from different time periods of someone's life (e.g., from childhood or the last holiday). Using this test, a body of research has assessed autobiographical memory in

AD, revealing autobiographical overgenerality (i.e., a tendency to retrieve general rather than specific autobiographical memories) in patients with AD (Greene & Hodges, 1996; Hou et al., 2005; Leyhe et al., 2009; Meeter et al., 2006; Muller et al., 2013; Piolino et al., 2003). Autobiographical overgenerality in AD has been also reported by research in which patients with AD have been invited to retrieve memories cued by words such as “family” or “school” (Philippi et al., 2015). Autobiographical overgenerality in AD has been also shown by research in which patients with AD were invited to retrieve unique memories lasting less than 24h and situated in time and space (El Haj & Allain, 2020; El Haj & Antoine, 2017a, 2017b; El Haj, Boudoukha, et al., 2020; El Haj, Boutoleau-Bretonnière, et al., 2020; El Haj, Boutoleau-Bretonnière, et al., 2020a). The autobiographical overgenerality in AD has been associated with a diminished subjective experience during retrieval and difficulties to mentally relive the past (El Haj & Antoine, 2017b; El Haj et al., 2016; Rauchs et al., 2007). According to the AMAD (Autobiographical Memory in Alzheimer’s Disease) model (El Haj et al., 2015), autobiographical overgenerality in patients with AD leads to a shift from the ability to mentally relive past events to a general sense of familiarity that may be expressed by AD patients as a sense of “having experienced this before”.

Building on the previous research, we investigated overgenerality using a method that has not been previously used in AD, the Sentence Completion for Events from the Past Test (SCEPT), developed by Raes et al. (2005). In this test, participants are typically provided with 11 sentences, each probing for thoughts relating to the past (e. g., “When I think back to/of..., I still recall how/that I...”) and are asked to complete each sentence with autobiographical memories. Retrieval is then analyzed regarding four categories of specificity: specific memories (i.e., specific autobiographical events that did not last longer than a day), categoric memories (i.e., similar or repeated autobiographical events), extended memories (i.e., autobiographical

information on an extended period of time) and semantic memory (i.e., general autobiographical information).

In this study, we used the SCEPT for several reasons. We reasoned that probing thoughts relating to the past (e.g., “When I think back to/of..., I still recall how/that I...), as proposed by the SCEPT, may offer AD patients with a non-directive instruction promoting retrieval in a reminiscence/elaborative and less effortful fashion compared with the typical directive instructions used in other autobiographical tests. For instance, retrieval to cue-words that target a specific theme (e.g., school, vacation), as implemented by cue-words autobiographical tests, may be more effortful for patients with AD compared to being invited to simply retrieve memories to a general thought (e.g., In the past...). We also used the SCEPT as this test allows a detailed investigation of autobiographical overgenerality. Research on autobiographical memory in AD has assessed autobiographical overgenerality using a dichotomy between specific and general retrieval, which is the case of research using the Autobiographical Memory Interview on which autobiographical retrieval is analyzed regarding “external details” (i.e., semantic information) vs “internal details” (i.e., episodic information). To go beyond this simple dichotomy, we used the SCEPT as this test may offer an in-depth analysis of autobiographical overgenerality by categorizing memories as specific, categoric, extended, or semantic.

While the main aim of this paper was to investigate whether patients with AD would retrieve less specific than categoric, extended, or semantic information, another aim was to investigate potential sex differences regarding specificity. While research has demonstrated a significant advantage of men with AD on tests assessing item-episodic memory (Irvine et al., 2012; Laws et al., 2016), little is known about sex differences regarding autobiographical memory in AD. In a study on sex differences regarding autobiographical memory in AD, patients with AD and healthy control participants were invited to retrieve autobiographical

memories (El Haj, Boutoleau-Bretonniere, et al., 2020a). Participants were invited to retrieve two autobiographical memories, each memory being cued with the following instruction: “recount in detail an event in your life”. Participants were instructed that the retrieved memories should be specific, namely, that memories had to have lasted no more than a day and spatiotemporal details had to be provided, such as the time and place at which the events had occurred. Memories were evaluated regarding specificity, using a scale ranging from zero (i.e., for a total lack of memory) to four points (for specific events situated in time and space enriched with phenomenological details, such as emotion). Using this scale, a mean score was calculated to assess autobiographical specificity with the maximum score of four points. Analysis demonstrated lower specificity in patients with AD than in healthy control participants with no sex differences regarding specificity in any of the two populations. However, the lack of sex differences in this study can be attributed to the use of a compound score that did not take into account the multidimensional nature of specificity. **Given research demonstrating that women retrieve autobiographical events with more richness of details compared with men in the general populations (Grysman, 2017; Grysman et al., 2016; Nahari & Pazuelo, 2015; Pasupathi & Wainryb, 2010), sex differences could be expected if a more detailed analysis of specificity, as proposed by the SCEPT, were to be applied.**

To summarize, research has assessed autobiographical specificity in AD using a simple dichotomy between general vs specific retrieval, or using compound scores that confound several features of specificity into a single metric. To overcome these limitations, we used a more detailed methodology, incorporated in the SCEPT, to provide a qualitative analysis of specificity. We hypothesized that patients with AD would retrieve less specific, categoric, and extended than semantic retrieval. We also used this methodology to assess potential sex differences regarding specific, categoric, extended, and semantic retrieval. We expected higher retrieval of specific memories in women than in men with AD.

Method

Participants

The study included 41 patients with a clinical diagnosis of probable mild AD (22 women and 19 men; M age = 70.32 years, SD = 3.24; M years of formal education = 9.02, SD = 1.62) and 44 control older adults (24 women and 20 men; M age = 70.11 years, SD = 3.88; M years of formal education = 8.95, SD = 1.66). We recruited patients with AD from local retirement homes. The diagnosis of probable AD dementia was based on the National Institute on Aging-Alzheimer's Association clinical criteria (McKhann et al., 2011). The control participants were, at 75%, spouses of patients with AD and the remaining were recruited from local community. The control participants were independent and living at home and were matched with patients with AD regarding sex [$X^2(1, N = 85) = .007, p = .93$], age [$t(83) = .28, p = .78$], and educational level [$t(83) = .20, p = .84$]. Exclusion criteria for all participants were significant psychiatric or neurological illness (other than AD for the patients' group), alcohol or drug use, or a history of clinical depression.

We were careful to match women and men with AD regarding age [$(M$ women = 70.59, SD = 3.25, M men = 70.00, SD = 3.28, $t(39) = .58, p = .56$], formal education [$(M$ women = 9.09, SD = 1.57, M men = 8.95, SD = 1.71, $t(39) = .28, p = .78$], and general cognitive functioning as assessed with the Mini Mental State Exam (Folstein et al., 1975) [$(M$ women = 21.95, SD = 2.20, M men = 21.86, SD = 1.96, $t(39) = .13, p = .90$]. We were also careful to match women and men in the control group regarding age [$(M$ women = 70.15, SD = 3.76, M men = 70.05, SD = 2.95, $t(42) = .11, p = .91$], formal education [$(M$ women = 9.20, SD = 1.67, M men = 8.75, SD = 1.64, $t(42) = .89, p = .38$], and general cognitive functioning [$(M$ women = 28.05, SD = 1.39, M men = 28.17, SD = 1.27, $t(42) = .29, p = .77$]. In doing so, we were careful to ensure that any potential sex differences in autobiographical memory of patients with

AD or control participants would not be due to differences in age, educational level, or general cognitive ability. As expected, regardless of sex differences Mini Mental State Exam scores of patients with AD ($M = 21.90$, $SD = 2.05$) were lower than those of control participants ($M = 28.11$, $SD = 1.32$), $t(83) = 16.76$, $p < .001$), corresponding to the stage of mild AD dementia. The study was conducted in accordance with the principles of the Declaration of Helsinki. All participants provided written consent and were able to withdraw whenever they wished.

Procedures

Procedures included assessment of episodic memory, as well as the SCEPT.

Episodic memory

We measured episodic memory using a French adaptation (Van der Linden et al., 2004) of the test of Grober and Buschke (Grober & Buschke, 1987). We invited participants to retain 16 words, each of which corresponded to an item belonging to a different semantic category. After immediate cued recall, the participants proceeded to a distraction phase, during which they had to count backwards from 374 in series of 20 seconds. This phase was followed by two minutes of free recall and the score from this phase (out of a maximum of 16) provided a measure of episodic memory.

SCEPT

We informed participants that they would be provided with 11 sentences, and more specifically, with parts of 11 sentences since only the beginning of each of the sentences would be provided. We explained that the purpose would be to complete each sentence with an autobiographical event, specifically, with a unique personal memory lasting less than 24h and situated in time and space. We encouraged participants to describe their feeling, emotions and thoughts during each event. We also encouraged participants to provide, as far as possible, a

different event for each sentence. The instructions, sentences, and responses were provided verbally. Responses were recorded.

Eleven sentences were presented in the following order: “I still remember well how...”, “I still recall how I...”, “Last year...”, “In the past...”, “Last week I...”, “I can still picture how...”, “When I think back to/of...”, “I will never forget...”, “The most important thing that I have ever...”, “Last year I...”, and “At the time when I...”. When participants were unable to complete the sentences, we encouraged them to describe any event that comes to mind. Interestingly, patients with AD experienced greater difficulties to retrieve events occurring in the last week/year, presumably because of anterograde amnesia, i.e., the difficulty of patients with AD to encode and later retrieve recent events (El Haj et al., 2015; El Haj et al., 2017). In this case, we invited them to retrieve any personal information, as long as they believe that it was encountered last week/year. Participants were allowed two minutes to describe each event. If spontaneous retrieval ended before the two-minutes period, we asked participants if they would like to add any other details. In case of participants providing more than one events for a given sentence, we only analyzed the first one.

Autobiographical analysis.

We analyzed SCEPT according to the guidelines provided by Raes et al. (2007). Specifically, we assessed whether each retrieved event referred to a: specific event (i.e., memory of an event that did not last longer than a day and was situated in time and space), categorical event (i.e., memory describing similar or repeated/related events without specification of a particular time and space), extended event (i.e., memory describing an extended period of time lasting longer than a day), or semantic event (i.e., memory describing general personal information). We also took into account omissions (i.e., when participants provided no response).

To illustrate our approach, we provide an event, which was retrieved by a patient with AD and was classified as a specific event: “I still remember well how I cried with relief and joy when I saw my first baby for the first time...It was in the intensive care unit as my baby was premature...I was overwhelmed by holding him for the first time...I then only really realized I was a mum...It was nearly 10 or 11 PM.... I just laid looking at him sleep all night wondering how to take care of him.” For comparison, the same patient provided another event, which we classified as a categorial event: “I can still picture how my kids and I used to bake real bread...my young daughter used to hurt, and even burn, her fingers as she tried to eat the bread as soon as it came out of the oven”. Also, the same patient provided another event, which we classified as an extended event: “In the past, with my husband and my kids, we used to spend the summer holidays with my husbands’ parents”. Finally, the same patient provided another event, which we classified as a semantic event: “Last year I was hospitalized”. To avoid scoring bias, retrieval was rated by two independent raters who were psychologists blind to the aims of the study and to group assignment. Inter-rater agreement coefficients of 0.85 and higher were obtained (as assessed by the intra-class correlation coefficient, two-way, random affects mode (Shrout & Fleiss, 1979)). Cases of disagreement were examined and discussed among the two raters until a consensus was reached.

Results

Statistical analysis

Scores are provided in Table 1. We investigated group and sex differences in AD patients and control participants for episodic memory using Mann-Whitney U-tests for between-group comparisons, and Wilcoxon's signed-rank tests for within-group comparisons. Regarding autobiographical memory, we counted for each participant the number of specific, categoric, extended, and semantic memories, as well as the number of omissions. We then calculated

means for patients vs. controls and women vs. men, with a maximum score of 11 (referring to the number of 11 sentences on the SCPT). We assessed between-group differences between AD patients and control participants using Mann-Whitney U-test. We also assessed group differences for different types of autobiographical retrieval (i.e., for specific memories, categoric memories, extended memories, semantic memories, and omissions) using Friedman tests followed with Wilcoxon's signed-rank. We used non-parametric tests because data were not distributed normally according to Shapiro-Wilk tests. We calculated effect sizes by using Cohen's d (Cohen, 1992) for non-parametric tests according to the recommendations of Rosenthal and DiMatteo (2001), and Ellis (2010) (0.20 = small, 0.50 = medium, 0.80 = large). For all tests, the level of significance was set as $p < 0.05$.

Higher episodic memory in men than in women with AD.

Regardless of sex, lower episodic memory was observed in AD patients ($M = 5.90$, $SD = 2.39$) than in control participants ($M = 10.84$, $SD = 3.03$) ($Z = -6.10$, $p < .001$, Cohen's $d = 1.75$). Lower episodic memory was observed in both women with AD compared to control women ($Z = -5.36$, $p < .001$, Cohen's $d = .73$), and men with AD compared to control men ($Z = -2.99$, $p = .003$, Cohen's $d = 1.09$). In the AD group, analysis demonstrated higher episodic memory in men compared to women ($Z = -3.83$, $p < .001$, Cohen's $d = 1.49$). In the control group, no significant differences were observed between women and men ($Z = -1.11$, $p = .27$, Cohen's $d = .33$).

Poor autobiographical retrieval in patients with AD.

Regardless of sex and the autobiographical category, and compared to control participants, patients with AD produced fewer specific memories ($Z = -5.83$, $p < .001$, Cohen's $d = 1.62$), categoric memories ($Z = -3.90$, $p < .001$, Cohen's $d = .93$), and extended memories

($Z = -3.25$, $p = .001$, Cohen's $d = .75$), but more semantic memories ($Z = -2.25$, $p = .025$, Cohen's $d = .50$) and omissions ($Z = -5.07$, $p < .001$, Cohen's $d = 1.30$).

No sex differences on autobiographical specificity in patients with AD or controls

More semantic memories ($Z = -2.15$, $p = .031$, Cohen's $d = .48$), and omissions ($Z = -3.86$, $p < .001$, Cohen's $d = .91$) were observed in women with AD compared to control women. Fewer specific memories ($Z = -4.39$, $p < .001$, Cohen's $d = .91$), categoric memories ($Z = 2.93$, $p = .003$, Cohen's $d = .57$), and extended memories ($Z = -2.31$, $p = .021$, Cohen's $d = .51$) were observed in women with AD compared to control women. More semantic memories ($Z = -2.13$, $p = .033$, Cohen's $d = .47$), and omissions ($Z = -3.20$, $p = .001$, Cohen's $d = .73$) were observed in men with AD compared to control men. Fewer specific memories ($Z = -3.83$, $p < .001$, Cohen's $d = .91$), categoric memories ($Z = 2.54$, $p = .011$, Cohen's $d = .57$), and extended memories ($Z = -2.38$, $p = .017$, Cohen's $d = .51$) were observed in men with AD compared to control men.

Critically, no significant differences were observed between women and men with AD regarding specific memories ($Z = -.49$, $p = .62$, Cohen's $d = .15$), categoric memories ($Z = -.69$, $p = .22$, Cohen's $d = .21$), extended memories ($Z = -.66$, $p = .51$, Cohen's $d = .20$), semantic memories ($Z = -.32$, $p = .75$, Cohen's $d = .21$), or omissions ($Z = -.08$, $p = .94$, Cohen's $d = .03$). No significant differences were observed between control women and men regarding specific memories ($Z = -.48$, $p = .63$, Cohen's $d = .14$), categoric memories ($Z = -.39$, $p = .70$, Cohen's $d = .11$), extended memories ($Z = -.21$, $p = .83$, Cohen's $d = .21$), semantic memories ($Z = -.47$, $p = .63$, Cohen's $d = .14$), or omissions ($Z = -.74$, $p = .48$, Cohen's $d = .22$).

More semantic than specific, categoric or extended memories in men and women with AD.

In the AD group, and regardless of sex, analysis demonstrated significant differences across specific memories, categoric memories, extended memories, semantic memories, and omissions [$X^2(1, N = 41) = 95.19, p < .001$, Cohen's $d = 2.47$]. Follow-up analysis demonstrated no significant differences between specific memories and categoric memories ($Z = -.28, p = .78$, Cohen's $d = .06$), specific memories and extended memories ($Z = -.79, p = .43$, Cohen's $d = .47$), or extended memories and categoric memories ($Z = -.74, p = .45$, Cohen's $d = .47$). However, AD patients provided more semantic than specific ($Z = -3.48, p < .001$, Cohen's $d = .81$), categoric ($Z = -3.84, p < .001$, Cohen's $d = .86$) or extended memories ($Z = -3.77, p < .001$, Cohen's $d = .82$). AD patients also demonstrated more omissions than specific ($Z = -5.60, p < .001$, Cohen's $d = 1.51$), categoric ($Z = -3.77, p < .001$, Cohen's $d = .82$) extended ($Z = -5.53, p < .001$, Cohen's $d = 1.48$) and semantic memories ($Z = -4.46, p < .001$, Cohen's $d = 1.10$).

In women with AD, analysis demonstrated significant differences across specific memories, categoric memories, extended memories, semantic memories, and omissions [$X^2(1, N = 22) = 48.00, p < .001$, Cohen's $d = 2.31$]. Follow-up analysis demonstrated no significant differences between specific and categoric memories ($Z = -.29, p = .77$, Cohen's $d = .47$), between specific and extended memories ($Z = -.32, p = .75$, Cohen's $d = .44$), or between extended and categoric memories ($Z = -.49, p = .62$, Cohen's $d = .47$). However, women with AD provided more semantic than specific ($Z = -2.34, p = .019$, Cohen's $d = .47$), categoric ($Z = -4.12, p < .001$, Cohen's $d = .47$) or extended memories ($Z = -2.73, p = .006$, Cohen's $d = .47$). Women with AD also demonstrated more omissions than specific ($Z = -3.84, p < .001$, Cohen's $d = .47$), categoric ($Z = -5.53, p < .001$, Cohen's $d = .47$), extended ($Z = -3.83, p < .001$, Cohen's $d = .47$), and semantic memories ($Z = -3.03, p = .002$, Cohen's $d = .47$).

In men with AD, analysis demonstrated significant differences across specific memories, categoric memories, extended memories, semantic memories, and omissions [$X^2(1, N = 19) = 47.84, p < .001$, Cohen's $d = 2.33$]. Follow-up analysis demonstrated no significant differences between specific and categoric memories ($Z = -.46, p = .64$, Cohen's $d = .21$), specific and extended memories ($Z = -.94, p = .35$, Cohen's $d = .44$), or extended and categoric memories ($Z = -.28, p = .78$, Cohen's $d = .13$). However, men with AD provided more semantic than specific ($Z = -3.84, p < .001$, Cohen's $d = 3.72$), categoric ($Z = -2.69, p = .007$, Cohen's $d = 1.56$), or extended memories ($Z = -2.80, p = .005$, Cohen's $d = 1.68$). Men with AD also demonstrated more omissions than specific ($Z = -4.12, p < .001$, Cohen's $d = 5.79$), categoric ($Z = -4.53, p < .001$, Cohen's $d = 6.22$), extended ($Z = -3.84, p < .001$, Cohen's $d = 3.72$), and semantic memories ($Z = -3.66, p = .002$, Cohen's $d = 3.42$).

More specific than categoric, extended, and semantic memories in control men and women.

In the control group, and regardless of sex, analysis demonstrated significant differences across specific memories, categoric memories, extended memories, semantic memories, and omissions [$X^2(1, N = 44) = 39.49, p < .001$, Cohen's $d = 3.47$]. Follow-up analysis demonstrated no significant differences between extended memories and categoric memories ($Z = -.41, p = .68$, Cohen's $d = .06$), semantic memories and categoric memories ($Z = -1.17, p = .24$, Cohen's $d = .47$), omissions and specific memories ($Z = -1.09, p = .27$, Cohen's $d = .47$). However, control participants provided more specific than categoric ($Z = -3.48, p < .001$, Cohen's $d = .81$), extended ($Z = -3.84, p < .001$, Cohen's $d = .86$) or semantic memories ($Z = -3.77, p < .001$, Cohen's $d = .82$). Control participants also demonstrated more omissions than categoric ($Z = -1.99, p = .046$, Cohen's $d = .47$), extended ($Z = -4.02, p < .001$, Cohen's $d = 1.51$) and semantic memories ($Z = -4.19, p < .001$, Cohen's $d = 1.10$).

In control women, analysis demonstrated significant differences across specific memories, categoric memories, extended memories, semantic memories, and omissions [$X^2(1, N = 24) = 21.64, p < .001$, Cohen's $d = 3.29$]. Follow-up analysis demonstrated no significant differences between extended memories and categoric memories ($Z = -.00, p = 1.00$, Cohen's $d = .00$), semantic memories and categoric memories ($Z = -1.03, p = .30$, Cohen's $d = .43$), omissions and specific memories ($Z = -.43, p = .67$, Cohen's $d = .18$). However, control women provided more specific than categoric ($Z = -2.69, p = .007$, Cohen's $d = 1.31$), extended ($Z = -2.71, p = .007$, Cohen's $d = 1.34$) or semantic memories ($Z = -2.83, p = .005$, Cohen's $d = 1.44$). Control women also demonstrated more omissions than categoric ($Z = -1.98, p = .048$, Cohen's $d = .83$), extended ($Z = -2.61, p = .009$, Cohen's $d = 1.26$) and semantic memories ($Z = -3.02, p = .003$, Cohen's $d = 1.56$).

In control men, analysis demonstrated significant differences across specific memories, categoric memories, extended memories, semantic memories, and omissions [$X^2(1, N = 20) = 20.65, p < .001$, Cohen's $d = 3.79$]. Follow-up analysis demonstrated no significant differences between extended memories and categoric memories ($Z = -.58, p = .56$, Cohen's $d = .26$), semantic memories and categoric memories ($Z = -.58, p = .56$, Cohen's $d = .26$), omissions and specific memories ($Z = -.42, p = .67$, Cohen's $d = .16$). However, control men provided more specific than categoric ($Z = -1.97, p = .049$, Cohen's $d = .98$), extended ($Z = -2.16, p = .031$, Cohen's $d = 1.10$) or semantic memories ($Z = -2.25, p = .025$, Cohen's $d = 1.16$). Control men also demonstrated more omissions than categoric ($Z = -2.10, p = .036$, Cohen's $d = 1.06$), extended ($Z = -3.01, p = .003$, Cohen's $d = 1.92$) and semantic memories ($Z = -2.88, p = .004$, Cohen's $d = 1.68$).

INSERT TABLE 1 HERE

Discussion

This study offered not only a detailed analysis of autobiographical specificity in patients with mild AD, but also demonstrated lack of sex differences regarding this specificity. Analysis demonstrated more semantic than specific, categories or extended memories in men and women with mild AD. In control participants, analysis demonstrated more specific than categoric, extended, and semantic memories in both men and women. Also, no significant differences were observed between women and men with mild AD, or between control women and men, regarding specific, categoric, extended, and semantic memories.

Autobiographical overgenerality in AD

As demonstrated by our analysis, and compared with the remaining categories of autobiographical specificity (i.e., specific, categories and extended memories), patients with mild AD produced a higher number of semantic memories. In other words, when retrieving autobiographical memories, patients with AD tend to retrieve more general personal information than repeated, extended, or specific events. As demonstrated by our findings, patients with AD also retrieve similar levels of specific, categoric and extended memories. Therefore, patients with AD experience not only difficulties to retrieve memories for unique events that occurred in a specific time and space, but also memories for similar or repeated/related events as well as memories for events occurring over an extended period of time. Taken together, autobiographical overgenerality in mild AD is characterized by an increased production of semantic memories and a decreased production of specific, categoric and extended memories.

Increased semantic autobiographical retrieval in men and women with AD

The increased semantic autobiographical retrieval was observed for both men and women with mild AD. Furthermore, no significant differences were observed between women and men with AD regarding specific, categoric, extended, and semantic memories. Thus, AD seems to affect women and men equally regarding autobiographical specificity, as no significant differences in any category of autobiographical specificity were observed between women and men with AD. Although some sex differences can be observed regarding the emotional load of autobiographical retrieval (El Haj, Boutoleau-Bretonniere, et al., 2020a), the ability of both men and women to retrieve unique memories situated in time and space seems to be equally affected by AD.

The lack of significant sex differences for autobiographical specificity is at odds with the better performance in episodic memory observed in men compared to women with mild AD in our study. This inconsistency can be reconciled by recognizing differences between episodic memory, as assessed in our study, and autobiographical memory. We assessed episodic memory using a typical test of item memory (i.e., words list) rather than using tests assessing the subjective experience of retrieval and mental time travel as defined by the model of Tulving (2002). Thus, while AD apparently affected more severely the women compared to the men who participated in our study regarding their ability to retain a words list, both women and men seem to have been affected equally regarding their ability to process specific autobiographical memories. However, the better episodic memory observed in men compared to women with AD in our study agrees with previous research demonstrating better episodic memory in men than in women with AD. For instance, a study by Ryan et al. (2018) has shown higher immediate item-episodic memory in men than women with AD, in agreement with previous research also suggesting a significant advantage of men with AD on tests assessing item-episodic memory (Irvine et al., 2012; Laws et al., 2016).

By investigating sex differences for autobiographical memory, our study can be embedded into a larger body of research on sex differences in AD. Females face unique risk factors, such as sexual hormone fluctuations associated with menopause that can be linked to risk of cognitive decline (Rocca et al., 2007). Dementia risk can even be doubled in pre-menopausal women (Rocca et al., 2012). Also, earlier population-based research had demonstrated benefits of estrogen replacement therapy in reducing AD risk, suggesting that estrogen withdrawal with menopause may be a risk factor for AD (Mulnard et al., 2000). Regarding risk factors for AD in males, research has demonstrated that the accelerated depletion of free testosterone can be linked to cognitive decline and risk of AD (Lv et al., 2016), probably through decreased protective effect on the deposition of brain amyloid beta (Gouras et al., 2000; Pike, 2001). The study of sex differences in AD is still however in its infancy compared to other areas of medicine (Mielke, 2018) and, critically, little research has been concerned with sex differences in various domains of cognitive performances in AD. Our study thus fills a gap in the field that may inform future diagnostic and disease-monitoring approaches according to precision medicine principles.

No significant sex differences on autobiographical specificity in normal aging

The lack of sex differences regarding autobiographical specificity in control participants, as observed in our study, mirrors previous research. Two studies have assessed sex differences regarding autobiographical specificity in normal aging using a scale ranging from zero (i.e., for a lack of memory) to four points (for specific events situated in time and space enriched with phenomenological details, such as emotion) (El Haj, Boutoleau-Bretonniere, et al., 2020b; El Haj et al., 2021). These studies demonstrated no significant differences in autobiographical specificity in normal aging. Our study extends this literature by demonstrating not only the lack of sex differences regarding the ability to construct specific memories, but critically, regarding the ability to construct categoric, extended, and semantic memories. One

may have expected higher autobiographical specificity in women than in men in normal aging, given research demonstrating that women retrieve events with more richness of details compared to men (Nahari & Pazuelo, 2015; Pasupathi & Wainryb, 2010), more basic factual details (e.g., when and where an event was encoded) (Grysmann, 2017; Grysmann et al., 2016) or even to whom an information was previously told (El Haj, Allain, et al., 2020). However, this research was mainly conducted in young adults. Our study suggests that the tendency of women to retrieve events with more richness of details compared to men can disappear in normal aging, at least regarding their ability to construct specific autobiographical memories.

Another finding of our study was the higher specific than categoric, extended, and semantic memories in both control men and women. This finding can be considered at odds with research demonstrating decreased specificity of autobiographical memory in normal aging (Addis et al., 2011; Borroni et al., 1989; Levine et al., 2002; Piolino et al., 2002; Piolino et al., 2006; St Jacques & Levine, 2007). This inconsistency can be due to differences in methodology between our study and previous research. Unlike previous research, which typically analyzed specific vs. general memories, here we used a detailed analysis of specificity, which allowed us to disentangle different degrees of autobiographical specificity. Also, previous research typically used directive instructions so that participants were invited to retrieve a specific memory that targets a specific theme (e.g., school, vacation). The non-directive instructions offered by SCEPT have may promoted retrieval in a reminiscence/elaborative and less effortful, fashion compared with the typical directive instructions used in previous research on autobiographical memory in normal aging ((for a similar view, see, (Peters & Sheldon, 2020)). This non-directive instructions may have enhanced retrieval not only in cognitively normal older adults, but also in patients with AD, as discussed below.

Clinical thoughts: the SCEPT as a tool to promote autobiographical retrieval in AD

Unlike other autobiographical assessments, the SCEPT has the advantage of offering open-ended sentences that may promote retrieval in a reminiscence/elaborative and less effortful fashion compared with the typical directive instructions used in other autobiographical tests. This reminiscence retrieval may be associated with reflective processes regarding the past (Westerhof et al., 2010; Westerhof & Bohlmeijer, 2014), which may promote recovery of autobiographical events and their reconstruction for the purpose of reflecting on them, sharing them with others, and/or even embedding them into a meaningful life story and a coherent sense of the self. While this hypothesis should be investigated by further research, one obvious clinical advantage of SCEPT is that it offers less directive retrieval prompts compared with other autobiographical tests. Clinicians can use the SCEPT scale to promote this non directive retrieval, added to typical autobiographical tests to target specific themes and life periods. Ideally, the SCEPT scale should be reduced to few sentences because, as demonstrated in our study, many omissions were observed in patients with AD, reflecting their difficulties to retrieve many autobiographical events. Perhaps, sentences probing memories from the period of “last week/year” can be eliminated because patients with AD have greater difficulties in retrieving recent than more remote events.

Limitations

One limitation of this study may be the lack of additional autobiographical tests, such as the Autobiographical Memory Interview, which would have allowed their head-to-head comparison. However, we had to shorten the assessment of patients with AD to avoid cognitive fatigue and distraction. Another limitation was the fact that participants with AD had mild dementia, therefore, findings may not be generalizable to other stages of the disease. However, patients with more advanced disease show such degrees of decline in attention, memory,

language and executive function that would have significantly interfered with performance on the SCEPT. Finally, the lack of sex differences regarding autobiographical specificity might be due to insufficient power of sample size. In other words, the lack of statistically significant differences may reflect a type II error.

Concluding remarks

Using a qualitative/descriptive approach, this study goes beyond the dichotomy of specific vs. general autobiographical retrieval adopted in previous research, offering a more nuanced and detailed assessment of a spectrum of autobiographical specificity in AD. By doing this, this study highlights not only how autobiographical overgenerality in AD is characterized by difficulties to retrieve unique events that occurred in a specific time and space, but also by difficulties to retrieve categoric and extended events.

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Conflict of Interest

The authors declare that they have no conflict of interest.

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Table 1

Differences between women and men with AD and women and men controls regarding episodic memory and autobiographical memory

	Alzheimer <i>n</i> = 41		Controls <i>n</i> = 45	
	Women <i>n</i> = 22	Men <i>n</i> = 19	Women <i>n</i> = 24	Men <i>n</i> = 20
Episodic Memory	4.59 (2.06) ***	7.42 (1.90)	11.29 (2.98) ^{ns}	10.80 (3.08)
Autobiographical memory:				
Specific memories	1.14 (.99) ^{ns}	1.00 (1.00)	2.92 (1.14) ^{ns}	2.75 (1.29)
Categoric memories	1.05 (.99) ^{ns}	1.21 (.85)	1.88 (.74) ^{ns}	1.95 (.76)
Extended memories	1.18 (1.00) ^{ns}	1.32 (.75)	1.88 (.85) ^{ns}	1.85 (.59)
Semantic memories	2.41 (1.56) ^{ns}	2.74 (1.63)	1.71 (.86) ^{ns}	1.85 (.67)
Omissions	5.18 (1.59) ^{ns}	5.16 (1.57)	3.13 (1.39) ^{ns}	3.40 (1.31)

Note. Standard deviations are given between brackets; the maximum score episodic memory was 16 points; eleven autobiographical memories were distributed across specific, categories, extended, and semantic memories and omissions. differences between women and men were significant at: ** $p < .01$; ^{ns} differences between women and men were not significant.