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ORIGINAL ARTICLE

Destination memory and familiarity: better memory for conversations with Elvis Presley than with unknown people

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Abstract
Background and aims Familiarity is assumed to exert a beneficial effect on memory in older adults. Our paper investigated this issue specifically for destination memory, that is, memory of the destination of previously relayed information.
Methods Young and older adults were told familiar (Experiment 1) and unfamiliar (Experiment 2) proverbs associated with pictures depicting faces of celebrities (e.g., Elvis Presley) or unknown people, with a specific proverb assigned to each face. In a later recognition task, participants were presented with the previously exposed proverb–face pairs and for each pair had to decide whether they had previously relayed the given proverb to the given face.
Results In general, destination performance was found to be higher for familiar than for unfamiliar faces. However while there was no difference between the two groups when the proverbs being relayed were unfamiliar, the advantage of face familiarity on destination memory was present only for older adults when the proverbs being relayed were familiar.
Discussion and conclusions Our results show that destination memory in older adults is sensitive to familiarity of both destination and output information.

Keywords Aging · Destination memory · Familiarity

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Introduction

There is a substantial body of literature documenting the beneficial effects of familiarity on memory. This literature finds its experimental origin in the work of Hermann Ebbinghaus [1], asking participants to retain lists of previously exposed and new insignificant syllables. The author found better memory for old than for new syllables. The familiarity advantage in list learning has been the subject of rigorous and extensive experimental replication, suggesting that familiarity may improve the strength of encoding [2]. Consistent with the above, a common consensus in human memory research is that repetition improves recall [3] and this observation can be extended to normal aging. Studies show memory enhancement after repeated learning in older adults, and some authors have shown that in some situations, repetition and familiarity can improve memory performance in older adults to the level of younger adults [4, 5]. All these outcomes argue in favor of an enhancing effect of familiarity on memory in younger adults and older adults. Our paper investigates this issue for destination memory in particular.

Destination memory is the ability to remember the destination to which a piece of information has been addressed [6–10]. This memory can be contrasted with source memory or the ability to remember where and when

an information was learned [11]. A substantial body of literature suggests that source memory is compromised in normal aging and neurological diseases (for a review, see, [12]). The comparison between destination memory and source memory was established by Gopie and MacLeod [8] who asked younger participants to tell (destination condition) and receive (source condition) facts by looking at pictures of celebrity faces. In a subsequent task, the participants had to decide to/from which face they had previously emitted/received the facts. These procedures showed more difficulties in destination than in source recognition. Subsequent work extended destination memory vulnerability to normal and pathological aging [6, 7, 9, 13, 14], further demonstrating how fallible destination memory can be. Interestingly, in these studies, only familiar faces were used, leaving open the question of the nature of memory for unfamiliar destinations.

In attempting to address the latter question, it is worth considering research that investigates the interaction between familiarity and source memory. Several papers show better source memory for familiar than unfamiliar information, revealing advantages for repeated over novel stimuli [15–18]. Bearing this in mind, it is likely that different types of information are processed in an initial as compared to successive exposures to a stimulus. During the first exposure, it is possible that only a general representation of the novel stimulus, with little encoding of contextual aspects, takes place. However, during successive exposures to the stimulus, contextual aspects may be encoded leading to source memory enhancement observed for familiar stimuli. Such an account has been proposed by Poppenk and Norman [17]. The authors suggest that novelty at encoding directs attentional processing toward the novel stimulus at the expense of contextual details, in turn inducing inferior contextual recall for novel than for familiar stimuli. This attentional account converges with research showing negative effect of attentional diversion on source memory. For instance, explicit instructions to direct attention away from contextual features at encoding reduces subsequent source recall [19]. However, there is not a consensus on the beneficial effect of familiarity on source memory. In a series of experiments, Kim et al. [19] found negative effect of item repetition on source memory: prior exposure to an item was found to impair memory for subsequently presented source characteristics. Kim et al. [19] interpreted the discrepancies between their results and those showing better source memory for familiar stimuli [17] in terms of experimental design; the repeated pre-study of unfamiliar proverbs, as designed by Poppenk and Norman [17], offered participants multiple opportunities to comprehend these proverbs and associate them with prior knowledge. This interpretation is interesting in emphasizing the beneficial effect of personal knowledge on source memory.

The apparent beneficial effect of personal knowledge on source memory motivates the examination of whether a similar advantage may be found with respect to destination memory. Broadly speaking, in everyday life, individuals tend to interact more with familiar than with unfamiliar people (for a sociological view arguing how individuals tend to feel more comfortable with familiar than unfamiliar others, see, [20]). At work, university, or in personal life, we are more likely to relay information to familiar than to unfamiliar persons and indeed may even feel uncomfortable when we have to approach strangers (e.g., asking people about the nearest underground station). In general, sociological research suggests that interactions with familiar people are smoother than with those who are unfamiliar—we smile more at known than unknown persons [21]. The same goes for older adults who prefer to spend time with close friends and family rather than with unknown people and who also tend to show smoother interaction with familiar than with unfamiliar people [22]. Based on the notion that encounters with familiar persons are smoother than those with unfamiliar people, it may be proposed that memory performance for a familiar destination will be higher than that for an unfamiliar destination, especially in older adults.

Our paper

Over two experiments, we investigated the effect of familiarity on destination memory. In Experiment 1, destination memory was evaluated by asking participants to tell information looking at familiar and unfamiliar faces. We predicted better performance with familiar than with unfamiliar faces and based on the notion of specific improvements in memory performance in older adults [4, 5] that these benefits would be greater in older than in younger adults. In Experiment 2, the same procedure was carried out but with novel information. We predicted higher destination performance with familiar than with unfamiliar faces, especially in older adults.

Experiment 1

The purpose of the current experiment was to test the destination memory for familiar and unfamiliar faces. To this aim, participants were asked to relay 40 proverbs looking at pictures of 20 celebrity faces and 20 unfamiliar faces and to later decide whether they had previously told a given proverb looking at a given face or not.

Participants

A cohort of 34 younger adults (19 women and 15 men; M age = 23.12 years, SD = 4.11), and 31 older adults (17 women and 14 men; M age = 68.32 years, SD = 9.18), willingly participated in the study. The younger participants were undergraduate students at the University of Lille 3. The older participants were following courses in history of art at the University of Lille 3 or came from the local community. These older participants were non-institutionalized and managed their own household. Their Mini-Mental State Examination (MMSE; [23]) score (M = 28.48, SD = 1.55) showed normal cognitive functioning, and their verbal ability (M = 34.84, SD = 6.38) was matched ($p > 0.10$) with the younger adults (M = 32.03, SD = 8.45) according to the Mill Hill vocabulary test [24].

All participants were native French speakers with normal or corrected-to-normal vision and hearing. Exclusion criteria were a history of psychiatric, neurological, or learning disorders. One older adult was excluded from the study as he had difficulties with the instructions provided, and two younger adults were excluded because of difficulties with the French language. Informed consent was obtained from all participants in accordance with the principles laid down by the Helsinki Declaration.

Materials

Materials consisted of: (a) 26 familiar French proverbs, (b) 13 coloured pictures of celebrity faces (e.g., Elvis Presley), and, (c) 13 coloured pictures of unfamiliar faces. In line with the procedures of Poppenk et al. [15], each proverb was a complete sentence in formal language: proverbs with archaic or vernacular language were excluded. With regard to the pictures, celebrity faces were taken from a large pool used by previous studies assessing destination memory [6, 7, 9]. The faces were those of politicians, musicians, artists, entertainers, athletes, and other newsworthy people. The unfamiliar faces were those of young, middle-aged, and elderly women and men. They were chosen from the internet due to their high attractiveness, emotional expression, and image quality. The degree of familiarity of proverbs and faces was controlled in a separate sample of eight younger adults and six older adults on a five-point scale (1 = never encountered; 5 = very familiar). This sample reported proverbs and celebrity faces as being above level 3, and unfamiliar faces as below level 2. No significant differences were detected between the two age groups.

Apparatus

A laptop computer with a 15-inch LCD display was used for testing. The software package Psychopy [25] controlled stimuli presentation and response recording. Participants provided button-press responses using a six-button response pad.

Procedures

Procedures are illustrated in Fig. 1. Testing included a 'study phase', an 'interpolated phase', and a 'recognition phase'. The study phase consisted of 24 trials. Each began with a 1,000-ms white fixation cross in the center of a gray background followed by a proverb presented in white Times New Roman 40-point font. After a 5-s time interval, during which participants read the proverb silently, a 250-ms white fixation cross appeared, followed by a (12 × 12 cm) colored picture of a celebrity or unfamiliar person. Participants had to tell the celebrity the proverb with no time limit. Afterward, they pressed the space bar again, eliciting another white fixation cross for 1 s. This procedure was repeated until they had told each of the 24 proverbs looking at one of the randomly assigned 12 celebrity and 12 unfamiliar faces. To ensure encoding, participants were informed about the purpose of the study, and that their memory for the association between proverbs and faces would be tested in a later session (for a similar use of non-incidental encoding in context memory, see [26]).

Immediately after the study phase, the participants were engaged in the interpolated phase, consisting of reading strings of three-digit numbers aloud for 1 min. Afterward, they proceeded to the recognition phase in which the previously exposed 24 proverbs and faces were paired and presented in random order: 12 intact pairs (6 proverb–celebrity face pairs + 6 proverb–unfamiliar face pairs) + 12 re-pairings (6 proverb–celebrity face pairs + 6 proverb–unfamiliar face pairs). Proverb–face pairs were presented one at a time, with the proverb below the face. For each pair, the participants had to decide whether they had previously told that proverb looking at that face or not. No time limit was imposed on responses, which constituted pressing a blue key for "yes" responses and a red key for "no" responses. After each response, a blank screen was displayed for 250 ms, followed by the next test trial.

Procedures were preceded by a training trial including one proverb–celebrity and one proverb–unfamiliar face pair. Here, the participants were presented, in the recognition phase, to repairing of the two-previously exposed proverbs and faces. To the question whether they had previously told that proverb looking at that face, all the participants correctly answered "no". One participant had,

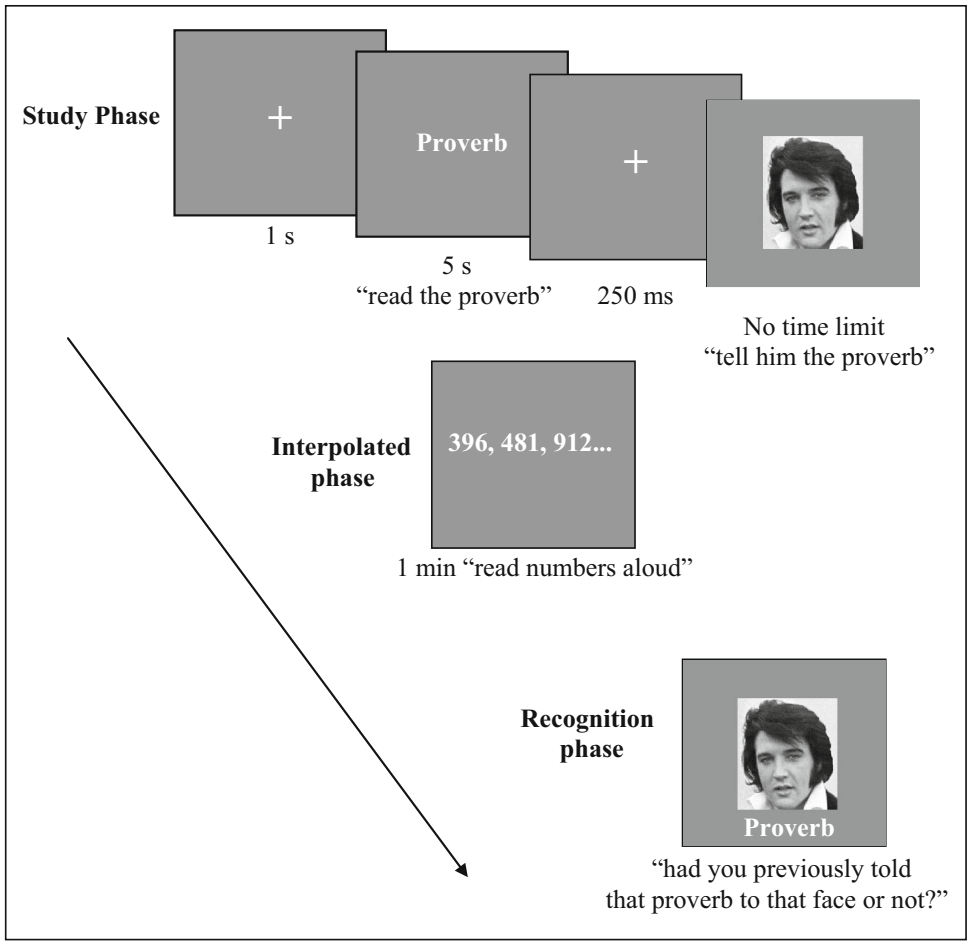

Fig. 1 Schematic view of the procedure. Note: Elvis Presley's image is covered by creative commons copyright

however, difficulties with the instructions and thus as reported in "Participants", his data were excluded from analysis.

Familiar and unfamiliar recognition performances were calculated as the proportion of hits (correct "yes" responses) minus the proportion of false alarms (incorrect "yes" responses). For instance, as regards familiar destination recognition, if a participant correctly remembered the destination of five proverbs among the six intact proverb–celebrity face pairs and misidentified the destination of one proverb among the six repaired pairs, the proportion of hits was rated as 0.83 (5 divided by 6) and the proportion of false alarms was rated as 0.17 (1 divided by 6). Thus, the recognition score of this participant was $0.83 - 0.17 = 0.66$. The same calculation was carried out for unfamiliar recognition performance (for a similar method in destination memory, see [6–8, 10]).

Results: familiarity benefits only present in older adults

Recognition scores, as depicted in Fig. 2, were submitted to analysis of variance (ANOVA) with age group (younger

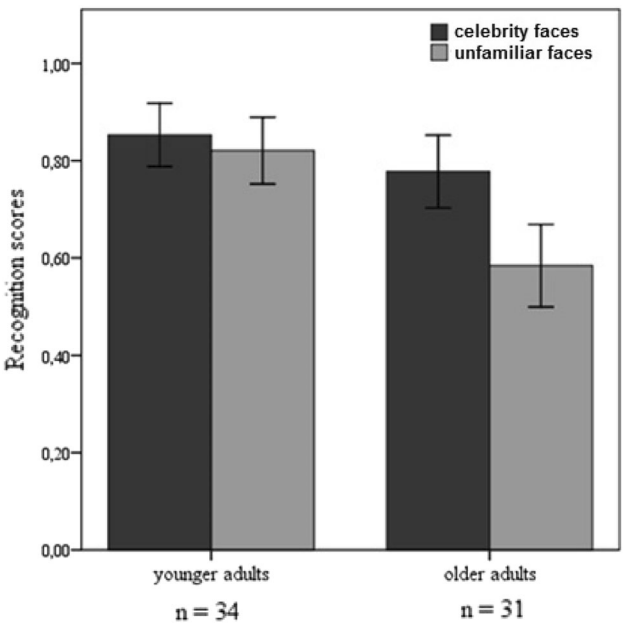

Fig. 2 Recognition scores for celebrity faces and unfamiliar faces when outputting familiar proverbs. *Error bars* represent intervals of 95 % within-subjects confidence

adults vs. older adults) as a between-subjects variables and familiarity (memory for familiar vs. unfamiliar faces) as a within-subject variable. Analysis showed a significant group effect, $F(1, 63) = 20.00$, $p < 0.001$, $\eta^2 = 0.24$. Older adults showed lower destination memory than younger adults, with respective means of 0.68 (SD = 0.21) and 0.84 (SD = 0.17). The familiarity effect was also significant, $F(1, 63) = 9.35$, $p < 0.01$, $\eta^2 = 0.13$, revealing better destination memory for familiar than for unfamiliar faces, with respective means of 0.82 (SD = 0.19) and 0.71 (SD = 0.24). Finally, interaction between group and familiarity was significant, $F(1, 63) = 4.76$, $p < 0.05$, $\eta^2 = 0.07$. Post hoc pairwise comparisons showed familiarity benefits only for older adults, $t(30) = 3.09$, $p < 0.01$.

Discussion

As predicted, better destination performance was observed for familiar than unfamiliar faces, with older but not younger adults showing benefits of familiarity. Familiarity is argued to offer improvements in memory performance in older adults [4, 5] and our data extend this notion to destination memory. These initial results must, however, be interpreted with caution, since it is possible that destination memory improvement is, somehow, influenced by proverb familiarity. Destination enhancement, as observed in older adults, could be attributed to familiarity of both proverbs and faces rather than to the faces' familiarity per se. This issue was addressed directly in Experiment 2.

Experiment 2

To investigate whether familiarity benefits, as observed in the previous experiment, are influenced by proverb familiarity, we repeated the same procedures as used in Experiment 1, but this time with unfamiliar proverbs. If destination enhancement is the result of proverb familiarity per se, then no destination enhancement should be detected for celebrity faces when outputting unfamiliar proverbs.

Participants

Thirty-seven younger adults (21 women and 16 men; *M* age = 24.03 years, SD = 4.60) and 33 older adults (19 women and 14 men; *M* age = 65.79 years, SD = 9.88) participated in this experiment. Recruitment, matching, and exclusion criteria were the same as those in Experiment 1.

Materials and procedures

Thirty unfamiliar English proverbs were selected from those used by Poppenk et al. [15]. The proverbs were translated into French with some being adapted to ensure smooth, concise reading in French and to avoid cultural ambiguity. With regard to faces, the same were used as in Experiment 1. An independent sample of seven younger adults and six older adults reported the translated proverbs as below level 2 on a five-point scale (1 = never encountered; 5 = very familiar), and no significant differences were detected between the age groups. Stimuli presentation and response recording employed the same apparatus as used in Experiment 1. The experimental design was also identical to that in Experiment 1.

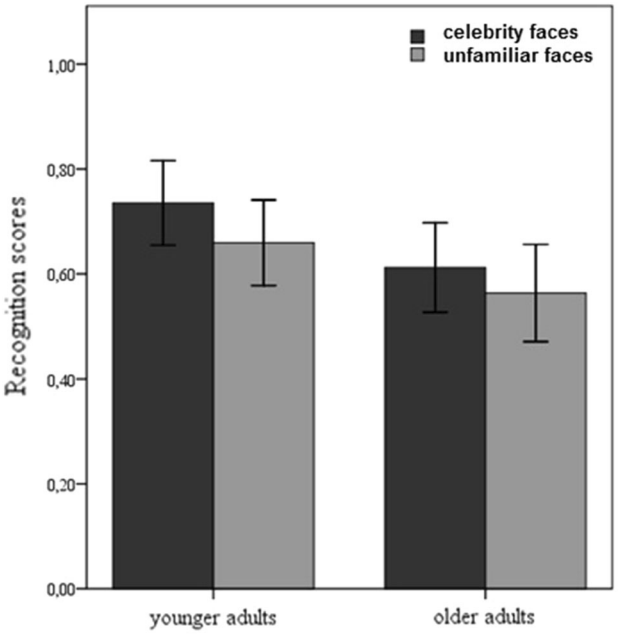

Fig. 3 Recognition scores for celebrity faces and unfamiliar faces when outputting unfamiliar proverbs

Results

Same familiarity effect for younger adults and older adults

Figure 3 depicts familiar destination performance and unfamiliar destination performance for both age groups. A 2 (age group: younger adults vs. older adults) × 2 (familiarity: familiar vs. unfamiliar faces) ANOVA revealed a significant group effect, $F(1, 68) = 4.53$, $p < 0.05$, $\eta^2 = 0.06$. Older adults showed poorer destination memory than younger adults, with respective means of 0.59 (SD = 0.25) and 0.70 (SD = 0.25). The Familiarity effect was significant, $F(1, 68) = 4.51$, $p < 0.05$, $\eta^2 = 0.06$, showing better destination memory for familiar than unfamiliar faces, with respective means of 0.67 (SD = 0.24), and 0.61 (SD = 0.25). The interaction

between group and familiarity was not significant, $F < 1$. Planned post hoc pairwise comparisons failed to show significant familiarity benefits for either group showing that the effect only existed when the two groups were combined.

Experiment 1 vs. Experiment 2: better destination memory for familiar than unfamiliar proverbs

To investigate the effect of familiarity of the proverbs across experiments (i.e., familiar proverbs in Experiment 1 vs. unfamiliar proverbs in Experiment 2), we conducted an ANOVA with age group (younger adults vs. older adults) and proverbs' familiarity (familiar proverbs in Experiment 1 vs. unfamiliar proverbs in Experiment 2) as a between-subjects variables and recognition scores (memory for familiar faces vs. unfamiliar faces in both experiments) as a within-subject variable. Analyses showed a significant group effect, $F(1, 131) = 17.73$, $p < 0.001$, $\eta^2 = 0.12$. When considering performances on both experiments, older adults showed poorer destination memory than younger adults, with respective means of 0.63 (SD = 0.22) and 0.76 (SD = 0.12). The effect of familiarity of proverbs was significant, $F(1, 131) = 13.59$, $p < 0.001$, $\eta^2 = 0.06$, showing better destination memory for familiar than unfamiliar proverbs, with respective means of 0.76 (SD = 0.14) and 0.64 (SD = 0.21). The effect of familiarity of faces was also significant, $F(1, 131) = 14.01$, $p < 0.001$, $\eta^2 = 0.10$, showing better destination memory for familiar than unfamiliar faces, with respective means of 0.74 (SD = 0.15) and 0.66 (SD = 0.18). Interaction between group, proverbs' familiarity, and faces' familiarity was significant, $F(1, 131) = 4.06$, $p < 0.05$, $\eta^2 = 0.03$. However, neither interaction between group and familiarity of faces, $F < 1$, nor interaction between familiarity of proverbs and familiarity of faces was significant, $F < 1$.

Discussion

This experiment repeated the procedures of Experiment 1, but using proverbs that were unfamiliar as opposed to familiar. Consistent with the findings of Experiment 1, better destination recognition was observed for familiar than for unfamiliar faces; however, no significant interaction was detected between group and familiarity suggesting that the two groups did not differ in this regard. When considering performances on both experiments, older adults showed poorer destination memory than younger adults, better destination memory was observed for familiar than unfamiliar faces, and for familiar than unfamiliar proverbs.

General discussion

Over two experiments we investigated the effect of familiarity on destination memory. Destination memory was found to be higher for familiar than for unfamiliar faces, regardless of the familiarity of proverbs. Relative to younger adults, older adults showed better memory for familiar than for unfamiliar faces when outputting familiar proverbs, but there was no difference between the two groups when unfamiliar proverbs were used.

The beneficial effect of familiarity on memory has been the subject of extensive experimental and theoretical inquiry. Prior knowledge of a stimulus has been shown to facilitate its subsequent processing [17]. For instance, as shown in priming, there is faster performance and more precise identification of a previously shown item. With regard to context memory, prior experience with an item is argued to facilitate source memory with research showing source memory advantages for familiar over unfamiliar stimuli [15–17]. Our data extend this consideration to destination memory. In our work, remembering the destination is found to be higher for celebrity than for unknown faces, suggesting better processing of familiar destination. As noted earlier, in everyday life, we tend to interact more with familiar than with unfamiliar people. Consistent with this suggestion, research shows that we feel less nervous when interacting with familiar than with unfamiliar individuals [27], and vice versa, we tend to be more anxious when interacting with unfamiliar then with familiar individuals [28]. These findings fit with the observation that people tend to smile more at known than unknown persons [22]. Taking these considerations together, it is not surprising that our participants showed better destination memory for familiar than for unfamiliar faces, an outcome that was observed regardless of proverb familiarity. Older adults, however, showed significant benefits for familiar faces only when outputting familiar proverbs.

Relative to younger adults, and when outputting familiar proverbs, older adults showed better memory for familiar than for unfamiliar faces (Experiment 1), while there was no difference between the two groups for unfamiliar proverbs (Experiment 2). Destination memory in older adults seems to be high when dealing with both familiar information and familiar destination, increasing the familiarity effect on destination memory of older adults. The observed beneficial effect of familiarity on destination memory in older adults converges with studies in normal aging, showing steady enhancement of memory performance as a function of repeated learning; for instance, memory performance is better for repeated than for new actions in older adults [5]. We suggest that destination memory is likely to be highly influenced by familiarity and older adults show memory benefits for familiar destination,

especially when outputting familiar information. Next, we link these outcomes to attentional processing.

Familiarity benefits on destination memory can be interpreted in terms of attentional shift. Stimulus novelty may direct attentional focus toward the stimulus itself at the expense of peripheral features, leaving fewer attentional resources to process contextual features surrounding the stimulus. In contrast, stimulus familiarity is likely to leave more attentional resources available for processing contextual information (for a similar view in source memory features, see [17]). We suggest that when attentional focus is directed toward the new stimulus itself and consequently away from destination information, destination details are likely to escape adequate memory encoding, resulting in lower destination memory for unfamiliar stimuli. This attentional shift may account for the higher destination memory for celebrity over unfamiliar faces we observe in our participants. It may also explain why the older participants failed to show the same benefits when outputting unfamiliar proverbs; it is likely that, in Experiment 2, proverb novelty directed their attentional focus toward processing the proverbs themselves, reducing resources for destination processing. In contrast, proverbs' familiarity in Experiment 1 allowed allocating more attentional resources for destination processing, triggering better memory for familiar than for unfamiliar faces in older adults. It is worthy of note that poor attentional processing is considered a main characteristic of normal aging, accounting for age-related context memory decline [29].

Although our results fit with the research showing better context memory for familiar than for unfamiliar stimuli [15–17], they contrast with others suggesting lower context memory for familiar stimuli [19]. This discrepancy may be due to differences in familiarity assessment. In the work of Kim et al. [19] familiarity was induced by experimental repetition, whereas in our work (and that of Poppenk et al. [15–17]) familiarity was assessed with pre-experimental familiar items that are likely to be of meaning and significance to participants. Another difference between the work of Kim et al. [19] and ours is that the former investigated source memory, whereas the latter considered destination memory.

One limitation of the current study is that it only used faces. Thus, familiarity benefits on destination memory may be attributed to our experimental stimuli. Participants had to differentiate between familiar and unfamiliar faces, a task that may be considered automatic and effortless. A substantial body of literature suggests spontaneous processing and recognition of familiar as compared to unfamiliar faces. Although familiarity was investigated with face discrimination in an imitation of everyday life interaction, future research should assess the phenomenon with a wider variety of destinations (e.g., familiar vs. unfamiliar locations). Another limiting factor is the lack of an attentional measure. Although we drew heavily on the attentional account, our experimental design did not assess attentional processes, a shortcoming that should be considered by future studies.

In sum, the present work shows positive effects of familiarity on destination memory, a benefit that seems to alleviate the perturbation of destination memory in older adults. Our results highlight the enhancing effect of familiarity on memory in older adults. Of interest would be to investigate this issue further in pathological aging, since destination memory has been found to show decline in diseases such as Alzheimer's disease [6, 7] and Huntington's disease [14].

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Conflict of interest None.

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