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"Choose it, and remember it": The impact of choice on destination memory

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Abstract

Destination memory can be defined as the capacity to remember to whom we transmit information. It is measured through the accuracy of retrieving the association between the information we transmit and the person to whom we transmit it. A destination memory procedure aims to emulate human interaction by sharing facts with celebrities (i.e., familiar faces) since we often communicate with people we know. However, the role of the choice about whom we intend to transmit the information to has not been evaluated before. This paper investigated whether deciding with whom to share a piece of information benefits destination memory. We designed two experiments with different levels of cognitive load, increasing it from Experiment 1 to Experiment 2. The experiments included two conditions: the choice condition, in which participants chose from two options to whom they desired to share a fact, and the no-choice condition, in which participants simply shared facts with celebrities without the possibility of a choice. Experiment 1 suggested that a choice component did not affect destination memory. However, when in Experiment 2 we raised the cognitive load by increasing the number of stimuli, we found that selecting the recipient during the more challenging task provided an advantage in destination memory. This result is congruent with the explanation that the shift of the participants' attentional resources to the recipient, caused by the choice component, leads to a destination memory improvement. In sum, it seems that a choice component can improve destination memory only under demanding attentional conditions.

Keywords: destination memory, choice component, attentional focus

Introduction

One of the most common challenges is not repeatedly sharing the same information with the same person. For instance, when researchers attend a conference to present their latest results, they usually share their studies with numerous colleagues. A potential problem arises when the same information is repeated later to the same recipient because the researcher does not remember with whom they shared it. Even though it causes social embarrassment, those occurrences are difficult to avoid and are recurrent throughout our lives. In previous literature, the ability to remember to whom we relay information was coined as destination memory (Gopie & MacLeod, 2009).

Destination memory is a fundamental social skill, and its significance in facilitating social interactions cannot be underestimated. As mentioned before, one of the consequences of a faulty destination memory is redundancy, which consists of repeating the same story multiple times to the same recipient (Kausler & Hakami, 1983). Another expression of social compromises related to destination memory is withdrawing important information (e.g., inadvertently concealing critical medical information from a doctor). These examples clarify the importance of destination memory in our daily routine and highlight the relevance of understanding how it operates.

Gopie and MacLeod (2009) pioneered the study of destination memory and sought to understand how the incoming and outgoing information differed in their processing. Specifically, the authors studied whether the encoding of information is more fallible when a person is transmitting (i.e., outgoing information) or when a person is receiving from another source (i.e., incoming information) (Gopie & MacLeod, 2009, Exp. 1). They hypothesized that participants would have more difficulty remembering outgoing information since more attentional resources would be necessary to generate the information to share with another person, remaining fewer resources to establish the association between the information and the recipient (i.e., the person who listens). To study memory for outgoing information, young adults first had to memorize facts (e.g., "A shrimp's heart is in its head") and then share them with familiar faces (e.g., Barack Obama). Subsequently, participants completed two different recognition tests: an item memory test and a destination memory test. In the item memory test, facts and faces presented during the study phase were later tested through a recognition test. In the destination memory test, fact-face pairs were presented to the participants, and participants answered whether they told the specific fact to the face presented alongside it. All facts and faces included in the destination memory test were previously studied, but matched pairs correspond to facts and faces previously presented associatively, and unmatched pairs included facts and faces reassembled. Gopie and MacLeod (2009) concluded that retrieving outgoing information was particularly difficult with this procedure. The authors suggested that this could be due to the additional attentional processes required to generate the information, weakening the fact-face pair association created at the encoding phase (for a more recent study that replicated this experiment in both young and older adults, see Johnson & Jefferson, 2018).

The paradigm created by Gopie and MacLeod (2009) has been used in several destination memory studies that also highlight the difficulty in retrieving the outgoing information in both older adults (Gopie et al., 2010) and several disorders (e.g., alzheimer's disease: El Haj et al., 2013; schizophrenia: El Haj et al., 2017; korsakoff's syndrome: El Haj et al., 2016; huntington's disease: El Haj, Caillaud, et al., 2016), which often presented difficulties in context memory and binding of information.

To understand the underlying mechanisms that influence destination memory, El Haj and Miller (2018) proposed a destination memory framework (DMF) in which the cognitive and social underpinnings were analyzed. On the one hand, the DMF focused on exploring the social mechanisms associated with destination memory since this type of memory is relevant for successful interactions and proper face-to-face conversations. Notably, several studies highlighted how various social factors are involved in destination memory, namely familiarity (El Haj et al., 2015), stereotypes (El Haj, 2017), the emotion of the receivers (El Haj, Fasotti, & Allain, 2015), and the theory of mind (El Haj, Raffard, & Gély-Nargeot, 2016). On the other hand, and regarding the cognitive mechanisms associated with destination memory, the DMF divided them into episodic processing (i.e., the context that is associated with the transmission of information) and executive functions (i.e., the choice and recall of telling a piece of specific information when meeting a person). The authors first explained how destination memory is part of the episodic memory and later identified the specific mechanisms that influence and predict its performance. Specifically, the DMF emphasizes how the association between the outgoing information and its recipient is mainly supported by binding (El Haj & Miller, 2018), which can be defined as the ability to associate an event with its context of acquisition to form an integrated episode (El Haj et al., 2013; Kessels & Kopelman, 2012).

Analyzing the previous literature on destination memory, some authors suggest that the destination memory procedure proposed by Gopie and MacLeod (2009) presents a potential limitation since it vastly differs from an actual conversation (Fischer et al., 2015; Lindner et al., 2015). Specifically, the transmission of different information to familiar faces presented on the same computer screen offers weak contextual cues compared to a real conversation, and these contextual cues are known to enhance memory (e.g., Eich, 1985). One of these cues that occurs in daily interactions and that is not present in the destination memory procedure is the possibility of choosing with whom a piece of information is to be shared (referred to as *choice component* hereafter). Precisely, the effect of the choice component on destination memory was a prominent aspect of the present research.

The benefits of choice have been widely documented in memory literature (e.g., Izuma & Murayama, 2013; Murty et al., 2015, 2019; Takahashi, 1991; Watanabe & Soraci, 2004). For example, it is widely accepted that self-chosen words lead to better remembering than researcher-assigned items in both recall and recognition, a phenomenon labeled as the self-choice effect (Takahashi, 1991). However, regarding destination memory, the possibility of choosing the recipient of the information has been scarcely studied. Specifically, in the only two studies of destination memory that have examined the choice component (El Haj, 2016; El Haj, Caillaud, et al., 2016), El Haj and colleagues aimed to determine if self-generated actions could lead to an improvement in destination memory, based on the premise that a memory advantage occurs in generation effect studies (Mulligan et al., 2006; Slamecka & Graf, 1978). In these studies, two forced-choice options[1] were presented to the participants, and the goal was to introduce everyday objects (e.g., a toothbrush) into one of them. When analyzing the results, the authors observed an improvement in the destination memory when a choice was available (see El Haj et al., 2013; Gopie et al., 2010; Gopie & MacLeod, 2009 for a comparison between incoming and outgoing information). Moreover, they postulated that this enhancement effect on destination memory might have occurred due to eliminating the participants' passivity. In other words, including a choice component in the procedure enhanced destination memory. When the authors broadened their conclusion to the destination memory procedures used in past literature (e.g., El Haj et al., 2013; Gopie & MacLeod, 2009), they suggested that merely saying the fact to the face without performing any additional activity, such as choosing the information or the recipient, is not an accurate simulation of what happens in daily interactions (El Haj, 2016; El Haj, Caillaud, et al., 2016).

A similar conclusion was reached by Marsh and Hicks (2002), although these authors studied target monitoring (giving an object) and source monitoring (receiving an object) instead of destination memory. Interestingly, their results showed that when there was an active choice (i.e., choosing to whom to deliver the object or choosing from whom to receive

[1] The two options were a squared white box and a circular black box.

the object), participants displayed higher memory for the association between the receiver and the object.

Together, these three studies (El Haj, 2016; El Haj, Caillaud, et al., 2016; Marsh & Hicks, 2002) concluded that a choice component could improve destination memory. A destination memory procedure with a choice component that leads to a shift of the attentional resources could be interesting since it would allow us to understand whether deciding with whom we share the information effectively leads to destination memory improvement.

Even though the destination memory procedures that used self-generated actions (El Haj, 2016; El Haj, Caillaud, et al., 2016) suggested that including a choice component enhances destination memory, it is not possible to generalize these findings to a destination memory procedure (such as the one applied by Gopie & MacLeod, 2009), since the procedures are vastly different. More specifically, in destination memory studies, the number of recipients is relatively high (e.g., 24 faces - El Haj, Raffard, & Gély-Nargeot, 2016; El Haj et al., 2018, or 50 faces - Gopie et al., 2010; Gopie & MacLeod, 2009), while in the studies mentioned above (El Haj, 2016; El Haj, Caillaud, et al., 2016; Marsh & Hicks, 2002) only two recipients were presented to the participants throughout the entire experiment. Destination memory has an evident social component and, as such, the type of procedure that El Haj (2016), El Haj, Caillaud, et al. (2016), and Marsh and Hicks (2002) proposed is not an accurate representation of social interactions since participants are continually sharing the information with the same two recipients.

Based on the premise that shifting the attentional resources to the recipient could improve destination memory, Gopie and MacLeod (2009, Exp. 3) conducted an experiment where half of the participants said the recipient's name before transmitting the fact, while the other half did not (for a similar destination memory procedure in which the attentional resources are directed to the recipient, see Johnson & Jefferson, 2018). The results showed that it is possible to improve destination memory performance by shifting attention from oneself to the person to whom one is sharing the information. The greater attention to the recipient improved destination memory relative to merely sharing the fact with a face, demonstrating that shifting the attention to the recipient during the encoding can lead to memory facilitation for the association between the fact and the face (Chun & Turk-Browne, 2007).

In this study, we aimed to investigate whether shifting the attention to the recipient via a choice component would improve destination memory. Destination memory is a type of memory that is essential for successful interpersonal interactions since it allows us to monitor what we previously transmitted to someone. However, in everyday interactions, individuals often have the option to choose whom to share specific information with. We designed Experiment 1 to understand the effects that a choice to whom to share information has on destination memory. In Experiment 2, we increased the number of stimuli during the encoding phase and the destination memory test to understand how increasing the cognitive load impacted destination memory. To investigate the impact of a choice component on destination memory, we compared two experimental conditions in both experiments. In one of them, there was no possibility of choosing to whom a fact was shared (hereafter *no-choice condition*), similar to the destination memory procedure Gopie and MacLeod (2009) applied. In the other one, a choice component during each trial of the encoding phase was included, allowing the participants to choose one of two faces to share a piece of information (hereafter, *choice condition*).

Experiment 1

In everyday social interactions, we can often decide with whom we want to share information. This freedom of choice was simulated using a choice component, in which participants performed a choice in each trial of the encoding phase. Since the choice component has been hinted at in previous studies as a potential mechanism to improve destination memory (El Haj, 2016; El Haj, Caillaud, et al., 2016; Marsh & Hicks, 2002), we hypothesized that participants who decide whom they want to share the information with (i.e., choice condition) would have higher destination memory than those who did not have a choice available (i.e., no-choice condition). In other words, choosing to whom we want to share the information should improve destination memory in an experimental procedure similar to the one presented by Gopie and MacLeod (2009). This destination memory improvement was expected due to two reasons: firstly, a greater focus on the recipient (face) prompted by choice should enhance the fact-face association, as shown in previous studies that shifted the attentional focus by saying the recipient's name before sharing the fact with them (Gopie & MacLeod, 2009). Secondly, destination memory studies using self-generated actions suggest that adding a choice could improve destination memory. The possibility of choosing the recipient of our information also addresses the problem indicated by El Haj (2016) and El Haj, Caillaud et al. (2016), in which the authors suggest that the participants' passivity observed in the procedures of this type of memory could hinder destination memory. We reduced the participants' passivity by introducing a choice component, and this methodological change should improve destination memory results. The conclusion of Marsh and Hicks (2002) also strengthens this hypothesis because they stated that experimental conditions in which the participants had a choice led to higher memory performance.

Method

Participants

The sample consisted of 60 undergraduate students (30 females) with ages between 18 and 29 (M_{age} = 21.40, *SD* = 2.13). This sample size was calculated *a priori* with the statistical software G*Power (Faul et al., 2007), suggesting a total sample of 60 participants to detect a large effect size (Cohen's *d* = .80), given an alpha (α) of .05 and a statistical power of .85. The effect size was chosen considering destination memory literature (Gopie & MacLeod, 2009). Participants were native Portuguese speakers with no history of drug or alcohol abuse, psychiatric disorders, and normal or corrected-to-normal vision. Written consent was obtained from all participants who received course credits for their participation. The local Ethics Committee approved the experiment.

Materials

Facts

Forty Portuguese proverbs (e.g., *"A pressa é inimiga da perfeição"*[2]) were selected from a previous study (Barros et al., 2021). We chose Portuguese proverbs as materials to ensure that the information was familiar to the participants. According to El Haj et al. (2015), more cognitive resources are available to memorize the individual items and the fact-face pair associations when the information is familiar. The proverbs' familiarity was measured using a 5-point Likert, with the level of familiarity varying between -2 and 2 (-2 = very unfamiliar proverb; -1 = unfamiliar proverb; 0 = neutral proverb; 1 = familiar proverb; 2 = very familiar proverb). Every proverb selected for this experiment was familiar, with values above 1 on the familiarity rating scale corresponding to the categorized level of "familiar" and "very familiar". Furthermore, the proverbs were controlled regarding their extension and emotionality. Only proverbs with an extension between five and nine words were included. The emotionality of the proverbs was also measured using a 5-point Likert scale that ranged between -2 to 2 (-2 = very negative proverb; -1 = negative proverb; 0 = neutral proverb; 1 = positive proverb; 2 = very positive proverb) and the chosen proverbs had a neutral emotional valence, with values between -.60 and .65, which were the values closer to zero (i.e., neutral valence).

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[2] An approximate English translation of the Portuguese proverb is "*Haste is the enemy of perfection*".

Faces

Seventy celebrity pictures (e.g., Barack Obama) were selected from a celebrity database validated for the Portuguese population using the same age group (young adults - Lima et al., 2021). The 70 celebrity pictures selected had over 83% recognition (M = 97.04, SD = 3.78) and 77% naming accuracy (M = 90.99, SD = 5.8). The images selected were also controlled regarding background (i.e., Portuguese and international celebrities) and gender (i.e., male and female), with all of these variables being presented proportionally. All images were black and white and had a 9 × 9 cm dimension.

Design

The independent variables manipulated were: (1) Choice component: half of the participants had to perform a two-faces forced choice to select the face with which they intended to share the fact (i.e., choice condition), whereas the other half did not select (i.e., no-choice condition); and (2) Type of stimuli: facts and faces. The choice component was manipulated through a between-subjects design, while the type of stimuli was manipulated through a within-subject design.

This experiment aimed to test whether a choice component presented during the encoding phase could improve destination memory. The sensitivity index d-prime (d') was calculated to measure our dependent variable. A d' score [z(P(hits)) – z(P(false alarms))] was calculated for both memory tests (item memory and destination memory), as well as for the binding test.

Procedure

First, participants signed an informed consent form and answered a sociodemographic questionnaire. Afterward, they were seated at 100 cm from a computer monitor in a soundproof booth. As in previous research, participants first performed a binding test, followed by the destination memory procedure (El Haj et al., 2013, 2017; El Haj, Caillaud, et al., 2016; Wili Wilu et al., 2018). The binding test was used as a covariate for destination memory. We opted to use this experimental task since previous literature has shown that the binding task results were correlated and predicted the participants' destination memory (El Haj, Caillaud, et al., 2016). Later, the destination memory procedure was presented. The stimuli presentation and response recording were controlled by the software Xampp (Friends, 2017).

Binding Test

The binding test was adapted from Mitchell et al. (2000) and consisted of two practice and twenty experimental trials, each containing four 3 × 3 grids. Eighty-eight 3 × 3 grids were created as part of this experimental procedure. Each grid included a different letter (font Arial, size 40) in one of eight possible positions since the grid's middle square never had any letter presentation. The first three grids presented a different upper-case letter, with each letter presented in a unique location. Each letter had a presentation time of one second, and the participant was instructed to remember each letter's location. After the first three grids, a fixation cross was presented for eight seconds. Afterward, a probe grid presentation occurred, containing a lower-case letter previously presented in one of the three preceding grids. In half of the trials, this letter was shown in the same position as before, whereas the letter was shown in a different location in the other half. After the presentation of the probe grid, the participants had to choose whether the letter presented appeared in the same position as before (i.e., answering "Y" or "N").

Destination Memory

After implementing the binding test, participants performed the destination memory procedure, which involved three phases: the encoding, interpolated, and retrieval phases. Moreover, two different memory tests constituted the retrieval phase: the item memory test and the destination memory test.

Participants were randomly assigned to one of two conditions: no-choice or choice condition. Participants were not informed that their memory would posteriorly be tested. In the no-choice condition, 30 facts were randomly paired with 30 faces. The participants were instructed to tell each fact to the face presented. Before doing so, each encoding trial began with a 500 ms black fixation cross ("+") on a white background. Then a fact was presented, and after reading and memorizing it silently, the participant pressed the space bar, which resulted in another 500 ms fixation cross, followed by a single face. The participant had to share out loud the fact with the face only once, pressing the space bar again to finish the trial. This procedure was repeated until the participant had told 30 facts to 30 faces.

In the choice condition, 30 facts were randomly paired with 60 faces. Thus, each trial included one fact and two faces, with the participant choosing one to share the fact. To start each trial, a 500 ms black fixation cross ("+") was presented on a white background. Then, a fact was presented, and after reading and memorizing it silently, the participants pressed the space bar, which resulted in another 500 ms fixation cross followed by the presentation of two faces, one on the left and one on the right side of the screen. Participants had to choose one of them to share the fact. Participants pressed a key when they intended to share the fact with the face on the left (key "1") or another key when they meant to share it with the face on the right (key "2"). After pressing the button, the chosen face would appear in the center of the screen.

The participant had to share out loud the fact with the face only once and, afterward, pressed the space bar to end the trial.

The interpolated phase occurred after the encoding of information, and it consisted of writing Portuguese city names on a piece of paper for one minute. Afterward, participants performed two counterbalanced memory tests in the destination memory retrieval phase, the item and destination memory tests. For the item memory test, 40 items (20 facts and 20 faces) were presented randomly. Half of the items were stimuli previously presented to the participant in the encoding phase (i.e., targets), and the other half were not (i.e., distractors). The presentation of each fact or face appeared accompanied by the question "Did you say this fact in the previous phase? (Y/N)" or "Did you say a fact to this person in the previous phase? (Y/N)", respectively. At the beginning of the item memory test, a fixation cross was presented for 500 ms, followed by an item's presentation. Each face or fact remained visible until the participant answered. The 20 items used on the item memory test were never presented in the destination memory test, with the remaining 20 facts and 20 faces that were previously presented during the encoding phase applied in that test instead (see Figure 1).

Figure 1 around here

The destination memory test consisted of an associative memory test in which 20 fact-face pairs were shown randomly. Half of these pairs had been presented previously in the encoding phase, while the other half consisted of randomly reassembled pairs of previously studied facts and faces. In the retrieval phase of the choice condition, only the previously selected faces in the forced-choice during the encoding phase were presented to the participant. Each fact-face pair was presented one at a time, with the fact appearing below the face. In each trial, the participant answered whether they had told that particular fact to that specific face. Participants' response keys and options were the same as in the item memory test. When the trial began, a fixation cross was presented for 500 ms, and then a fact-face pair was presented. Each pair remained visible until the participant responded. As mentioned, the stimuli presented on the destination memory test differed from those presented in the item memory, eliminating the risk of cross-test contamination (see Figure 2). The duration of the entire procedure was approximately 30 minutes.

Figure 2 around here

Results and Discussion

The mean proportion of hits, false alarms, and d' values are shown in Table 1. The software used for the data analysis was JASP 0.11.1 (JASP Team, 2019).

Table 1 around here

Binding

To determine whether the binding test was a predictor for destination memory, a one-way analysis of covariance (ANCOVA) was conducted to analyze differences between having a choice or not on d' data, controlling for the d' values of the participants' binding task. The results showed that the binding test did not explain a significant amount of variance in the destination memory test, $F(1, 57) = .04$, $p = .84$, $\eta_p^2 < .001$.

Item Memory

To analyze whether a choice component influenced item memory, we used a 2 (Choice component: no-choice vs. choice) × 2 (Type of stimuli: facts vs. faces) mixed ANOVA, performed on the d' data, with Choice component as the between-subjects factor and Type of stimuli as the within-subjects factor. Results showed only a significant main effect of Type of stimuli, $F(1, 58) = 19.95$, $p < .001$, $\eta_p^2 = .26$, indicating that item memory was higher for faces ($M = 3.07$, $SD = .40$) than for facts ($M = 2.67$, $SD = .59$). Since there was no main effect of Choice component, $F(1, 58) = .96$, $p = .332$, $\eta_p^2 = .02$, we can conclude that a choice component did not influence item memory. Lastly, no interaction Choice component × Type of stimuli was found, $F(1, 58) = .04$, $p = .851$, $\eta_p^2 = .01$.

Destination Memory

To determine if a choice component could improve destination memory, an independent samples t-test was performed on d' data, in which we compared participants who made a choice and those that did not. The analysis revealed no significant difference between the two conditions, $t(58) = -.78$, $p = .439$, *Cohen's d* = -.20, 95 % CI [-.72, .32]. In other words, choosing to whom each fact was told did not influence destination memory accuracy.

Reviewing our hypothesis that destination memory would be better when a choice component was presented during the encoding phase, the results found in Experiment 1 showed that this hypothesis was not confirmed because no difference was observed between the choice and no-choice conditions. That is, shifting the attention to the recipient produced by the choice component did not influence destination memory. However, it should be noted that the d' data values in our no-choice condition were relatively high compared to the pioneer study of destination memory (Gopie & MacLeod, 2009). When analyzing destination memory in both studies, a possible interpretation for the discrepancy is that our task demands could have been too low to be sensitive to the effect of the inclusion of a choice component. That is why we consider increasing the task's difficulty level to know whether including a choice component could affect destination memory. Specifically, in Experiment 2, we increased the cognitive task demands by first introducing more stimuli (i.e., fact-face pairs) and, second, introducing a longer interpolated phase between the encoding and retrieval phases. In our opinion, these two changes would increase the cognitive load of the task and allow us to clarify the effect of a choice component on destination memory, using the same type of stimuli and a similar procedure to Experiment 1.

In summary, the main goal of Experiment 2 was to establish whether the attentional shift of resources produced by a choice component influenced destination memory, this time using a more cognitively demanding experimental design. The changes included in Experiment 2 allowed us to confirm whether the results obtained in Experiment 1 were due to (1) the study was not difficult enough for differences to emerge between participants who had a choice and those that did not; or (2) the inclusion of a choice component was not a variable that significantly influences destination memory.

Experiment 2

To confirm if applying a choice component could influence destination memory in a procedure with higher cognitive demands, in Experiment 2, we increased the task's cognitive load by introducing two changes to our procedure: increasing the number of stimuli and adding a longer interpolated phase. We expected these procedural changes to further show a choice component's influence on destination memory. As such, participants who have the option to choose to whom they intend to share the fact (i.e., choice condition) were expected to have a higher destination memory than participants who do not have the option to do so (i.e., no-choice condition). Additionally, if the changes included made the experimental task more difficult in Experiment 2 than in Experiment 1, we also expected that the d' data of destination memory in Experiment 2 would decrease in both conditions.

Finally, since we observed that the effects on the item memory test were not affected by the experimental condition, and the focus of Experiment 2 was to understand destination memory with the addition of a choice component, we decided to remove the item memory test, as in recent studies (e.g., El Haj, Raffard & Gély-Nargeot, 2016; El Haj et al., 2018). Therefore, the retrieval phase only comprised the destination memory test.

Method

Participants

A sample of 60 undergraduate students (45 females) ranging between 17 and 36 years (M_{age} = 20.76, *SD* = 3.57) was used in this experiment. This sample size was calculated with the same parameters considered in Experiment 1. The inclusion criteria were the same as previously reported.

Materials

Materials were the same as those used in Experiment 1, but the number of faces increased from 70 to 80. The 80 celebrity pictures selected had over 79% recognition (*M* = 96.34, *SD* = 4.47) and 71% naming accuracy (*M* = 89.13, *SD* = 6.79).

Procedure

Participants were randomly assigned to one of two conditions, the no-choice condition or choice condition, previously described in Experiment 1. In both conditions, 40 facts were randomly paired with 40 faces, 10 fact-face pairs more than in Experiment 1. Once again, participants were not informed that their memory would later be tested.

The interpolated phase was more prolonged than in Experiment 1. To increment this experimental phase's duration, we included a binding test in the middle of the experimental procedure (i.e., between the encoding and the retrieval phase). Additionally, we increased the fixation cross duration from eight to fifteen seconds in the binding test. This change increased the interpolated phase from one to eight minutes.

As mentioned before, the retrieval phase only included the destination memory test. This test followed a similar procedure to Experiment 1; however, the number of fact-face pairs presented doubled from 20 to 40 pairs. Thus, half of the pairs were previously shown in the encoding phase, while the other half consisted of random reassemblies of previously studied facts and faces. The duration of Experiment 2 was approximately 35 minutes.

Results and Discussion

Destination Memory

To understand whether a choice component could improve destination memory, an independent samples t-test was performed on d' data, in which we compared participants who chose to whom to share the fact (i.e., choice condition) and those who did not (i.e., no-choice condition). The analysis revealed that destination memory was higher in the choice condition than in the no-choice condition, $t(58) = 2.43$, $p = .018$, *Cohen's d* = .63, 95 % CI [.09, .95] (see Table 2).

Table 2 around here

Thus, the results showed that participants who made a choice during the encoding phase had higher destination memory than those who did not perform it, confirming our hypothesis that the choice component would improve this type of memory. However, it is worth noting that this effect only appeared in Experiment 2 when we used a cognitively demanding task. In sum, the choice component can be pertinent to understanding destination memory, but only when the cognitive demands needed to perform the task are high.

Analysis of the Demands of the Destination Memory Test

To confirm whether the changes included in Experiment 2 (i.e., a higher number of items and a longer interpolated phase) increased the task demands, we used a 2 (Choice component: no-choice vs. choice) × 2 (Experiment: Experiment 1 vs. Experiment 2) two-way ANOVA, performed on the d' data, with both of the variables being between-subjects factors. There was a significant main effect of Experiment, $F(1, 116) = 11.12$, $p = .001$, $\eta_p^2 = .01$, which revealed that participants had a higher destination memory in Experiment 1 ($M = 1.70$, $SD = 1.00$) than in Experiment 2 ($M = 1.14$, $SD = .81$). There was no significant main effect of Choice component, $F(1, 116) = .89$, $p = .346$, $\eta_p^2 = .01$. Furthermore, we observed a significant Choice component × Experiment interaction, $F(1, 116) = 4.61$, $p = .034$, $\eta_p^2 = .04$. Post-hoc Bonferroni comparisons revealed that the destination memory was significantly higher in Experiment 1 than in Experiment 2 in the no-choice condition (d' values: 1.80 vs. 0.88, respectively), $p = .001$, 95% CI [.30, 1.54], but not in the choice condition (d' values: 1.60 vs. 1.40, respectively), $p = 1.000$, 95% CI [-.42, .82].

General Discussion

Destination memory is crucial for successful interpersonal interactions, yet little is known about the effect of a choice component on this type of memory. Although previous studies (e.g., Gopie & MacLeod, 2009) have shown how the association between the information we transmit and the recipient to whom we share it takes place, the impact of a choice component on destination memory remains unexplored. Therefore, the present study aimed to investigate whether choosing to whom we share a piece of information can enhance destination memory.

Previously, El Haj and colleagues (El Haj, 2016; El Haj, Caillaud et al., 2016) conducted two studies on destination memory that included self-generated actions suggesting that the presence of a dichotomic choice (e.g., deciding one of two different boxes to insert an object) led to an improvement in the destination memory. According to the authors, the shift of attentional resources from the information people transmit (e.g., facts) to the recipient was responsible for these results. In this study, we included a choice during encoding in order to shift the attention to the recipient of the information. We hypothesized that destination memory would be higher when deciding to whom we transmit the information (i.e., choice condition) than when a choice is not allowed (i.e., no-choice condition).

We carried out two experiments to ascertain the effect of a choice component on destination memory. In both experiments, destination memory was tested by comparing two conditions: choice and no-choice. In the choice condition, a choice between two different recipients was available during each encoding phase trial. In contrast, a fact was transmitted to a recipient without any available choice in the no-choice condition. The main difference between Experiment 1 and Experiment 2 was the higher cognitive load of Experiment 2, achieved by lengthening the study list and the interpolated interval.

Experiment 1 revealed no significant differences in destination memory between choice and no-choice conditions. However, analyzing our data, we observed that the results of the no-choice condition were considerably higher in Experiment 1 than in Gopie and MacLeod's (2009) study. Even though we used a similar procedure (i.e., telling facts to a familiar face without having a possibility of choosing a recipient) than these authors, they applied a higher number of trials in both encoding and retrieval phases. Therefore, although presenting a choice component during the encoding phase did not influence destination memory, it was possible that the number of stimuli used in Experiment 1, and consequently the cognitive demand, was not enough to make the choice component useful at encoding.

In Experiment 2, we increased the cognitive demands by lengthening the study list and the interpolated phase. We expected these procedural changes to help us assert the possible influence of a choice component on destination memory. Our hypothesis about the influence of a choice on destination memory was confirmed since Experiment 2 revealed a positive effect of a choice on the recipient of the information, with significantly higher destination memory in the choice condition than in the no-choice condition.

When we compared the results of Experiments 1 and 2 to confirm whether the increase in the task's cognitive demands was successful, we found that, in general, Experiment 2 was more difficult since a decrease in destination memory performance was observed (1.70 vs.

1.14 in Experiment 1 and Experiment 2, respectively). In addition, the interaction between experiment (i.e., Experiment 1 vs. Experiment 2) and choice component (i.e., no-choice condition vs. choice condition) indicated that destination memory was higher in Experiment 1 than in Experiment 2, only in the no-choice condition but not in the choice condition. In other words, the higher cognitive demands of the task only negatively affected the recollection of associations created during encoding if the option to choose the recipient of the information was not available.

We seek to simulate human communication in this work and understand how destination memory can affect the recollection of previous social interactions (see also, Gopie & MacLeod, 2009). Specifically, we propose that introducing a choice component better simulates daily life interactions since we can often choose the recipient of the information we intend to share. In destination memory studies using self-generated actions (El Haj, 2016; El Haj, Caillaud, et al., 2016), a possible explanation for the difficulties demonstrated in most destination memory procedures could be the inherent passivity of the experimental procedure. That is, only saying a fact to the face without any additional processes could hinder destination memory. Following El Haj (2016) and El Haj, Caillaud et al. (2016) recommendation to eliminate the participants' passivity while performing the encoding phase, our study included a choice component. Our results are congruent with the idea that adding an active choice component, which replaces the participants' passivity, has a positive effect on destination memory if there are high cognitive demands when compared to merely sharing the information without the possibility of choosing to whom we intend to do so (e.g., Gopie et al., 2010; Gopie & MacLeod, 2009). Furthermore, by obtaining a higher destination memory through the use of a choice component, our results also strengthen the attention hypothesis proposed by Gopie and MacLeod (2009). Specifically, the authors stated that shifting attentional resources towards the recipient has a positive effect on destination memory, whereas focusing on the information has the opposite effect.

While this study confirms that choice influences destination memory performance, it is unclear if the benefit observed was due to the benefits of choice on other types of memory (e.g., Izuma & Murayama, 2013; Murty et al., 2015, 2019; Takahashi, 1991; Watanabe & Soraci, 2004) or due to the directing of the attentional resources to the recipient. A future study in which a choice is applied to the information, directing the attentional resources to it, should allow us to clarify how choice ultimately affects destination memory. According to previous research (Gopie & MacLeod, 2009; Johnson & Jefferson, 2018), destination memory performance worsens when the attentional resources are directed to the information. In other words, including a choice component on the information would help to disentangle the relative influence of attention directed toward the information versus the recipient on destination memory performance.

Additionally, we did not ask participants to report the reason behind each choice. This information could provide an interesting insight into how choice affects destination memory and should be considered as a variable in future studies. Another variable that could be important in understanding why participants chose a specific face is the confidence in their responses. Examining the relationship between confidence and face selection could provide additional insights into the motives behind participant choices and potentially shed light on whether higher confidence levels lead to different destination memory results.

In sum, destination memory can be positively affected by including a choice that shifts attentional resources from the information to the recipient of the information, as suggested by previous literature (El Haj, 2016; El Haj, Caillaud, et al., 2016; Marsh & Hicks, 2002), but only when there are high cognitive demands. By focusing on the recipient, a choice component created stronger fact-face pair associations, demonstrating a higher destination memory than when no choice was performed. In other words, the introduction of choice in the encoding phase forces the engagement in an additional response (i.e., choosing to whom to say a fact out loud), thus shifting their attentional resources to the recipient's face. Given our results in which a destination memory improvement is observed, the experimental procedure applied in this study can serve as the basis for future destination memory studies. Considering this, our study could be a critical finding to constructing future methodologies using the same conceptual backbone observed in most destination memory literature.

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Figure 1

Illustration of a trial on the item memory test

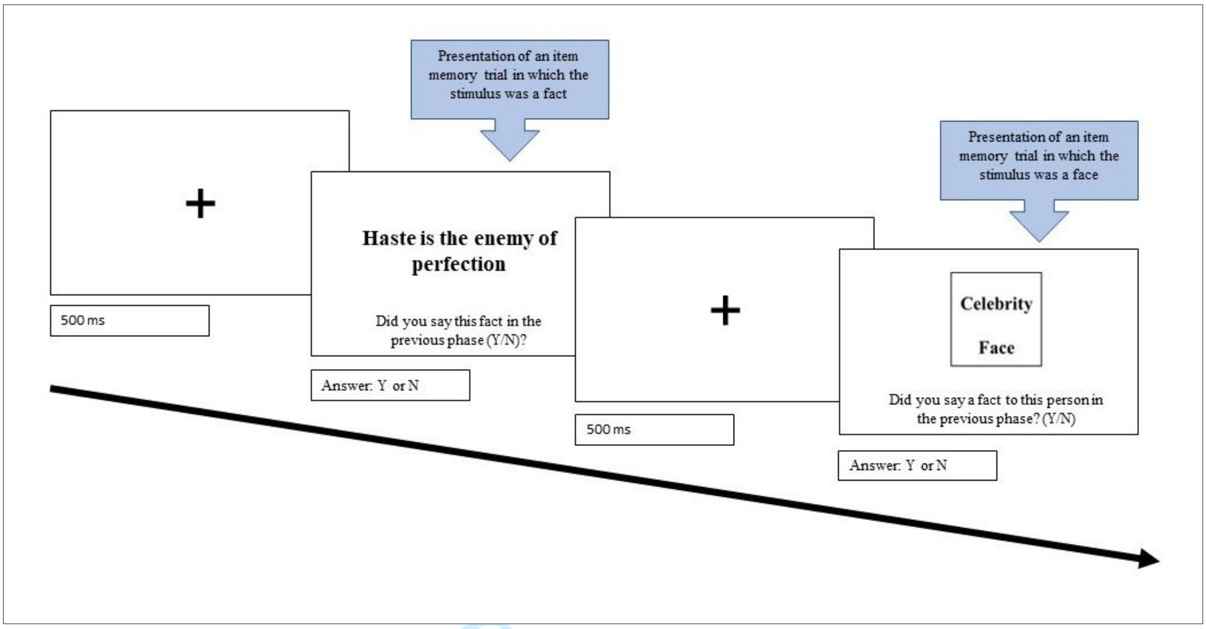

Figure 2

Illustration of a trial on the destination memory test

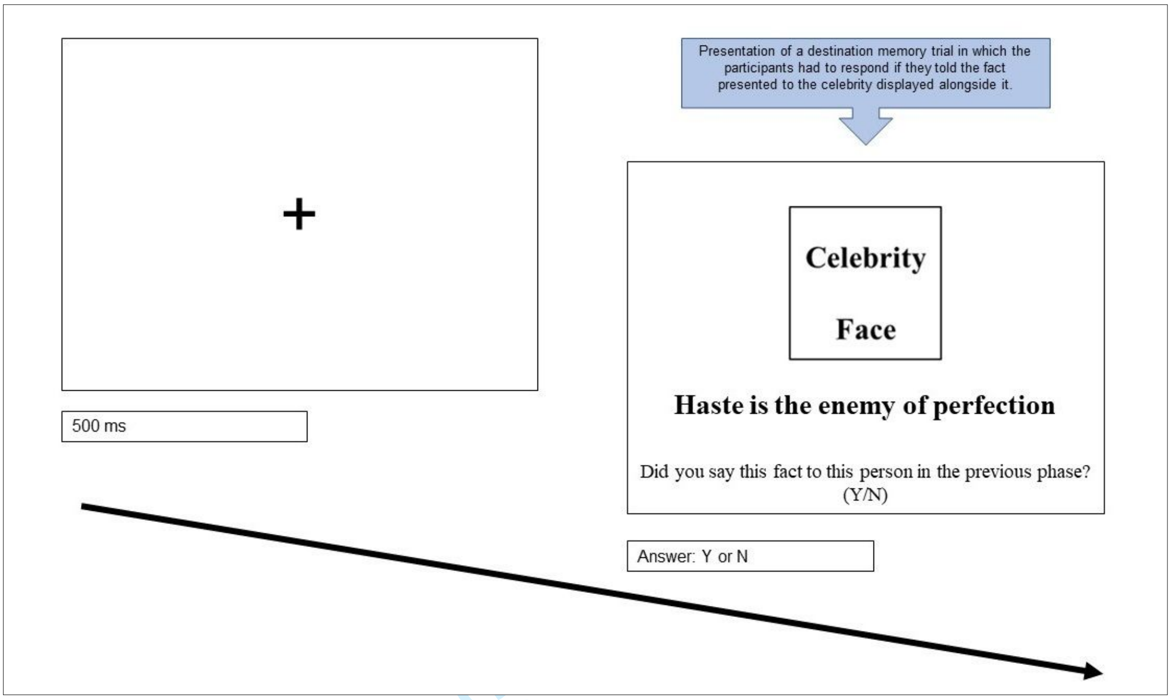

Table 1

Mean proportion (SD) of hits, false alarms, and d' data values to item memory and destination memory in Experiment 1 as a function of condition.

	Hits	False Alarms	d'
No-choice Condition			
Item Memory: Facts	.87 (.15)	.05 (.06)	2.61 (.61)
Item Memory: Faces	.95 (.06)	.03 (.05)	3.03 (.47)
Destination Memory	.80 (.19)	.22 (.20)	1.80 (.99)
Choice Condition			
Item Memory: Facts	.86 (.13)	.05 (.06)	2.72 (.57)
Item Memory: Faces	.97 (.06)	.04 (.09)	3.11 (.31)
Destination Memory	.76 (.19)	.25 (.23)	1.60 (1.02)

Table 2

Mean proportion (SD) of hits, false alarms, and d' data values to destination memory in Experiment 2 as a function of condition.

	Hits	False Alarms	d'
No-Choice Condition	.62 (.16)	.31 (.17)	.88 (.61)
Choice Condition	.70 (.18)	.26 (.19)	1.40 (1.00)