Age Differences in Source Monitoring and Referent Discrimination

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In contrast to previous studies which addressed separately memory for source and referent, the present experiment analyzes the effects of aging on memory for both, source and referent. The experiment simulated a conversation between two people exchanging descriptors of themselves and the other speaker (e.g., "I am helpful," "you are capable"). Participants ($N = 60$) were divided into two age groups: younger ($M = 23.47$ years old, $SD = 2.37$), older ($M = 70.30$ years old, $SD = 3.73$). Recall, recognition, and accuracy in identifying source (e.g., "who said helpful?") and referent (e.g., "about whom was capable said?") were analyzed. Younger and older adults recalled and recognized equally well information read by the experimenter about herself, but only young adults showed better memory for the descriptors they read about themselves. Older adults were impaired in source monitoring, but not in reference discrimination. Normal referent discrimination in older adults is attributed to the fact that the referent forms part of the content of the episode, whereas who spoke it is part of its context, and older adults tend to show greater deficits in context than in content memory. These results are explained within the source and reality monitoring framework.
Keywords: aging, recall and recognition, source monitoring, reference discrimination, self-reference, memory for conversations.

A diferencia de estudios anteriores que han abordado por separado la identificación del origen y del referente de la información, este experimento analiza los efectos del envejecimiento sobre la discriminación conjunta de ambos, origen y referente. El experimento simula una conversación entre dos personas (investigadora y participante) que intercambian descriptores de sí mismas y de su interlocutora (e.g., "yo soy amable"; "tú eres capaz"). Se dividió a los participantes ($N = 60$) en dos grupos en función de la edad: joven ($M = 23'47$ años, $DT = 2'37$), mayor ($M = 70'30$ años, $DT = 3'73$). Se analizó recuerdo, reconocimiento y precisión en la identificación del origen (e.g., "¿quién dijo amable?") y del referente (e.g., "¿sobre quién se dijo que era capaz?") de los descriptores intercambiados en la conversación. Los resultados indicaron que jóvenes y mayores recordaron y reconocieron por igual la información que la experimentadora leyó sobre sí misma, pero sólo los jóvenes recordaron mejor los descriptores que ellos leyeron sobre sí mismos. Los mayores tuvieron dificultades en la identificación del origen, pero no del referente. El mantenimiento de la discriminación del referente se atribuye a que forma parte del contenido del episodio, cuyo recuerdo no está afectado por el envejecimiento. Por el contrario, el recuerdo del origen, como parte del contexto, sí se ve afectado. Los resultados se explican en el marco teórico del control del origen en la memoria.
Palabras clave: envejecimiento, recuerdo y reconocimiento, control del origen, discriminación del referente, auto-referencia, recuerdo de las conversaciones.

It has been established that aging does not affect all aspects of memory functioning equally and that, for example, recalling contextual aspects tends to be worse than recall of the event's content (for a meta-analysis, see, e.g., Spencer & Raz, 1995). The ability to identify the source of remembered information, as part of its context, has generated great research interest (for a review, see Johnson, Hashtroudi, & Lindsay, 1993). Several studies find older people have more difficulty than young people determining the source of a memory (e.g., Simons, Dodson, Bell, & Schacter, 2004). Age differences are greater when one is asked to discriminate between two external sources (e.g., "did person A or B say it?") or two internal sources (e.g., "did I think it or did I say it?") as opposed to discriminating between an internal and an external source (e.g., "did I see it or did I imagine it;" Brown, Jones, & Davis, 1995; Hashtroudi, Johnson, & Chrosniak, 1989). The first two situations are usually considered within the framework of "source monitoring" (Johnson et al., 1993), while the last tends to be considered a type of "reality monitoring" (Johnson & Raye, 1981). Johnson and collaborators' model explains this differential difficulty based on greater sensory, perceptual, contextual, cognitive, and affective similarity between memories of experiences that originate in the same domain (internal-internal or external-external), which diminishes the potential to discriminate (Johnson et al., 1993).

Several models, based on a diversity of assumptions, provide differing explanations about the difficulties that emerge with age in discriminating a memory's source, but they agree in suggesting deficiencies in: information binding (Mitchell & Johnson, 2009), integration (Bayen, Phelps, & Spaniol, 2000), organization and spontaneous integration (Dywan & Jacoby, 1990), and associating an event's contextual aspects and its content when information is initially processed (Old & Naveh-Benjamin, 2008). This deficit in the ability to bind the contextual aspects and content of events could be due to the decline in the allocation of attentional resources during old age (McIntyre & Craik, 1987). What is more, the initial disconnection between context and content may lead subsequent source monitoring to be based: more on familiarity than on a particular memory of source (e.g., Dywan & Jacoby, 1990), or on a comparison of characteristics that fail to diagnose the source and lead to confusion (e.g., Hashtroudi et al., 1989). Johnson and collaborators' model posits that typically, sources are almost automatically ascribed to memories, but when that process lapses or experimental conditions demand it, a more careful comparison of critical characteristics is required to make the judgment. Sometimes, however, source monitoring involves retrieval of supporting memories or meta-memory assumptions (e.g., "I would never say something like that") to allow one to elucidate the source of the memory in question (Johnson et al., 1993). The model predicts that difficulty discriminating memories' sources will increase whenever processing conditions do not allow to clearly register source diagnostic characteristics or the content those sources express is very similar (Johnson et al., 1993).

The referent of the information (of whom something was said) is an aspect of content and thus, according to the literature, discriminating it should be less affected by age than source monitoring (e.g., Spencer & Raz, 1995). It is worth noting that far fewer studies have been conducted on the reference effect than on the source effect, and even fewer have explored the relation with old age. Nevertheless, in all of them, the self-reference effect was observed to remain stable over the years (e.g., Glisky & Marquine, 2009; Gutchess, Kensinger, Yoon, & Schacter, 2007; Mueller, Wonderlich, & Dugan, 1986). Thus, older adults tend to recall less information, but benefit as much as young adults from self-referencing compared to other-referencing material (Gutchess et al., 2007; Mueller et al., 1986). Self-referential processing is superior to general semantic processing even into very old age (Glisky & Marquine, 2009). These types of results have fueled a debate as to whether the self constitutes a super-ordinate schema that, when activated during processing, makes later recall of the information more likely (e.g., Symons & Johnson, 1997). Recent studies of amnesic patients who exhibit severe deficits in episodic and semantic memory while still describing their personality traits with certainty have been discussed in favor of the special status of self-referential knowledge (e.g., Klein & Gangi, 2010). Given the robustness of the self-reference effect, it seems plausible that having to state information about oneself, even if not truly self-descriptive, would make it more memorable than stating equivalent information about others, and this is one of the aspects we tested in the experiment.

In contrast to previous studies, which addressed separately memory for source and referent, the present experiment analyzes the effects of aging on memory for both, source and referent, in a paradigm similar to a conversation. In the conversation, the participant ("I") and the experimenter ("You") read characteristics, which they attributed either to themselves (i.e., about me) or to the other person (i.e., about you), in the format, for instance, "I am (or You are) audacious." According to prior studies, we did expect age differences in recall, but not in recognition of the information exchanged in the conversation (e.g., Craik & McDowd, 1987; Simón, Ruiz-Gallego-Largo, & Suengas, 2009; Whiting & Smith, 1997). Based on the literature on source and referent, we expected participants to recall and recognize better what they said than what the experimenter said, and what was said about them than what was said about the experimenter (e.g., Glisky & Marquine, 2009; Hashtroudi et al., 1989). From the previous general hypothesis, we specifically predicted that memory for what "I" said "about me" should be better than memory for what "You" said "about you". The

rationale for this prediction is that having myself as both source and referent should have a positive impact on memory that would be missing when my conversation partner speaks about herself. As for source monitoring, we expected identifying self as source to be better that identifying the other speaker as source. With respect to reference discrimination, we expected better identification of self as referent than the other speaker as referent. Based on the literature comparing memory for context and content, of which source and referent are examples, we expected younger participants´ source monitoring (who said it) to be superior to that of older participants, while expecting no age differences for referent discrimination (about whom it was said; e.g., Spencer & Raz, 1995).

Method

Participants

Sixty people voluntarily participated in this study, of whom 30 were young adults (24 women and 6 men) between the ages of 21 and 31 ($M = 23.47$ years old, $SD = 2.37$), with an average of 19.5 years of education ($SD = 2.37$; range = 18-24 years). The other 30 were older adults (25 women and 5 men) between the ages of 65 and 79 years old ($M = 70.30$ years old, $SD = 3.73$), with an average of 17.57 years of education ($SD = 5.49$; range = 8-30 years). All participants were students at the Universidad Complutense de Madrid: the young people were psychology students and the older participants were enrolled in the program *University for the Older*. The active participation of the latter in academic and cultural university activities in addition to having scored higher than 26 ($M = 27.33$, $SD = 1.40$) on the Spanish language adaptation of the *Mini-Mental State Examination* (Folstein, Folstein, McHugh, & Fangiang, 2001) by Lobo, Saz, Marcos, and the ZARADEMP group (2002) was considered indicative of adequate cognitive achievement.

Materials

The materials consisted of sentences with the structure "I am (descriptor)" (e.g., "I am helpful"), and "You are (descriptor)" (e.g., "You are capable"). The descriptors were 80 gender-neutral words taken from Alameda and Cuetos's (1995) dictionary on the frequency of linguistic units in Spanish. Words were chosen that could be used as personal descriptors of women and men indiscriminately (e.g., audacious). According to the results from a pilot study, descriptors were age-neutral and thus, on the average, could be equally applied to younger and older adults. We also controlled word selection such that words differ enough not to be confused in terms of morphological or semantic similarity, and would not be viewed as offensive.

The 80 attributes were randomly distributed into two sets between which there were no differences as far as average frequency of use (set 1, $M = 47.77$, $SD = 75.86$; set 2, $M = 47$, $SD = 72.20$). The two sets of stimuli were counterbalanced by presenting them to the same number of participants as descriptors during the acquisition phase and distractors in the subsequent recognition test. Of the original set of stimuli, 10 descriptors were assigned to each of four conditions created by combining the two within-subjects variables, source (I, You) and referent (about me, about you): I - about me (participant reads descriptor about participant), I - about you (participant reads descriptor about experimenter), You - about me (experimenter reads descriptor about participant), You - about you (experimenter reads descriptor about experimenter). The descriptors were counterbalanced by using them a similar number of times in each of the four conditions. Their order of presentation was different for every participant in both the acquisition and recognition phases. In both of those phases, each descriptor comprised a page in a DIN A4-sized notebook.

Procedure

All participants did the experiment individually and in the same order: they first performed the initial, acquisition phase, which consisted of a structured exchange of descriptors with the experimenter by means of a simulated conversation, followed by recall, recognition, source monitoring, and referent discrimination tests. The experimenter/conversation partner was always the same person, a 40 year old female.

The instructions described the experiment as a simulation of a conversation in which speakers would alternate in making statements using the descriptors to refer to each other and to themselves. Therefore, attention should be given to what both the experimenter and participant say. An incidental paradigm was used and no mention was made of the memory evaluation to come. Two practice trials were provided to ensure that participants understood the mechanics of the conversation. The experimenter and participants alike had a notebook containing 20 sentences; they had to read half about themselves (e.g., "I am irritable") and half about the other person (e.g., "you are original"). In the conversation, experimenter and participant alternated in reading one sentence at a time, and also alternated in reading one sentence about themselves and about the other person. Once the 40 statements had been exchanged, a free recall test was performed in which participants were asked to recall all the descriptors they possibly could that had been exchanged over the course of the conversation. Next, they were given a notebook with 80 words and were asked to indicate, first, whether each one was a descriptor mentioned in the conversation, if so, who had read it (the experimenter or themselves), and about whom it was read (about the experimenter or about themselves).

Results

Recall

Recall was measured as the number of descriptors from the conversation correctly recalled. To determine whether there were significant differences in recall as a function of age and the descriptors' source and reference, a mixed model 2x(2x2) ANOVA was performed with age (young, older) as the between-subjects factor and source (I, you) and reference (about me, about you) as within-subjects factors. The upper part of Table 1 displays the means and standard deviations of recall as a function of the factors included in the analysis.

Results indicated, as can be seen in Table 1, there were significant main effects of age, $F(1, 58) = 26.16$, $p = .001$, $\eta_p^2 = .31$, $1-\beta = .99$; source, $F(1, 58) = 5.88$, $p = .018$, $\eta_p^2 = .09$, $1-\beta = .66$; and reference, $F(1, 58) = 5.66$, $p = .021$, $\eta_p^2 = .09$, $1-\beta = .65$. Thus, young people recalled more information than older people; participants generally recalled more descriptors that they themselves had read than those read by the experimenter; and they also recalled more descriptors that were self-referential than referencing the experimenter. The interaction between source and age nearly reached statistical significance, $F(1, 58) = 3.51$, $p = .066$, $\eta_p^2 = .06$, $1-\beta = .45$. We used the Bonferroni test for these and all subsequent post-hoc comparisons. Results revealed only young participants recalled significantly more descriptors they had read themselves than those read by the experimenter, $t(1, 30) = 0.65$, $p = .004$.

We performed planned comparisons to analyze for each age group the situation where participants read descriptors about themselves (I - about me; first column of Table 1) and the one where the experimenter read descriptors about herself (You - about you; last column of Table 1). The results of within-groups comparisons showed significant differences in the young group, who better recalled descriptors they had read about themselves than those the experimenter had read about herself, $F(1, 29) = 12.86$, $p = .001$, $\eta_p^2 = .31$, $1-\beta = .93$. There were no significant differences found, however, for older participants, who recalled both situations equally well, $F(1, 29) = 0.66$, $p = .423$, $\eta_p^2 = .02$, $1-\beta = .12$. By performing the comparison as a function of age, we found that young participants recalled descriptors they had read about themselves significantly better than older participants, $F(1, 58) = 16.60$, $p = .001$, $\eta_p^2 = .22$, $1-\beta = .98$. Nevertheless, there were no differences found between the two groups in terms of recall of what the experimenter had read about herself, $F(1, 58) = 2.38$, $p = .128$, $\eta_p^2 = .04$, $1-\beta = .33$.

We also compared the frequency with which participants generated examples of descriptors that had not been presented in the conversation. The results indicated a significant difference between the age groups, $F(1, 58) = 6.40$, $p = .014$, $\eta_p^2 = .10$, $1-\beta = .70$. Older participants generated significantly more invented descriptors than young ones (older: $f = 23$, $M = 0.80$, $SD = 0.99$; young: $f = 8$, $M = 0.27$, $SD = 0.58$).

Recognition

We assessed participants' ability to discriminate between descriptors, that had been exchanged in conversation, and distractors by means of the *probability of recognition*[1]: p(H)-p(FA)]/[1-p(FA)], where p(H) and p(FA) are, respectively, the proportion of hits and of false alarms. One-way ANOVAs were performed for each of the dependent variables with age as the between-subjects factor (young, older). The results indicated there were no significant differences between young

Table 1

Means (standard deviations) of the descriptors recalled and recognized (Hits) as a function of age (young, older), source (I, You), and reference (about me, about you)

| | | Source | | | |
| | | I | | You | |
	Reference	About me ($n = 10$)	About you ($n = 10$)	About me ($n = 10$)	About you ($n = 10$)
Recall	Young	3.10	2.46	2.47	1.80
		(1.58)	(1.36)	(1.19)	(1.13)
	Older	1.60	1.83	1.93	1.33
		(1.25)	(1.31)	(0.83)	(1.21)
Recognition	Young	8.33	7.30	7.77	6.63
		(1.49)	(1.93)	(1.45)	(2.11)
	Older	7.33	6.60	7.33	7.00
		(1.92)	(1.67)	(1.77)	(2.07)

Note. n = number of stimuli. Partner's support.

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[1] The *probability of recognition* is the classical correction for chance guessing (Green & Swets, 1966; McNicol, 1972).

($M = .73$, $SD = .12$) and older people ($M = .67$, $SD = .15$) in the probability of recognition, $F(1, 58) = 3.27$, $p = .076$, $\eta^2 = .05$, $1\text{-}\beta = .43$. While there were no differences as a function of age in the probability of hits (young: $M = .75$, $SD = .12$; older: $M = .71$, $SD = .14$), $F(1, 58) = 1.88$, $p = .176$, $\eta^2 = .03$, $1\text{-}\beta = .27$, there were significant differences in the probability of false alarms (young: $M = .07$, $SD = .07$; older: $M = .13$, $SD = .10$), Brown-Forsythe $(1, 53.12) = 5.68$, $p = .021$, $\eta_p^2 = .09$, $1\text{-}\beta = .65$. According to the probability of recognition, younger and older participants performed the recognition task equally well. Older and younger adults were equivalent in hits, but older adults made more false alarms.

In order to determine the source and reference of the descriptors correctly recognized, a mixed model 2x(2x2) ANOVA was performed for hits with age (young, older) as the within-subjects factor and source (I, you) and reference (about me, about you) as within-subjects factors. The lower part of Table 1 conveys the means and standard deviations of correctly recognized descriptors as a function of the factors included in the analyses. Results indicated that only the main effect of reference was significant, $F(1, 58) = 16.13$, $p = .001$, $\eta_p^2 = .22$, $1\text{-}\beta = .98$. In general, participants better recognized descriptors referring to themselves ($M = 15.38$, $SD = 2.71$) than those referring to the experimenter ($M = 13.77$, $SD = 3.29$). The interaction between source and age nearly achieved statistical significance, $F(1, 58) = 3.51$, $p = .060$, $\eta_p^2 = .06$, $1\text{-}\beta = .45$. Post-hoc comparisons demonstrate that young participants recognized significantly more descriptors that they themselves had read ($M = 15.70$, $SD = 2.94$) than those read by the experimenter ($M = 14.33$, $SD = 3.12$), $F(1, 58) = 4.81$, $p = .032$, $\eta_p^2 = .08$, $1\text{-}\beta = .58$. The older participants showed no significant differences between recognition of descriptors they had read themselves and recognition of those read by the experimenter, $F(1, 58) = 0.01$, $p = .934$, $\eta_p^2 = .01$, $1\text{-}\beta = .05$.

We performed planned comparisons of the conditions in which the participant was both, source and referent (I - about me; first column of Table 1), and the experimenter was both source and referent (You - about you; fourth column of Table 1). The results showed that, as in the case of recall, there were significant differences in the young group, $F(1, 29) = 13.50$, $p = .004$, $\eta_p^2 = .25$, $1\text{-}\beta = .85$, but not in the older group, $F(1, 29) = 0.66$, $p = .423$, $\eta_p^2 = .02$, $1\text{-}\beta = .12$. Therefore, young people recognized what they had read about themselves better than what the experimenter had read about herself. Through the comparison as a function of age, we found that young participants recognized descriptors that they had read about themselves significantly better than older participants, $F(1, 58) = 5.07$, $p = .028$, $\eta^2 = .08$, $1\text{-}\beta = .60$. However, there were no significant differences between the two groups in their recognition of items the experimenter had read about herself, $F(1, 58) = 0.46$, $p = .499$, $\eta^2 = .01$, $1\text{-}\beta = .10$.

Source Monitoring and Reference Discrimination

Once participants had identified that a descriptor had been read in the conversation, they were asked its source (e.g., "who read *capable*"? I – participant or You – experimenter). We were interested in analyzing whether participants were better at monitoring themselves (I) or the experimenter (You) as the source. Table 2 shows the schema from which the dependent variables in the analysis were derived. Given that the analysis only included correctly recognized descriptors, and that not every participant would necessarily recognize the same number of descriptors with I and You as source (see Table 1, columns 1 and 2 vs. columns 3 and 4), we calculated the following measurements: (1) *Probability of hit, source-I*, $H_I/(H_I + E_I)$, where H_I and E_I, respectively, are the number of hits and errors when monitoring self as source. (2) *Probability of hit, source-You*, $H_{You}/(H_{You} + E_{You})$, where H_{You} and E_{You}, respectively, are the number of hits and errors when monitoring other as source. Figure 1 displays these probabilities for both young and older participants.

Table 2

Schema depicting the combinations of stimuli (descriptor read by, descriptor referring to) and participants' responses during the source monitoring and discriminating reference phase

		Response			
		By whom the descriptor was read		To whom the descriptor referred	
		participant	experimenter	participant	experimenter
Descriptor read by	participant	H_I	E_I		
	experimenter	E_{You}	H_{You}		
Descriptor referring to	participant			$H_{about\ me}$	$E_{about\ me}$
	experimenter			$E_{about\ you}$	$H_{about\ you}$

Note. H_I / H_{you}: The participant correctly indicates that the descriptor was read by him or herself / by the experimenter; E_I / E_{you}: The participant incorrectly indicates that the descriptor was read by the experimenter / by him or herself; $H_{about\ me}$ / $H_{about\ you}$: The participant correctly indicates that the descriptor referred to him or her / to the experimenter; $E_{about\ me}$ / $E_{about\ you}$: The participant incorrectly indicates that the descriptor referred to the experimenter / to him or her.
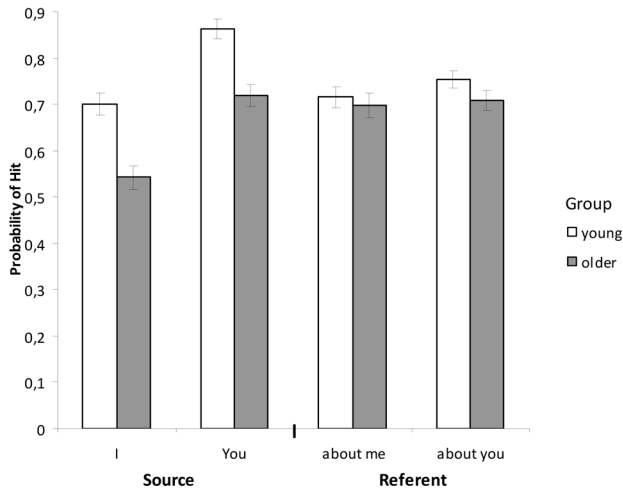
Figure 1. Probability of hit in source monitoring (who read it) and referent discrimination (about whom it was read) of descriptors as a function of age (young, older), source (I, You), and referent (about me, about you).

A mixed model 2x2 ANOVA was employed with age (young, older) as the between-subjects factor and source (I, You) as the within-subjects factor. The results indicated, as Figure 1 shows, significant main effects of age, $F(1, 58) = 51.29$, $p = .001$, $\eta_p^2 = .47$, 1-$\beta = 1.00$, and source, $F(1, 58) = 41.08$, $p = .001$, $\eta_p^2 = .41$, 1-$\beta = 1.00$. The interaction between age and source was not significant, $F(1, 58) = 0.08$, $p = .775$, $\eta_p^2 = .01$, 1-$\beta = .06$. Thus, young participants monitored better than older people who (I - You) had read the descriptors (young: $M = .62$, $SD = .02$; older: $M = .79$, $SD = .02$). As for source, the *probability of hit, source-You,* was significantly higher than that of *source-I* (You: $M = .79$, $SD = .15$; I: $M = .62$, $SD = .15$). In other words, in general, participants' monitoring of the descriptors read by the experimenter was better than their monitoring of the descriptors read by the participants themselves.

With respect to reference (e.g., "about whom was *capable* read?" about me – participant or about you – experimenter), in order to determine whether participants were better at discriminating descriptors with themselves (about me) or the experimenter as referent (about you), we calculated the following probabilities, displayed in Figure 1: (1) *Probability of hit, reference-self*, $H_{about\ me}/(H_{about\ me} + E_{about\ me})$, such that $H_{about\ me}$ and $E_{about\ me}$ are, respectively, the number of hits and errors when discriminating self as reference (see Table 2). (2) *Probability of hit, reference-you*, $H_{about\ you}/(H_{about\ you} + E_{about\ you})$, where $H_{about\ you}$ and $E_{about\ you}$ are, respectively, the number of hits and errors when discriminating you as reference (see Table 2). A mixed model ANOVA 2x2 was performed with age (young, older) as the between-subjects factor and reference (about me, about you) as the within-subjects factor. The results did not indicate any significant effect: age, $F(1, 58) = 1.48$, $p = .229$, $\eta_p^2 = .02$, 1-$\beta = .22$; reference, $F(1, 58)$

$= 1.50$, $p = .230$, $\eta_p^2 = .02$, 1-$\beta = .22$; interaction of age and reference, $F(1, 58) = 0.54$, $p = .466$, $\eta_p^2 = .01$, 1-$\beta = .11$. Thus, both young and older participants discriminated self-referential descriptors and descriptors referencing the experimenter equally well.

Discussion

The major innovation of this experiment was to combine the study of memory for source (i.e., who spoke) and reference (i.e., who were they speaking about) in young and older adults. The results indicated that younger and older adults recalled and recognized the same amount of information read by the experimenter about herself, but only young adults showed an advantage in memory for the descriptors that they read about themselves. With respect to source and referent monitoring, the findings indicated that older adults were impaired in source memory as found in many previous experiments, but not in reference memory. Normal reference discrimination in older adults is attributed to the fact that the referent of the descriptor forms part of the content of an episode whereas who spoke it is part of the context of the episode, and older adults tend to show greater deficits in context than in content memory.

Recall

Older participants recall fewer descriptors than young people, but our most interesting result on this topic is that they recalled equally well descriptors that they read about themselves (co-occurrence of self as source and referent) and that the experimenter read about herself (co-occurrence of other as source and referent). Young people are dissimilar in that respect and, according to the hypothesis we initially posited for all participants, they recalled descriptors they had read about themselves better than those the experimenter had read about herself. We must highlight that these results indicate that aging specifically erodes recall of what I say about myself, which is so strong in youth. The fact that older participants forget what they say about themselves could lead them to repeat the same personal stories, thus reinforcing a social stereotype attributed to older people (e.g., Gázquez, et al., 2009; Gopie, Craik, & Hasher, 2010).

Our results do not indicate there were repetitions so much as invention of descriptors on the part of older participants. This result supports the findings of prior research analyzing free recall (e.g., Intons-Peterson, Rocchi, West, McLellan, & Hackney, 1999; Koriat, Ben-Zur, & Sheffer, 1988). An analysis of these invented descriptors revealed that in general, they were personality traits semantically related to the descriptors actually presented, with which they shared formal characteristics (i.e., gender-neutral, average frequency of use); for example, *leal* (loyal) was one of the invented descriptors and is a synonym for

fiel (faithful), which was presented. None of the invented descriptors in the recall task coincided with any of the distractors presented in the recognition task. Thus, they cannot account for increased false alarms by older adults on the recognition test. Essentially, an error in source monitoring (extra-experimental *vs.* intra-experimental) could have led older participants to generate invented descriptors during recall (e.g., Dywan & Jacoby, 1990; McIntyre & Craik, 1987). We are not able to establish, as other authors have stated, whether generating these invented descriptors and confusing them with those heard during the experiment occurs during the conversation phase, recall, or at both points in time (e.g., Intons-Peterson et al., 1999).

Recognition

Although older and younger adults were equivalent in recognizing descriptors that were exchanged in the conversation, older adults tended to falsely endorse distractors that were not part of the conversation. The "false recognition" effect in old age has been confirmed across different studies (for a review, see, e.g., Schacter, Koutstaal, & Norman, 1997). Similar to false recall, generating false alarms in recognition could also be considered an example of difficulty with source monitoring (extra-experimental *vs.* intra-experimental) setting in with old age, given that the distractors employed are descriptors that participants undoubtedly use in their everyday lives (e.g., Johnson et al., 1993). Suengas, Ruiz-Gallego-Largo, and Simón (2010) argue that making more false recognitions during old age when the task is complicated could be due to having developed a metamnemonic strategy wherein one takes into account the fallibility of their own memory. Older people may be conscious of their frequent forgetfulness and thus, when asked to determine whether they heard something previously, they say they did in spite of their doubts, reasoning that it's most probable they did.

As for the source and reference effects on recognizing descriptors, we once again observed that age affects the two variables distinctively in the way we predicted: there were no changes to the reference effect, which is a content variable, but there were changes to the source effect, which is a contextual variable. All participants were better at recognizing descriptors referring to themselves than to the other speaker, indicating that age does not affect the self-reference effect. Nevertheless, only young people were better at recognizing descriptors they themselves had read, and even more so if they were self-referential, than those that the experimenter had read, particularly when they referred to her. Similar to the case of recall, we would like to emphasize the finding that aging particularly erodes the advantage to recognizing descriptors that participants read about themselves.

Why were older people not better at recalling and recognizing what they said about themselves than what the other speaker said about herself? We could speculate about the possibility that when aging, contrary to what occurs in youth, people pay equal attention to what others say and what they themselves say. Perhaps this is due to increased wisdom and coming to view the relative importance of one's knowledge, beliefs, and values (Baltes & Staundinger, 2000). Of course, it is not possible to generalize, and there are many individual differences and personal contexts that should be taken into account (e.g., Mateos, Meilán, & Arana, 2002; Triadó, Villar, Solé, Celdrán, & Osuna, 2009), but if relativism leads one to pay the same attention to others as to him or herself, it could also lead to equality in recall and recognition of the information exchanged in conversation, regardless of source and reference. In our experiment, people did not employ self-generated descriptors; rather, they read descriptors of themselves that were randomly assigned. Our informal observation of the comments made by some older participants during the conversation (e.g., apologizing for having to say "you are vulgar" to the experimenter) seems to indicate that they spontaneously elaborated on the affective aspects of some sentences more than young people did. Hashtroudi, Johnson, Vnek, and Ferguson (1994) found that older participants who elaborated on affective aspects of the situations were worse at source monitoring those situations. Perhaps in the present study, affective elaboration about the descriptors not only influenced discrimination, but also reduced the favorable effects of having oneself as source and referent on recall and recognition. Nevertheless, we can merely speculate on this because the experimental design did not allow us to determine the influence participants' spontaneous elaboration on the descriptors may have had on the results.

Source Monitoring and Reference Discrimination

Results supported our hypothesis that age differences would be greater when source monitoring (who said it), because it is a context variable, than when determining a descriptor's reference (about whom it was said), which is a content variable. Though young people were better at source monitoring (I, You) the descriptors, there were no differences between the age groups in their ability to discriminate a descriptor's reference (about me, about you). These results concur with the majority of publications about the differential effects of old age on source monitoring and reference discrimination of information (e.g., Glisky & Marquine, 2009; Hashtroudi et al., 1989; Spencer & Raz, 1995).

With regards to source, contrary to our hypothesis, participants exhibited more hits when indicating descriptors read by the experimenter than read by them. Participants were required to read and attribute to themselves self-descriptors that were not always accurate (e.g., "I am audacious" when I am really not). Descriptors that were not self-accurate might have been difficult to integrate into the knowledge about oneself, thus rendering them more

difficult to later attribute to oneself. This might explain that, when in doubt about the source, participants tended to attribute it to the other person. This is all part of a meta-memory response strategy known as "it had to be you" (Johnson & Raye, 1981), in which one attributes to the other person the statement recalled, but whose source (I, You) is unclear. We assume that when participants had to decide who had read a given descriptor, they must have searched their memory for some clue as to the source. Some authors have suggested that source monitoring verbal material is fundamentally based on recalling the cognitive operations implicated in generating the words (Hashtroudi et al., 1989). Thus, participants tend to attribute source to themselves to what they recall having elaborated upon and stated. The source monitoring model predicts that reading rather than generating the descriptors makes source identification more difficult because it attenuates the processing of source diagnostic characteristics (e.g., Johnson et al., 1993).

The absence of differences between youths and older people in discriminating a descriptor's reference (about me, about you) agrees with the proposed hypothesis and supports prior studies on the subject (e.g., Glisky & Marquine, 2009; Gutchess et al., 2007; Mueller et al., 1986). This result reinforces the idea that old age affects a memory's content less, which includes reference, and context more (e.g., Spencer & Raz, 1995). It has been argued that self-reference poses minimal cognitive demands, which would explain the stability of this effect over the life span (Gutchess et al., 2007). Contrary to what we expected, participants were no better at discriminating self-referential descriptors than those referring to the other speaker. The absence of a self-reference effect in discrimination could perhaps be explained by the fact that participants were reading terms that really had no reason to strictly apply to them as personal descriptors. However, in spite of the fact that participants were no better at discriminating descriptors read about themselves, we did find that they recalled and recognized them better. Clearly, the self-reference effect in old age warrants more exhaustive investigation given that older people do not always benefit as much as young people from other types of semantic manipulation while processing information (e.g., Brown et al., 1995). The current debate as to the possible existence of a special, self-knowledge schema, is mainly based on data from young people, and lacks data from older populations with the exception of certain contributions from the field of neuropsychology (e.g., Klein & Gangi, 2010).

In summary, we showed that in a conversation, source monitoring (who said something?) is more affected by old age than referent discrimination (about whom was something said?). It can be argued that these two aspects are each distinctly affected by aging as instances of context and content of the episodes. Memory for context (source) is known to be more affected by aging than memory for content (referent). The main deficit we found to set in with age affects recall and recognition of the information older participants read about themselves. Further research studies must be developed to determine the role of self-reference in maintaining memory functioning during old age.

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