Running head:

DRM and source monitoring.

Original title:

False memories: Young and Older adults think of semantic associates at the same rate but young adults are more successful at source monitoring.

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Abstract

Two experiments explored whether the higher vulnerability to false memories in the DRM (Deese, 1959; Roediger & McDermott, 1995) paradigm in older compared to young adults reflects a deficit in source monitoring. In both experiments, adding together the number of falsely recalled critical lures and the number of critical lures produced on a post-recall test asking participants to report items that they had thought of but did not recall indicated that the critical lures were activated during the experiment equally often in young and older adults. However, older adults were more likely than young adults to say that they had actually heard the lures. When strongly encouraged to examine the origin of memories (Experiment 2), the warning substantially reduced false recall in young but not older adults. These results are consistent with the idea that older adults have more difficulty later identifying the source of information that was activated as a consequence of intact semantic activation processes.

Introduction

Several studies have shown that elderly people are more prone to memory distortions than younger adults on various laboratory tasks, showing a higher rate of false recall and/or false recognition (see Schacter, Koutstaal, & Norman, 1997 for a review), even when levels of correct performance are quite similar in both age groups (Balota et al., 1999; Schacter et al., 1997; Norman & Schacter, 1997).

One such laboratory task used to study false memories is the DRM paradigm (originally created by **D**eese, 1959; and later revived by **R**oediger & **M**cDermott, 1995) in which participants are presented with lists of thematically related words converging on associated non-presented lures (e.g., thread, pin, eye, sewing, sharp, point,…, for which the nonpresented lure is NEEDLE). This procedure has been shown to robustly elicit high rates of false recall and false recognition (see Roediger, McDermott, & Robinson, 1998 for a review) of the critical non-presented lure (CL). In addition, those false memories are quite compelling as participants are very confident that the CL has occurred and are able to provide descriptions and details regarding its presentation although it has never been presented (see Mather, Henkel & Johnson., 1997; Norman & Schacter, 1997 ; Roediger et al., 1998).

False memories in this paradigm are thought to occur because, during the presentation of the list, the CL is activated as a result of a spreading of activation in an associative network that will subsequently result in its easier accessibility (McDermott & Watson, 2001; Roediger & McDermott, 1995 but see also fuzzy trace theory Brainerd & Reyna, 1998). During retrieval, this activation must be correctly attributed to the participant’s own thoughts and not to the item's occurrence in the list through a successful « reality monitoring » process (Johnson, Hashtroudi & Lindsay, 1993; Johnson & Raye, 1981). In other words, the participants must distinguish prior real experience from thoughts in deciding whether or not the activated CL actually belonged to the previously studied list. If the participant fails, this means that his/her prior thoughts were mistaken for an actual prior perception. Conversely, if the participant attributes correctly, erroneous recall of the critical lure will not occur.

However, another possibility for the non-occurrence of a false memory for a particular list is that, basically, the list failed to activate the CL in the participant’s mind. Hence, when a false memory does not occur in this paradigm, the reason may be found either in a CL activation failure or may be due to successful source monitoring. A recent study (Brédart, 2000) has explored this issue with a modification added to the original paradigm to test whether the CL had been activated or not. After the memory test, participants were asked to say if, during the learning phase or during the recall phase, a word came to their mind, but they did not write it down during the recall task, because they thought the experimenter had not produced it. The experimenter then presented the participants successively with their own word lists produced during the recall phase and asked them to write down any other words they had thought when producing that list. This modification allowed us to examine the distribution of the CLs throughout the experiment and to determine the best explanation for why at some trials false memories do not occur (i.e., a monitoring success versus an activation failure). Specifically, failure to recall a CL either in the initial recall phase or during the added phase suggests that the list failed to evoke it. On the other hand, the reporting of a CL during the added phase for a list that did not initially produce a false memory is indicative of successful monitoring. Using this additional phase in the DRM paradigm with young adults, Brédart (2000) obtained results that were more consistent with the second explanation : young adults frequently reported CLs during this third phase that they had not intruded during the list recall phase. Hence, these results suggest that some of the CLs that have been activated may not produce false memories, but also, highlight the importance of source monitoring abilities (Johnson et al., 1993) in the resistance to false memories. The present studies use this modified procedure to investigate age-related differences in false recall in the DRM paradigm.

Experiment 1

In the current study, younger and older participants' performance was examined using Brédart's (2000) modified procedure. The question adressed was whether the higher rates of false memories in the older adults occurred because they were less likely to monitor the source of the CL during remembering. Previous data suggest that thinking of the CL is presumably the consequence of spreading activation in a semantic network (see McDermott & Watson, 2001) and there is some reason to believe that this is relatively unaffected by aging (Balota et al., 1999; Tun, Wingfield, Rosen & Blanchard, 1998). However, several lines of evidence have shown that older adults experience difficulties in source monitoring tasks (see for example Hashtroudi, Johnson & Krosniak, 1989; and Spencer & Raz, 1995 for a meta-analysis).

Therefore, in line with previous literature, older adults, relative to young adults, were expected to recall fewer studied items and more CLs during the initial recall test. In addition, if aging affects source monitoring processes, elderly adults should be less likely to recall the CL during the additional phase compared to the younger adults. However, no effect of aging on the activation of the CL is expected and the rates of produced CLs should then be no different between the two age groups. Therefore, according to our predictions, the summed proportions of CLs recalled at test and CLs produced during the additional phase should be equal in young and older adults, but the number of false recalls should be greater in older adults and the number of CLs produced during the additional phase should be higher in younger adults.

Method

Participants. Thirty younger adults and 30 older adults (15 females and 15 males in each group) participated in the experiment. All the participants were in good health and free from history of alcohol or drug abuse, cerebrovascular etiology, myocardial infarction, psychiatric treatment or psychotrope medication, or head-injury (descriptive data are given in table 1).

Material. The participants were presented with six French DRM word lists of 15 items (see appendix). These lists came from a larger pool that was initially constructed to obtain DRM materials in French. In an initial pilot study, participants (n=20) were presented with the lists and had to rate the degree of association between each word of the list and the target on a

7-point scale (1= the word is not associated with the target, 7 = the word is strongly associated with the target). The words (common nouns, adjectives or verbs) were then rearranged with the strongest associates presented first in a decreasing order. In a second pilot study, another group of participants (n=20) was asked to try to determine what was the word that ties all the words together. Results showed that, for all the lists, the CL was identified by all of the participants.

Procedure. The present study used Brédart's (2000) procedure, albeit with one modification: a 30-second interval between the learning phase and the recall phase was added in order to avoid recency effects. The participants were tested individually. They were told that the experimenter would read 6 lists of words and that they would be tested for each list after having counted backward by 3's for 30 seconds. The six lists were presented in a random order for each participant. The words were read aloud by the experimenter at the rate of one word per 1.5 s. For each recall phase (Phase 1), the participants were instructed to recall as many words as possible from the list they had just heard. They were then asked to write down the words on a sheet of paper in any order, but without guessing. They were given 90 seconds to complete each recall phase. After having recalled all the lists a first post-recall task was administrated to the participants. In this task (Phase 2), they were instructed to rate their confidence in having heard the word in the list they had just heard on a 5-point scale (1 = not very confident, 3 = fairly confident, 5 = extremely confident that the experimenter produced the word). In a second post-recall phase (phase 3), they were instructed to say if, during the learning phase or during the recall phase, a word came to their mind but they did not write it during the recall task because they thought the experimenter had not produced it. Then, the participants were presented successively with the word lists they recalled in the first phase and the subjects were asked to write down (with a different-coloured pen) any other words they had thought of for that list. In this phase, the participants were instructed to only write down words they remembered having thought of during the presentation of the lists and not to infer or to guess the words from the current instructions. During a final phase, they were asked to assign a rating reflecting their confidence in NOT having heard the experimenter produce that word on a 5-point scale (1= not very confident, 3= fairly confident, 5= extremely confident that the experimenter did not produce the word). The participants were also asked to complete a French language adaptation of the Mill-Hill Vocabulary Scale at the end of the testing. Finally, the participants were fully debriefed.

Results and Discussion

The descriptive data are presented in table 2. For both experiment, the alpha level was set at .05.

Please, insert table 2 about here

Performance in recall (Phase 1). The mean proportion of veridical items and of CLs recalled by each participant across the lists was computed in both groups. As expected, the influence of aging on veridical and false recall was obtained: Older adults recalled significantly fewer studied items than younger adults $t(58) = 7.21$ while they recalled more CLs $t(58) = -3.99$. The mean proportions of non critical intrusions recalled by each participant (n intrusions/ 6 (lists) X 15), were very low and not submitted to statistical analyses (see table 2).

A two-way ANOVA 2 (Group: young vs old) X 2 (Item Type: studied vs CL) was then carried out in order to compare the mean confidence ratings assigned to the different kinds of items. A significant effect of the Group was obtained $F(1,49) = 9.90$, $MSE = 0.55$ showing that the older participants assigned globally higher confidence ratings to their responses than younger participants. A significant effect of the Item Type $F(1,49) = 23.20$, $MSE = 0.53$ was also obtained. Planned comparisons showed that the confidence ratings assigned to the studied items were significantly higher than the confidence ratings assigned to the CLs. The Group X Item Type Interaction was also significant $F(1,49) = 6.05$, $MSE = 0.53$. Planned comparisons showed that, in the younger group, the confidence ratings assigned to studied items were significantly higher than the confidence ratings assigned to CLs while the confidence ratings assigned to both kind of responses were similar in the older group.

<u>Production of the CL during the third phase (Phase 3) and confidence.</u> The percentage of CLs produced during the third phase was computed for each participant across all lists. In agreement with our predictions, the analysis showed that the older adults recalled fewer CLs during this phase *t(58)=3.81* than the younger participants. However, no difference between the two age groups was obtained with respect to the confidence ratings assigned to CLs recalled during the third phase *t(50)= - 0.83*. These confidence ratings, which reflect how confident the participant was that the word had not been produced by the experimenter (on a 5-point scale), were quite high in both groups.

In addition, in agreement with our predictions, the total proportion of activated CLs on Phase 1 and Phase 3 were not different t(58)= - 0.83 between both age groups (.84 and .81 for younger and older adults, respectively). However, as shown above, young adults were found to recall less CLs during the recall phase (Phase 1) and to produce more CLs in Phase 3 while older adults presented the reverse pattern of performance. This suggests that older adults were as prone as younger adults to think of the CLs and that the monitoring explanation is a likely account for the non-occurrence of a false memory in younger but not in older adults.

Experiment 2

Several reasons could account for the observed source monitoring reduction in older adults. For example, it has been shown that older people sometimes improve their source monitoring performance with the use of a more fine-grained judgement (resulting in more stringent response criteria), suggesting that they might fail to spontaneously use strategies that could help them to avoid memory errors (Craik & Jennings, 1992; Koutstaal, Schacter, Gallucio & Stofer, 1999; Multhaup, 1995). However, Norman & Schacter (1997) failed to reduce DRM false memories when asking both younger and older participants to carefully examine the characteristics of their memories and suggested that the age-related deficit shown by the older adults might be the result of general/indistinct encoding (see also, Chalfonte & Johnson, 1996; Mitchell, Johnson, Raye, Mather & D'Esposito, 2000). Therefore, in this second experiment, we explored whether a failure to spontaneously engage source monitoring processes could account for older adults' pattern of performance in this paradigm. Strong warnings before the encoding phase were used in order to elicit the use of strategic processes in both older and younger adults, enabling them to adopt more conservative decision criteria.

Method

Participants. Fifty-six younger adults (32 females and 24 males) and 56 older adults (38 females and 18 males) participated in the experiment (descriptive and demographic data are given in Table 1).

Material. We used the same material as in the first experiment except that, a female voice producing the words of the lists was recorded and digitalized. Lists were presented in random order using a computer. The duration of the recorded lists ranged from 34 to 37 s and, as in Experiment 1, the interval between items was 1.5 s.

Procedure. The procedure was the same as in experiment 1 except that, in each age group, half of the participants were randomly assigned to the "unwarned" or "warned" condition. In both conditions, the procedure was similar except that, in the "warned" condition, participants received a strong warning before the beginning of the procedure and were given a list similar to those used in the experiment. They were told that the lists were not constructed randomly, that each list was associated with a theme-word, and that all the words belonging to a list were associated to another common noun that would never be presented in that list. For example, a word list could be: "tea, drink, hot, black, milk, sugar, cup, ...". In this case, "coffee" was the word that linked all the words from the list together but it has not been presented. They were told that, sometimes, people mistakenly remember the critical word that links all the others together (e.g., coffee) even if it was not presented and even if they were asked not to make this error. For each list, they were told to figure out which word tied all the words together and to be sure that it had not been presented.

Results and Discussion

The descriptive data are presented in table 3.

Please, insert table 3 about here

Performance in recall (Phase 1) and confidence. The mean proportion of items correctly recalled by each participant across the lists was computed for each condition in both groups. A two way ANOVA with Age (young vs old) and Condition (unwarned vs warned) as between-subjects factors was performed on mean proportions of correct recall. This analysis revealed the expected significant effect of Age $F(1,108)= 157.69$, $MSE = 0.01$, with older adults recalling significantly fewer studied items than younger adults. No significant effect of Condition ($F<1$) or interaction ($F<1$) was found, suggesting that warnings did not affect veridical performance.

The mean proportion of CLs recalled by each participants across the lists was computed for each condition in each age group. A 2 (Age) X 2 (Condition) ANOVA revealed the expected significant effect of Age $F(1,108)= 54.37$ $MSE =0.03$, showing that older adults recalled more CLs than younger adults. No significant effect of the Condition $F(1,108)= 1.31$ was found but a significant Age X Condition interaction was obtained $F(1,108)= 5.26$, $MSE = 0.03$. HSD Tukey Post hoc tests showed that warnings had an effect in the younger group. However, the rates of false recall in the older adults were similar whatever the condition.

As in Experiment 1, the proportions of non-critical intrusions were very low and were not submitted to statistical analyses (see table 3).

An ANOVA with 2 (Age: young vs old) X 2 (Condition: unwarned vs warned) X 2 (Item Type : studied vs CL) with repeated measures on the last factor was performed on the mean confidence ratings assigned to the different kinds of items[note 1]. A significant effect of Age was obtained $F(1,66)= 13.63$, $MSE = 0.54$ showing that the older participants assigned globally higher confidence ratings to their responses than younger participants even if both were quite high. A marginally significant effect of the Condition $F(1,66)= 3.41$, $MSE = 0.54$, $p= .07$ showed that unwarned participants gave higher confidence ratings than warned participants. The main effect of Item Type was significant $F(1,66)= 27.80$, $MSE = 0.47$. Planned comparisons showed that the mean confidence rating assigned to correct items was significantly higher than the confidence rating assigned to CLs. The Age X Item Type

Interaction was also significant *F(1,66)=12.55, MSE = 0.47*. Planned comparisons showed that, as in Experiment 1, the confidence ratings assigned to studied items were significantly higher than the confidence ratings assigned to CLs in the younger group whereas the confidence ratings assigned to both kind of responses were not significantly different in the older group. The Condition X Item Type interaction *F(1,66)=2.43* and the other interactions were not statistically significant (*Fs <1*).

<u>Production of the CL during the third phase and confidence.</u> The proportion of recall of the CLs during the third phase was computed for each participant. A 2 (Age: young vs old) X 2 (Condition: unwarned vs warned) ANOVA was carried out on those mean proportion and revealed a significant main effect of Age *F(1,108)= 62.73, MSE = 0.06* showing that, globally, younger adults produced more CLs during the third phase than did older adults. There was no significant main effect of the Condition *F(1,108)=1.28*. However, a significant Age x Condition interaction was obtained *F(1,108)=13.19, MSE = 0.06*. Tukey post hoc tests showed that, although younger adults produced significantly more CLs during the third phase, strong warnings still improved their performance but had no significant influence in the older group. In addition, a 2 (Age) X 2 (Condition) ANOVA was performed on the mean confidence ratings assigned to the CLs produced during the third phase. The analysis revealed a tendency *F(1,95)= 2.82, MSE= 1.12, p= .09* to assign higher confidence ratings in younger adults than in older adults. There was no significant effect of the Condition *(F<1)* but there was a significant Age X Condition interaction *F(1,95)= 9.11, MSE = 1.12.* Tukey Post hoc tests showed that in the warned condition, the younger participants rated confidence higher than older participants. In the unwarned condition, there was no difference between the two age groups.

A 2 (Age) X 2 (Condition) ANOVA was conducted on the proportion on activated CLs (CLs recalled during the memory test plus CLs produced during the third phase). A significant effect of the age group was obtained *F(1,108)= 10.58, MSE= 0.04* showing that the proportion of activated CLs was higher in the younger group (.83) than in the older group

(.70). The effect of condition was not statistically significant (F<1). However, a significant Age X Condition interaction F*(1,108)=6.23, MSE= 0.04* was found. As in Experiment 1, the total proportions of activated CLs on phase 1 and Phase 3 in the "unwarned" condition were not different between both age groups (.77 and .74 for younger and older adults, respectively). However, young adults were found to recall less CLs during the recall phase and to produce more CLs in Phase 3 while the reverse was obtained in older adults. This is an additional support to the idea that both age groups were as prone to think of the CLs and that the monitoring explanation is a likely account for the non-occurrence of a false memory in younger adults but not in older adults. Conversely, in the "warned" condition, the proportion of activated CLs was higher for the younger participants (.89) than for the older adults (.66).

It might be argued that providing warnings to older adults might have made the memory task quite difficult for them. Indeed, subjects are required to try to determine what the critical lure was, to keep it in mind, and to avoid producing it during the subsequent memory test, while at the same time memorizing the other words from the lists. This would be close to a dual task situation and would be a likely explanation for the failure to observe any effect of warnings in older adults. Nevertheless, if warnings made the task more difficult for the older adults, one would also expect a decrease of correct recall in the warned condition. Results are not consistent with this interpretation. Indeed, the rates of correct recall were similar for the two older groups (warned vs unwarned).

General Discussion

In agreement with previous studies, the well-documented effect of normal aging on true and false recall using the DRM paradigm was replicated in both experiments. That is, older adults recalled less studied items and were more likely to falsely intrude the CLs than were younger adults (Balota et al., 1999; Tun et al., 1998). However, in both experiments, we replicated previous data (Brédart, 2000; McKelvie, 2001; Read, 1996) that the assigned confidence ratings were higher for studied items than for critical lures suggesting that confidence ratings might sometimes be useful in discriminating correct performance (i.e., the confidence ratings seemed to vary as did accuracy; see also Busey,Tunnicliff, Loftus & Loftus, 2000; McKelvie, 2001).

Secondly, when the confidence ratings assigned to both responses were compared in both age groups, a different pattern emerged for the older adults. Indeed, there were no differences between the confidence ratings assigned to studied and critical items suggesting that older adults were equally confident that those items had occurred. These results parallels evidence (i.e., faster recognition responses and lower amount of contextual details for critical lures than for studied items) suggesting that it is more difficult for older adults to discriminate between both kinds of items (Norman & Schacter, 1997; Tun at al., 1998). On the other hand, since older adults tended to rely more on indistinct/thematic information, one might also argue that they preferentially based their confidence judgements on semantic closeness/similarity. Based on this hypothesis, critical lures would therefore be very strong semantic associates and would also receive high confidence ratings. Again, this latest suggestion would fit with measured reaction times for the acceptance of the critical lure during a recognition test well (Tun et al., 1998). Further work is needed in order to better understand the origins of confidence ratings in younger and older adults.

Brédart’s (2000) results that younger adults were able to avoid producing the CLs through efficient source monitoring processes was replicated in both experiments. However, the main finding from these two experiments is the observation that younger and older adults were as likely to think of the CLs but older adults preferentially recalled them during the initial recall test while younger adults recalled them during the third phase. These results are important because they support the view that false recall in the DRM paradigm comes from a failure to efficiently monitor the origins of the memories (Johnson et al., 1993 ; Johnson & Raye, 1981; 2000). Because of the necessary delay between the study of a list and the start of the Phase 3 for that list, one might argue that older adults were as likely as young adults to note the non-occurrence of the CL but more likely to forget that they noted it. However, such a differential forgetting does not seem to have played a major role in the reported experiments. Indeed, it would then be hard to explain why older adults falsely remembered a higher percentage of CLs on the recall test, or why the sum of CLs produced in the recall test (phase 1) and in phase 3 did not differ for young and older adults.

In Experiment 2, it was shown that strong warnings were beneficial to younger adults and enabled them to improve memory accuracy. However, consistent with Norman & Schacter's (1997) findings, older adults were not able to profit from the warnings, suggesting that the age-related increase in false recall was not mainly attributable to a deficit in the spontaneous use of monitoring processes.

Overall, our results support the idea that a source monitoring deficit in older adults is the main factor responsible for the occurrence of false memories in the DRM paradigm. According to the Source Monitoring Framework (Johnson et al., 1993; Johnson & Raye, 2000), several reasons may explain this observed reduction in source monitoring efficiency in older adults. For example, older adults might have difficulties in accessing distinctive information during retrieval (Schacter et al., 1997) and/or in encoding information less distinctively (Chalfonte & Johnson, 1996; Schacter et al., 1997). Indistinct encoding in older adults would have made the characteristics of their true and false memories more similar to each other (see also Norman & Schacter, 1997). The fact that deficits in the recollective experience in old-age disappeared once encoding differences were accounted for (Perfect & Dasgupta, 1997) supports this hypothesis. Further work is needed to investigate the relative contributions to age-related differences in source monitoring accuracy of encoding deficits and retrieval and evaluation deficits (e.g., see Mitchell, et al., 2000).

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Table 1

Participants' descriptive and demographic data. Standard deviations are presented in brackets.

	Experiment 1		Experiment 2	
Group	Younger	Older	Younger	Older
Age (in years)	22.57 (1.43) (from 20 to 26)	70.67 (2.68) (from 66 to 75)	23.10 (3.22) (from 18 to 31)	71.90 (5.98) (from 60 to 83)
Mill Hill (score out of 44)	36.86 (2.81)	40.03 (2.82)	35.89 (4.01)	38.37 (3.65)
Educational level (in years)	13.01 (2.47) (from 12 to 20)	13.00 (1.52) (from 11 to 17)	15.00 (2.17) (from 12 to 21)	14.80 (1.29) (from 12 to 19)

Table 2

Mean proportion of recall as a function of the Experimental Phase, the Response Type, and the Age Group (Experiment 1). The mean confidence ratings assigned to the various kinds of responses are also presented in italics. Standard deviations are presented in brackets.

Phase	Response type	Age group	
		Young	Old
Phase 1			
	Studied	.51 (.08)	.69 (.10)
	Confidence	*4.78 (0.26)*	*4.86 (0.16)*
	Critical lures	.24 (.23)	.48 (.21)
	Confidence	*3.69 (1.36)*	*4.52 (0.69)*
	Non-critical intrusions	.02 (.02)	.04 (.03)
	Confidence	*2.82 (1.41)*	*3.63 (1.03)*
Phase 3			
	Critical lures	.60 (.30)	.33 (.24)
	Confidence	*4.00 (0.83)*	*4.21 (1.02)*

Table 3

Mean proportions of recall as a function of the Experimental Phase, the Response Type, and the Age Group (Experiment 2). The related mean confidence ratings assigned to the various kinds of responses are also presented in italics. Standard deviations are presented in brackets.

Phase	Response type	Age Group			
		Young		Old	
Phase 1		Unwarned	Warned	Unwarned	Warned
	Studied	.63 (.09)	.64 (.10)	.40 (.09)	.40 (.10)
	Confidence	*4.78 (0.21)*	*4.76 (0.30)*	*4.86 (0.14)*	*4.83 (0.22)*
	Critical lures	.16 (.19)	.04 (.08)	.34 (.21)	.39 (.25)
	Confidence	*3.84 (0.90)*	*3.20 (1.80)*	*4.78 (0.48)*	*4.41 (1.18)*
	Non-critical intrusions	.02 (.03)	.01 (.01)	.03 (.02)	.03 (.03)
	Confidence	*3.04 (1.46)*	*3.24 (1.17)*	*3.76 (1.20)*	*3.90 (1.00)*
Phase 3					
	Critical lures	.61 (.29)	.85 (.18)	.40 (.29)	.28 (.29)
	Confidence	*4.13 (1.20)*	*4.74 (0.55)*	*4.42 (0.88)*	*3.73 (1.56)*

Appendix

Critical lures with list items 1 to 15. The translation of the French words are given in brackets when necessary.

Fruit: pomme (apple), orange, banane (banana), poire (pear), kiwi, citron (lemon), jus (juice), macédoine (fruit salad), légume (veggetable), baie (berry), passion, mûrir (to ripen), défendu (forbidden), corbeille (basket), sorbet.

Maison (house): toit (roof), demeure (home), habitat (accommodation), residence (residence), adresse (address), foyer (heart), famille (family), appartement (appartment), cheminée (chimney), jardin (garden), confort (comfort), chalet, abri (shelter), chaumière (thatched cottage), cabane (hut).

Araignée (spider): toile (web), mygale (trapdoor spider), tisser (to weave, to spin a web), tarentule (tarantula), pattes (legs), insecte (insect), velu (hairy), animal, grenier (attic), peur (fear), mouche (fly), affreux (hideous), venin (venom), morsure (bite), ramper (to creep).

Lion: rugir (to roar), crinière (mane), félin (feline), fauve (big cat), féroce (ferocious), jungle, savane (savannah), dompteur (tamer), cirque (circus), tigre (tiger), cage, prédateur (predator), horoscope, chasse (hunting), antre (den).

Musique (music): note, instrument, son (sound), orchestre (orchestra), classique (classical), concert, symphonie (symphony), piano, radio, rythme (rythm), chanter (to sing), art, mélodie (melody), air (tune), groupe (band).

Arbre (tree): tronc (trunk), feuille (leaf), branche (branch), forêt (forest), racine (root), bois (wood), écorce (bark), cîme (top), sapin (fir tree), fruitier (fruiterer), souche (stump), bucheron (woodcutter), généalogique (genealogical), plante (plant), graine (seed).

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Note 1

The degrees of freedom for the confidence rating analyses are lower than those for the recall analyses because some participants did not produce any critical lure. Consequently, these participants did not provide confidence ratings for CLs and they were lost for the ANOVA since a mixed design with repeated measures on the response type was used.