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Diogo Alberto Ferreira Lima

How Choice can Affect our Social Interactions:
The Impact of a Choice Component on Destination Memory

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STATEMENT OF INTEGRITY

I hereby declare having conducted this academic work with integrity. I confirm that I have not used plagiarism or any form of undue use of information or falsification of results along the process leading to its elaboration.

I further declare that I have fully acknowledged the Code of Ethical Conduct of the University of Minho.

Como a Escolha Pode Afetar as Nossas Interações Sociais: O Impacto de uma Componente de Escolha na Memória de Destino

RESUMO

A memória de destino é a capacidade de recordar a quem transmitimos uma determinada informação e, como tal, está intimamente ligada a interações interpessoais bem-sucedidas. Este tipo de memória é medido pela capacidade de recordar associações previamente criadas entre a informação que transmitimos (i.e., factos) e a pessoa com quem a partilhamos (i.e., destinatário). Para tornar o procedimento experimental de estudo da memória de destino o mais próximo possível das interações humanas, são utilizadas fotos de celebridades como destinatários, visto que frequentemente transmitimos informação a pessoas que nos são familiares. Estudos anteriores mostraram que recordar a quem transmitimos informação é mais difícil do que recordarmos a pessoa que a transmitiu (i.e., memória de fonte – a capacidade de recordar o transmissor de uma informação). Uma explicação proeminente para as dificuldades vinculadas à memória de destino é que são necessários recursos atencionais adicionais para transmitir informação, dificultando assim a recordação da associação entre a informação e o destinatário. No entanto, há limitações associadas ao procedimento da memória de destino que podem estar ligadas a essas dificuldades. Alguns estudos sugeriram que escolher o quê e a quem transmitimos informação pode ser uma variável importante, pois, no dia-a-dia, realizamos escolhas tanto sobre o que transmitimos como a quem queremos transmitir a informação. Na presente tese, procurámos compreender como a escolha influencia a memória de destino através de quatro experiências inter-participantes em que a aplicação da escolha foi aplicada tanto ao conteúdo a transmitir, como ao destinatário dessas informações. No Estudo 1, em duas experiências, um componente de escolha foi aplicado ao destinatário da informação (i.e., faces), enquanto no Estudo 2 foi aplicado à informação transmitida (i.e., factos). No Estudo 3, foram apresentadas duas escolhas em ambos os tipos de estímulos (i.e., factos e faces), permitindo-nos assim compreender mais aprofundadamente os efeitos da escolha na memória do destino e apoiar as conclusões obtidas nos dois primeiros estudos. Os resultados desta tese sugerem que o foco dos recursos atencionais ao codificar as associações é uma variável importante para a compreensão do desempenho da memória de destino.

Palavras-chave: escolhas na codificação, foco atencional, memória , memória de destino.

How Choice can Affect our Social Interactions: The Impact of a Choice Component on Destination Memory

ABSTRACT

Destination memory is the ability to remember to whom we transmit a piece of certain information, and, as such, it is intimately linked with successful interpersonal interactions. This type of memory is measured by the capacity to retrieve previously created associations between the information we transmit (i.e., facts) and the person we share (i.e., recipient). To make this experimental procedure as close as possible to human interactions, this type of procedure uses celebrity pictures as recipients of the information since we often transmit information to familiar persons. Previous research has shown that remembering to whom we transmit information is more challenging than remembering who told a certain piece of information to us (i.e., source memory – the ability to remember which person shared information with us). A prominent explanation for the difficulties tied with destination memory is that additional attentional resources are required to transmit information, ultimately hindering remembering the association created between the information and the recipient. Nevertheless, other studies hinted that the limitations of the destination memory procedure might be linked to these difficulties. Furthermore, they also hinted that choosing what we transmit and the person to whom we transmit it may be an important variable since, in daily interactions, we often make choices about both what we share and the person to whom we want to share. In the present thesis, we aimed to understand how choice influences destination memory through a total of four between-subjects experiments in which the application of choice was manipulated across the types of stimuli available at encoding. In Study 1, across two different experiments, a choice component was applied to the recipient of the information (i.e., faces), while in Study 2, it was applied to the information itself (i.e., facts). In Study 3, two choices regarding both types of stimuli (i.e., facts and faces) were presented, allowing us to ultimately understand the effects of choice on destination memory and support the conclusions obtained in the first two studies. The results from this thesis suggest that the focus of the attentional resources when encoding the associations is an important variable in understanding destination memory performance.

Keywords: attentional focus, choices while encoding, destination memory, memory.

TABLE OF CONTENTS

ABBREVIATIONS, ACRONYMS, AND SYMBOLS

ANCOVA – Analysis of Covariance

ANOVA – Analysis of Variance

AoA – Age of Acquisition

APA – American Psychological Association

d' – D-prime

DMF – Destination Memory Framework

JCR – Journal Citation Reports

M – Mean

SD – Standard Deviation

SJR – Scimago Journal & Country Rank

SNIP – Source Normalized Impact per Paper

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THESIS OVERVIEW

Destination memory can be defined as the ability to remember to whom we transmit a certain piece of information (Gopie & MacLeod, 2009). This type of memory has important social implications since human beings constantly share information with their social circle and, more broadly, even with strangers throughout their daily lives. The present work is focused on understanding how having a choice regarding what we share and on the person with whom we wish to share the information can affect destination memory. Choice is an important variable to explore since daily interactions are not static or pre-determined. We often have several options regarding what we say and choose our information depending on the person we are speaking with at a given moment.

This thesis is organised into three parts: an introductory theoretical part; a second part presenting the empirical studies carried out throughout this doctoral program; and a final part highlighting the contribution of the present work to the field of research and comprising the main conclusions on the effect of choice on destination memory.

The introductory part (i.e., PART I) describes the relevance of the experimental study of destination memory and, more specifically, how choice can affect this type of memory. In chapter 1, we explore how this type of memory is assessed, and we highlight a central variable of this research project – the focus of the attentional resources during the encoding of our social interactions. In chapter 2, we explain the variables that are important for understanding destination memory performance, dividing the chapter into the cognitive and social variables that are already proven to influence this type of memory. Chapter 3 is dedicated to exploring the possible limitations that the typical assessment of destination memory could present. Additionally, we propose a possible solution to address these limitations: adding a choice component to a destination memory procedure. That should make the assessment of destination memory closer to a real-life social interaction and enhance our comprehension of this type of memory and how it operates when we have choices regarding what we transmit and the person to whom we wish to say a piece of information. Finally, the motivation for the present work, as well as a summary of the research presented in the empirical section, is described in chapter 4.

The second part of this thesis (PART II) contains the four empirical experiments conducted. First, two submitted studies, the first of which comprises two experiments (i.e., Study 1), are presented in chapters 6 and 7, followed by a manuscript in-preparation (chapter 8).

The final part (PART III) consists of a general discussion integrating results from all studies and the contribution of this thesis for the destination memory area of research (chapter 9), as well as limitations and suggestions for future research (chapter 10).

PART I

INTRODUCTION

1. Destination Memory

A human being has approximately 12 social interactions per day (Zhaoyang et al., 2018). As such, keeping track of what we said and to whom we told it could be quite difficult. That is why most of us have faced the embarrassing moment of recounting a story, just to be interrupted halfway by the recipient of our information (i.e., the person who receives it) to inform us that we already told it before. The capacity to recall to whom a piece of information was previously shared, or in other words, the association of an information with a recipient, was coined as destination memory (Gopie & MacLeod, 2009).

When destination memory is effective, it improves communicative efficacy (El Haj et al., 2017), allowing more fluid communication whenever we interact with another person. The consequence of a faulty destination memory is redundancy – repeating the same story several times to the same recipient (Kausler & Hakami, 1983). However, redundancy is not the only social compromise related to destination memory. Withdrawing important information is another disruption in destination memory that may be critical in some circumstances. For example, it can have a negative impact both in our relationships (one person does not share a certain information and later blames the other for not listening) and in our professional life (a supervisor expecting a particular task to be performed by an employee that they did not delegate before). More importantly, withdrawing important information can cause compromises in our health by, for example, inadvertently concealing critical medical information from a doctor, especially in older adults, where these types of monitoring flaws are more frequent (Gopie et al., 2010). These examples help clarify the impact of destination memory on daily communication and how it operates.

In the following sections, we will summarise the methodology used to assess destination memory, a type of memory first presented by Gopie and MacLeod (2009). Furthermore, and since most destination memory studies carried out since then used a similar methodology to the one proposed by these authors, we will then focus on understanding the variables that can improve or hamper this type of memory to prevent monitoring flaws and ultimately allow us to attribute a piece of information to its appropriate recipient.

1.1. Research Procedure

Destination memory is measured by the retrieval of the association between the information we transmit and the recipient. Specifically, Gopie and MacLeod (2009) compared destination memory and source memory, the capacity to remember which person shared an information with us (Johnson et al., 1993), to understand if the processing of outgoing (i.e., destination memory) and incoming information (i.e., source memory) differed. To do so, participants in both conditions (i.e., destination and source condition) would establish 50 fact-face pairs associations during the encoding phase. In the destination memory condition, a fact was first presented to the participants, who shared it aloud with a celebrity face afterwards. In the source memory condition, the order of the stimuli was reversed, with the presentation of the face occurring first. Then, when the fact was shown, participants were instructed to say it aloud as if the celebrity's face was telling it to them. After the encoding phase, an associative memory test was applied, which measured the memory for 40 of the fact-face pairs established before during the encoding phase.

Interestingly, the results attained in the associative memory test highlighted the difficulties (i.e., lower accuracy) in destination memory compared to source memory. Gopie and MacLeod (2009) suggested that this may be due to the higher self-focus needed to generate information on the destination memory condition. In other words, more attentional resources are focused on the processes required to transmit information since generating information leaves fewer attentional resources available to encode the association. In addition to the associative memory test, Gopie and MacLeod (2009) also applied an item memory test to the individual units of the associations created during the encoding phase. In this test, participants were presented with either a fact or a face and had to answer if the stimuli were previously presented during the encoding phase. Half of the stimuli presented were targets, while the other half were fillers. In the item memory test, the results seemed to back up the authors' conclusion since the memory for faces in the source memory condition was significantly higher than in the destination memory condition, supporting a higher focus of the attentional resources on the generation of information when transmitting and consequently hampering the remembering of faces previously encoded.

1.2. Importance of the Attentional Resources

After clarifying the processing differences between incoming and outgoing information and suggesting the focus of the attentional resources as a possible explanation for the differences observed, Gopie and MacLeod (2009) implemented two additional experiments to manipulate the focus of the participants' attentional resources. Specifically, in the encoding phase of Experiment 2, the attentional resources were directed to the information recurring to personal facts (e.g., "My favourite pet animal is ..."). In contrast, in the encoding phase of Experiment 3, the attentional resources were directed to the recipient by adding the name of the celebrity face in each trial before sharing the fact (e.g., "Bill Gates, the snickers chocolate bar was invented in 1930").

The results of these two experiments strengthened the authors' suggestion that the focus of attentional resources on a destination memory test is a variable that impacts its performance. More specifically, a decrease in destination memory accuracy was observed when the attentional resources were directed to the information. When the attentional resources were focused on the recipient, an increase in destination memory was observed. These conclusions were also akin to previous memory literature that demonstrated that associative memory is adversely affected when actions were self-performed rather than performed by others (i.e., monitoring inputs; Engelkamp et al., 1989; Koriat et al., 1991), as well as studies that demonstrated that shifting attention away from oneself improves associative memory (Zimmer & Engelkamp, 1989).

More recently, the conclusions of Gopie and MacLeod (2009) regarding the attentional focus were explored by Johnson and Jefferson (2018) in a study where the main aim was to determine if mental imagery, a memory strategy that leads to memory improvements in other types of memory (Dirkx & Craik, 1992) could improve destination memory. In this study (Johnson & Jefferson, 2018), two different age groups (i.e., younger and older adults) were divided into four conditions: control; self-focus (the attentional resources were directed to the information); refocus (the attentional resources were directed to the recipient); and imagery (i.e., imagining the social interaction while sharing the fact with the face). In the control condition, a destination memory task was applied to assert the differences in associative memory accuracy in the age groups, younger and older adults, with the aim of understanding if the greater difficulty in remembering past social interactions in older adults observed in previous destination memory studies would occur (for a previous study comparing young and older adults, see Gopie et al., 2010). Indeed, older adults revealed a lower remembering of previously established fact-face pairs associations.

After understanding the differences in destination memory between the two age groups in the control condition, in the self-focus and refocus conditions Jonhson and Jefferson (2018) manipulated the focus of the attentional resources by directing the attentional resources to the information in the self-focus condition and directing the attentional resources to the recipient in the refocus condition. Following the manipulation of the attentional resources done previously by Gopie and MacLeod (2009), the authors hypothesised that directing the attentional resources to the information would lead to a decrease in destination memory performance while focusing the attention on the recipient should lead to an increase on this memory. Understanding the directing of attentional resources was particularly relevant in older adults since no previous data regarding this variable was available for this age group. As expected, the results revealed a lower destination memory accuracy in the self-focus condition compared to the control group. Additionally, these results occurred despite the participant's age, further validating that the focus of attentional resources while encoding was an important variable that should be considered to analyse destination memory.

However, no differences were found between refocus and control conditions (Johnson & Jefferson, 2018). The authors explained this result by the differences between their procedure and the Gopie and MacLeod (2009) one. Instead of applying a familiarisation phase to ensure the participants knew the name of the celebrity face before the destination memory task, Johnson and Jefferson (2018) presented the name in each trial under the face. This change in the encoding phase left the participants with more information to encode in each trial (i.e., the participants encoded the fact as well as the name of the celebrity). This could mean that the attentional resources could have been unwittingly directed to the information leaving less attentional resources for the fact-face pair association.

Lastly, Johnson and Jefferson (2018) tested if mental imagery, a memory strategy known to improve memory (Dirkx & Craik, 1992), could enhance destination memory. In the imagery condition, participants were instructed to imagine being face-to-face with a celebrity and telling them the fact. This type of strategy led to an improvement in destination memory in both younger and older adults. This is an important finding, especially in the older adult population, since using this strategy when transmitting information can mitigate the difficulty of appropriately remembering past social interactions exhibited by this age group (Gopie et al., 2010).

2. Destination Memory Framework (DMF)

After creating the destination memory procedure and establishing the focus of attention as an important variable (Gopie & MacLeod, 2009) for its understanding, posterior studies focused on learning which underlying mechanisms influenced destination memory. In a systematic review, El Haj and Miller (2018) analysed all known variables influencing destination memory accuracy and proposed a destination memory framework (DMF). Furthermore, the authors divided the underpinnings that affect destination memory into cognitive and social mechanisms.

2.1. Cognitive Mechanisms

To explain the cognitive mechanisms of destination memory, it is important to note that this memory seems to be a part of the episodic memory system (El Haj & Miller, 2018). It is plausible that cognitive mechanisms that affect episodic memory may be relevant for understanding destination memory. Executive function has previously been implicated in episodic memory (Schacter et al., 1984) as well as source memory (Glisky & Kong, 2008; Siedlecki et al., 2005), and it can be defined as the high-order control processes involved in the regulation of action and thought (Friedman et al., 2006; Miyake et al., 2000).

In the destination memory literature, the cognitive mechanisms involved were evaluated primarily in studies that used clinical populations (e.g., alzheimer's disease – El Haj et al., 2013; korsakoff's syndrome – El Haj et al., 2016). Nevertheless, these studies offer an important insight into the underlying cognitive mechanisms that explain the higher difficulty of older adults in remembering past interactions. Similar to the episodic and source memory results, a relationship between the executive function and destination memory was verified. Two executive processes emerged to explain the decline observed in older adults: inhibition and binding. Inhibition can be defined as the capacity to discard an inappropriate memory that could disrupt a suitable alternative. The greater difficulty of older adults in suppressing inappropriate information (e.g., Hasher et al., 2007) was correlated to the problems demonstrated in this age group on destination memory (El Haj et al., 2013).

Moreover, to further understand the involvement of executive function on destination memory, we need to consider another executive process: binding. This is an associative process, namely the ability to associate an event with its context of encoding, and in normal ageing, deficits in this type of process have been linked to the compromise of episodic memory (e.g., Mitchell et al., 2000; see

Naveh-Benjamin, 2000 for an insight on the associative deficit hypothesis). These deficits were later evaluated in destination memory. The importance of binding on destination memory was demonstrated in patients with korsakoff's syndrome (El Haj et al., 2016), and their destination memory performance was correlated and predicted by their binding capacity. Although the relationship between binding and destination memory is not particularly clear in normative population, the importance of this executive process was suggested in a destination memory study that evaluated episodic recall (El Haj & Allain, 2014). In this study, performance on a task that measured context recall predicted the older adults' destination memory compromise. These results regarding context recall suggested that the difficulties in remembering the associations created between the information and its context (i.e., their binding capacity) could be one of the causes contributing to the destination memory difficulties observed in this population.

2.2. Social Mechanisms

Even though destination memory is intimately linked with the episodic system, differently from other components, this type of memory has a clear social component. As social beings, humans constantly share information with their social circle and even strangers. Besides our own cognitive and social characteristics, it is also important to consider our recipients and how we perceive them when sharing information. Considering that most of the destination memory literature focused on understanding the social mechanisms that influenced destination memory, we opted to divide social mechanisms into two different subsections to allow a clearer insight into these mechanisms– the social processing of our recipients and personal social characteristics.

2.2.1. Social processing of our Recipients

At the time of the development of the destination memory framework (El Haj & Miller, 2018), most of the destination memory studies that involved social components focused on the social characteristics of the recipients and how those characteristics could affect destination memory. Namely, the authors pinpointed three social elements linked to the recipients that affect destination memory performance: familiarity, emotion, and stereotypes (El Haj & Miller, 2018).

Based on the positive effects reported for familiarity in memory, specifically the significant improvement of the encoding strength (Greene, 2008) and the facilitation of the subsequent processing of a previously known stimulus (Poppenk & Norman, 2012), El Haj et al. (2015) investigated if these benefits also occurred on destination memory. To do so, for both types of stimuli presented at the encoding phase of the destination memory procedure, familiar and unfamiliar information and recipients were used and compared in two age groups – younger and older adults. Regarding the familiarity of information, a significant difference between familiar and unfamiliar information was only found in the older adults' age group, where a higher destination memory accuracy was observed when transmitting familiar information. More interestingly, the familiarity of the recipient of our information seems particularly important when remembering our past social interactions since destination memory was higher for familiar faces in both younger and older adults (El Haj et al., 2015).

Another social mechanism related to the social processing of the recipients of our information proven to affect destination memory is emotion. To assess how the perceived emotion of a recipient can influence destination memory, younger and older adults were required to share neutral facts with three types of unfamiliar faces: faces displaying positive, negative, and neutral emotionality. Results showed that, although young adults' destination memory for emotional and neutral recipients did not differ when sharing information, older adults displayed a better destination memory for emotional faces when compared to neutral ones (El Haj, Fasotti & Allain, 2015), suggesting that as a person progressively ages, its emphasis on the recipient's emotion increases.

The implications of social processing of our recipients for destination memory can be extended to the effects of stereotypes. For example, in a source memory study in which plausible headlines were provided to the participants, a better memory was observed when a trustworthy reporter delivered the headlines than when they were given by an untrustworthy one (Nash et al., 2010). Furthermore, the effect of stereotypes on source memory was proven to vary with age, with older adults relying more on stereotypes than younger adults (Mather et al., 1999; Mather & Johnson, 2003). With these results in mind, El Haj (2017) investigated whether stereotypes influenced destination memory by making participants share facts related to medicine and mechanics with two different recipients: a physician and a mechanic. Destination memory was better when the modality of the fact was consistent with the recipient than when the fact and recipient were inconsistent (El Haj, 2017). Also, similarly to the results observed for source memory, older adults relied more on stereotypes than younger adults, indicating that older adults may compensate for their destination memory difficulties by depending on the stereotypical characteristics available when sharing the information.

More recently, another aspect of the social processing of the recipients was highlighted: the distinctiveness of the recipient. The distinctiveness was evaluated in a study in which faces with a distinctive feature (e.g., tattoo) were compared with faces without distinctive features (Barros et al., 2021). Destination memory improved when participants shared information with faces with a distinctive feature; however, only when the design was within-participant, and more than one distinctive feature was available for encoding, congruent with previous research that studied the distinctiveness effect (Hunt, 2006). To explain the relationship between memory and distinctiveness, Hunt (2006) stated that differences between the items are required since distinctiveness is relative. In other words, if all of the faces had the same distinctive feature, then none of them would be perceived as distinctive by the participants (Barros et al., 2021; Hunt, 2006). Another hint about the importance of the distinctiveness of our recipients was also obtained in a study in which destination memory for attractive, unattractive, and neutral faces was compared (El Haj & Ndobo, 2021). The results revealed that destination memory for attractive and unattractive faces did not differ significantly. Even so, when comparing both types of stimuli to neutral faces, a better destination memory was observed for attractive and unattractive faces. When interpreting their results, the authors attributed their results to the distinctiveness caused by the attractiveness of the recipient, suggesting that more attentional resources may be devoted to attractive or unattractive recipients than to neutrally attractive ones (El Haj & Ndobo, 2021).

2.2.2. Personal Social Characteristics

After understanding how our recipients' social characteristics can affect destination memory, it is also important to note that personal social attributes can affect destination memory. In the destination memory framework, there are two processes related to the individual characteristics that have been proven to affect destination memory: the theory of mind and deception.

Focusing firstly on the theory of mind, the ability to process emotional and cognitive states of the recipients of the information (Shamay-Tsoory & Aharon-Peretz, 2007), the association between destination memory and theory of mind was assessed by El Haj, Raffard, and Gély-Nargeot (2016). In their study, besides a typical assessment of destination memory, the authors also assessed the cognitive theory of mind and the affective theory of mind in two age groups: younger and older adults. In the cognitive theory of mind assessment, participants had to infer characters' beliefs represented in short comic strips with a short-written description indicative of everyday life scenarios (e.g., "X thinks that ...") and to assess the affective theory of mind, participants performed the *Reading the mind in the eyes* task (Prevost et al., 2014), Since a large body of literature on the theory of mind revealed a robust decline of this capacity in older adults in both of these domains (see Henry et al., 2013 for a meta-analysis on the topic), El Haj, Raffard, and Gély-Nargeot (2016) expected that the theory of mind would be worse in older adults when compared to younger adults. Furthermore, the authors expected that the decline observed in the theory of mind could predict destination memory performance. Results showed that older adults had a lower accuracy on the destination memory task and in both assessments of the theory of mind compared to young adults (El Haj, Raffard, & Gély-Nargeot, 2016). Furthermore, destination memory was significantly positively correlated and predicted by the theory of mind assessment. Overall, these results suggest that the mechanisms associated with the theory of mind could be involved in the successful remembering of our past interactions (i.e., destination memory) since it allows deeper processing of our recipients and, consequently, a better recall of those interactions.

However, the theory of mind does not only influence destination memory; it is also critical for deception. To explore this issue, El Haj et al. (2017) applied the Paulhus Deception Scale (Paulhus, 1998), as well as a destination memory and a cognitive theory of mind assessment (same as mentioned in El Haj, Raffard, & Gély-Nargeot, 2016). Interestingly, a significant positive correlation was found between deception and destination memory. El Haj et al. (2017) attributed this result to the need to remember to whom we told a falsified story; otherwise, the lie can easily be uncovered. Furthermore, the relation between destination memory and deception was mediated by the cognitive theory of mind (El Haj et al., 2017), suggesting that when a person is deceiving, the ability to monitor the mental state and how the other person processes the information we are transmitting is important to keep track of the falsified story and avoid inconsistencies that could expose our deception.

After understanding that a person's ability to deceit affects destination memory, a question was left unanswered: do individuals with different impulses to lie process their past interactions differently? To answer this question, El Haj et al. (2018) designed a destination memory study where truthful and deceiving information was shared with recipients. Additionally, the participants were divided, based on their results on the Paulhus Deception Scale (Paulhus, 1998), into two groups: participants with a high tendency to lie (i.e., high deception scores) and participants with a low tendency to deceive (i.e., low deception scores). The results highlighted the different effects on destination memory related to the individual tendency to lie. Namely, participants with a high tendency to lie had similar destination memory for both deceitful and truthful information. In contrast, participants with a low tendency to lie had better destination memory for deceitful relative to truthful information. In other words, individuals with a high tendency to deceive have to keep track of true and false information to avoid exposing their lies (El Haj et al., 2018).

Recently, other personal social characteristics were proven to influence destination memory: gender and personality. The differences between males' and females' memory processing have been extensively studied, with males performing better visuospatial working memory tasks (Cornoldi & Vecchi, 2004) while females outperformed males regarding verbal memory (Ullman et al., 2008). Furthermore, studies that aimed to understand why the advantages of verbal memory on females occurred demonstrated that females express more affection, connection, and factual elaboration than males (Fivush et al., 2011; Grysman et al., 2016) and ultimately retrieve more elaborated and emotionally tainted memories (Grysman, 2017).

Based on the previous research, El Haj et al. (2020) designed a study to understand if gender differences verified in other types of memory could also apply to destination memory, expecting that the advantage observed in females regarding verbal memory (Ullman et al., 2008) would extend to destination memory since this type of memory involves transmitting verbal information. Their hypothesis was confirmed given that females had a better destination memory than males; however, it is essential to note that an own-gender bias did not occur since differences dependent on the recipient were not observed. In sum, females seem to have a better destination memory than males, regardless of the person they share the information with (El Haj et al., 2020).

Lastly, the relationship between personality and destination memory has also been explored. More specifically, a study assessed if degrees of extraversion can explain different destination memory results (El Haj et al., 2021). To determine the level of extraversion, each participant rated themselves through the extraversion subscale of the *Big Five Inventory* (John et al., 1991). Since extroverts are quicker in comparing the contents of working memory to an external target (Lieberman, 2000) and reported significantly fewer errors in short and long-term prospective memory than introverts (Heffernan & Ling, 2001), El Haj et al. (2021) expected that a higher score on the extraversion subscale (John et al., 1991) would be linked to a better destination memory. Results showed a significant positive correlation between extraversion and destination memory, meaning that as the individual perception of extraversion increases, so does their memory for previous social interaction (i.e., destination memory). In other words, the more participants perceive themselves as extroverts, the higher their destination memory (El Haj et al., 2021).

3. Importance of Choice in Social Interactions

Destination memory and the variables influencing its performance have been widely studied over the last decade. However, in studies that evaluated destination memory by sharing information face-to-face with a person present in the same room (as opposed to sharing information with a screen in a typical destination memory procedure), a potential limitation was suggested (Fischer et al., 2015; Lindner et al., 2015). Based on their results, Fischer et al. (2015) and Lindner et al. (2015) proposed that the typical destination memory assessment applied in most of this type of memory literature (e.g., El Haj et al., 2013; Johnson & Jefferson, 2018) could be vastly different from a real conversation.

Firstly, the robust effect of ageing, lower destination memory in older adults than young adults did not occur (Lindner et al., 2015). Additionally, no differences were reported between destination memory and source memory in both age groups (Fischer et al., 2015; Lindner et al., 2015), a contrasting result to studies that apply a typical destination memory assessment (e.g., Gopie & MacLeod, 2009), in which destination memory accuracy is lower than source memory. More specifically, destination memory only had poorer performance than source memory when the cognitive demands of the destination memory were increased by making the participants recite each sentence from memory (i.e., read the sentence and hold it in mind before sharing it), akin to the Gopie and MacLeod (2009) method. These results suggest that destination memory in real-life interactions seems to function differently from the results attained on destination memory assessments whose procedure is run in a computer and that different variables can contribute to differences in destination memory which are not accounted for in a typical destination memory assessment.

Other destination memory studies using self-generated actions (El Haj, 2016; El Haj, Caillaud, et al., 2016) further support that a real-life social interaction could function differently. In these studies, the authors noted that the participants' passivity while encoding the information could also cause the lower accuracy associated with destination memory. In other words, merely saying a fact to a recipient without performing any additional action, such as choosing the information we transmit or choosing the person with whom we intend to share, is not an accurate simulation of what happens in daily interactions[1]. As mentioned before, and with this idea in mind, this thesis focused on understanding how presenting a choice (referred to as the *choice component* hereafter) during the encoding phase of a destination memory procedure could affect destination memory. Regularly in our social interactions,

[1] A more in-depth explanation of the participants' passivity will be included in section 3.2.

we have several options of the information to share and the recipients with whom to share it. It is important to clarify if the processing prompted by choice could affect destination memory and, more importantly, if having choices in information or recipient, or even a choice in both types of stimuli, could influence destination memory performance differently.

3.1. Benefits of Choice on Different Types of Memory

The benefits of having a choice while encoding information have been widely documented in memory literature throughout the years (e.g., Izuma & Murayama, 2013; Murty et al., 2015, 2019). An example of these benefits is the *self-choice effect*, which refers to the memory advantage for self-chosen items compared to experimenter-assigned items (Takahashi,1991). In a typical study, several response candidates are presented to the participants (e.g., wool, cotton, and silk), and they are instructed to choose one to remember posteriorly. In the force condition, one of the possibilities of response is circled as a target to remember. In the choice condition, participants could freely choose one of the response candidates to remember. Retrieving the target items was significantly better when participants selected the items than when the targets were circled beforehand (Takahashi, 1991; for further evidence on the efficacy of the self-chosen effect, see Watanabe & Soraci, 2004).

Declarative memory was also proven to be improved by the simple act of choosing (Murty et al., 2015, 2019). In their studies, Murty et al. (2015, 2019) presented two occluder images (i.e., images that concealed the stimuli to be encoded, in this case hiragana characters such as み) in each trial, one on the left and one on the right. Participants were divided into two conditions to understand the effects of choice: choice and fixed condition. The main difference between the groups was that participants in the choice condition could choose one of the occluder images. In contrast, one of the buttons appeared in red in the fixed condition, and participants were instructed to choose the occluder image corresponding to that button. When selecting one of the occluder screens, the hiragana character would disappear and reveal an object. In sum, all the participants in both conditions saw the same objects, with the only difference being the choice or not of which occluder screen to remove. Therefore, the stimuli to remember and the recognition test were the same for both conditions. Results revealed that the opportunity to choose resulted in a robust enhancement of declarative memory compared to having previously selected options even after a 24-hour delay, suggesting that individuals who have perceived control over their learning seem to demonstrate better declarative memory, as well as a better consolidation of the information (Murty et al., 2015, 2019).

Lastly, Coverdale and Nairne (2019) found that the mnemonic benefits of choice did not depend on the level of congruity between the word chosen and the encoding context. In their experiments, participants were given pairs of words and were instructed to select one based on its relevance to survival (Experiment 1) or its match to an objective category (e.g., a sport; Experiment 2). For half of the words, participants had to choose the word that better fit the encoding context, while the other half had to select the word that was less representative of the encoding context. By doing so, the choice was dissociated from congruity with the encoding context since half of the choices were the ones that were the better match, and the rest of the choices reflected the words that were less related to the category. Using a free recall test, Coverdale and Nairne (2019) found that participants recalled more chosen words than unchosen words for both types of choice available (i.e., words that fitted the encoding context and words that did not). Furthermore, choice did not interact with congruity, meaning that the act of choosing led to a better memory regardless of the match between the word and its encoding context (Coverdale & Nairne, 2019).

3.2. Benefits of Choice Hinted for Destination Memory

Even though the benefits of choice in other types of memory seem straightforward, further clarification is needed regarding how this variable could influence interpersonal interactions and, more specifically, the influence that choice exerts on destination memory. Several studies (El Haj, 2016; El Haj, Caillaud, et al., 2016) analysed the effects of choice on the association between an information and a recipient. However, instead of mimicking social interactions, as in most destination memory studies, these studies used objects as information and boxes as recipients. Based on the conclusion of Marsh and Hicks (2002) that having an active choice of an object led to higher memory for the association between the information and the recipient, two destination memory studies (El Haj, 2016; El Haj, Caillaud, et al., 2016) were proposed to understand if these benefits of having an active choice could extend to destination memory.

While both studies used a similar procedure, different populations were evaluated in each of them. In one of them, healthy adults were compared with adults clinically diagnosed with huntington's disease (El Haj, Caillaud, et al., 2016). The other study compared healthy younger and older adults (El Haj, 2016). In these studies, participants performed the same two assessments: the destination and the source assessment (El Haj, 2016; El Haj, Caillaud, et al., 2016). In the destination assessment, participants introduced 12 everyday objects (e.g., glasses) into two boxes[2]. In the source assessment, 12 objects were evenly distributed between the two boxes, and participants had to extract, name, and put aside each of the objects, one at a time. After performing both assessments, the participants' memory for the previously created associations was evaluated using a recognition test. When analysing their results, the authors observed an improvement in the destination memory prompted by having an available choice as well as an active engagement in the destination memory task (see El Haj et al., 2013; Gopie et al., 2010; Gopie & MacLeod, 2009 for a comparison between incoming and outgoing information). Consequently, El Haj (2016) proposed that the participants' passivity could cause the lower destination memory accuracy observed on typical destination memory assessments (El Haj, 2016; El Haj, Caillaud, et al., 2016).

All in all, the possibility of choice has a robust effect on memory. Even though destination memory studies that used objects hinted that these benefits could extend to social interactions, further evidence is needed to understand the impact of a choice component when transmitting the information.

[2] The two boxes were a squared white box and a circular black box.

4. The Present Work

Destination memory is crucial for our communication since remembering the information we shared in previous interactions and whom we shared it with improves communicative efficacy (El Haj et al., 2017). Even though a wide variety of variables have been proven to influence destination memory, it is still important to understand how this type of memory operates in realistic interactions since having an effective destination memory helps prevent monitoring flaws and improve the quality of our social interactions. Thus, it is important to take into account the limitations of a typical destination memory assessment (i.e., Gopie & MacLeod, 2009) that suggest that this method may not be an accurate representation of a real-life conversation since destination memory processing occurs differently when communicating with a person that is present in the room (Fischer et al., 2015; Lindner et al., 2015). Additionally, the participants' passivity while performing a destination memory procedure was also unrealistic since social interactions rarely consist of having a unique piece of information to share with a person without any possibility of choice (El Haj, 2016; El Haj, Caillaud, et al., 2016).

In daily interactions, we often have choices regarding the information we intend to share and the person we share it with. This thesis aimed to understand how having a choice regarding the information we shared and/or the person with whom we shared can impact destination memory. More specifically, this research project focused on understanding the effects that a choice component (i.e., having the possibility of choice between two different options) can exert in the remembering of our previous social interactions, taking into account the two main theoretical rationales that could explain its influence: the mnemonic benefits for our memory that choice has (Coverdale & Nairne, 2019) and the focus of attentional resources during the encoding of information (Gopie & MacLeod, 2009; Johnson & Jefferson, 2018). To that end, a total of four experiments were conducted and organised into three different studies: two submitted studies comprising two (Study 1) and one experiments (Study 2), and a yet-to-be-submitted study (Study 3) containing the final experiment performed. These three studies are summarised below. Please see the relevant study for specific objectives, hypotheses, methodology, and results (Chapters 6 to 8). All of the experimental work of this thesis received the ethical approval of the Ethics Committee for Human and Social Sciences of the University of Minho (see Appendix E).

Study 1 aimed to understand how applying a choice component on the recipient of the information can affect destination memory. More specifically, participants were divided into two conditions, one in which a choice between two faces would be available in each trial of the encoding phase (i.e., choice condition) and another in which participants completed a typical destination memory assessment (i.e., no-choice condition, akin to Gopie & MacLeod, 2009). Since adding a choice should inadvertently direct the participants' attentional resources to where the choice was presented, we expected participants in the choice condition to have a better destination memory than participants in the no-choice condition. In Experiment 1, the participants firstly shared facts with faces during the encoding phase, after which their memory for the associations created was tested using two memory tests: an item memory test for the individual units of the association and a destination memory test which measured the participants' memory for the fact-face pairs associations created during the encoding phase. In Experiment 2, the procedure was equal to Experiment 1; however, only a destination memory test was applied afterwards. Experiment 1 results revealed that adding a choice component did not affect destination memory performance since destination memory performance in the choice conditions did not differ significantly from the no-choice condition. However, the number of trials included in our destination memory task was half the number of trials applied to the destination memory assessment by Gopie and MacLeod (2009). As such, the task's difficulty level could have been too low to be sensitive to the effect of the inclusion of a choice component. Thus, in Experimental 2, we increased the cognitive task demands by including a number of stimuli proportional to the Gopie and MacLeod procedure (2009). Since the item memory test would be equal to the one applied in Experiment 1 and the focus of Experiment 2 was to understand if a choice component could indeed affect destination memory performance with a higher number of stimuli, we decided not to include the item memory test, as in recent destination memory studies (e.g., El Haj, Raffard, et al., 2016; El Haj et al., 2018). The results of Experiment 2 showed an effect of applying a choice component on the recipients, with destination memory being significantly higher in the choice component when compared to the no-choice component, suggesting that having choices regarding the recipient with whom we share information leads to a better remembering of our previous social interactions.

Study 2 aimed to explore the effect of a choice component as well. However, this time applied to the information the participants transmitted instead of the recipient. Once again, participants were divided into the same two conditions (i.e., choice condition and no-choice condition), with the only difference occurring in the choice condition, in which participants would have a choice between two facts in each trial of the encoding phase. The participants' memory was tested using two memory tests: an item memory test and a destination memory test. This study was particularly interesting since two different outcomes could occur based on previous literature regarding the effects of a choice component on a destination memory procedure. On the one hand, the simple act of choosing information, and in that way, increasing the perceived control over our learning (Murty et al., 2015, 2019), has been linked to improvements in memory (Izuma & Murayama, 2013; Takahashi, 1991), as well as improvements in the remembering of fact-face pairs associations (El Haj, 2016; El Haj, Caillaud, et al., 2016; Marsh & Hicks, 2002). Considering the benefits of choice, a destination memory improvement could occur when applying a choice component on the information. On the other hand, using a choice component on the information should direct the participants' attentional resources to the information, and focusing on the information while encoding the fact-face pairs has been linked to a destination memory decrease in destination memory literature (Gopie & MacLeod, 2009; Johnson & Jefferson, 2018). In sum, by applying a choice component on the information, Study 2 helped clarify which mechanism could be more prominent in explaining destination memory performance variance. Results showed a decrease in destination memory on the choice condition compared to the no-choice condition. This finding suggests that the focus of attentional resources during the encoding phase of a destination memory procedure is an important variable to account for when analysing destination memory and that its influence is prevalent even when applying a variable (i.e., choice) that is linked to robust benefits of memory.

Finally, after asserting the effect that a choice component has individually when applied on the information or the recipient of information, in Study 3, we applied a choice in both the information and the recipient in each trial of the encoding phase. This allowed us to understand if adding a choice for both types of stimuli available in the encoding phase of a destination memory procedure (i.e., facts and faces) could influence destination memory. More specifically, participants were divided into two conditions. Half performed the choice condition, in which two choices were available in each trial of the encoding phase: one between two facts, in which the participant chose which one he wished to share, and one between two faces, in which the participant chose one face to tell the fact to. The other half performed the no-choice conditions, in which they performed a destination memory procedure akin to the one applied by Gopie and MacLeod (2009). Based on the results of Study 1 and Study 2, which suggest that the focus of attentional resources has a prominent effect on destination memory performance, we expected that destination memory would not significantly differ between the two conditions.

Moreover, Study 3 allowed us to ultimately understand the effects that choice could potentially have on destination memory since applying a choice on both types of stimuli should distribute the focus of attentional resources evenly on the encoding phase and, if a difference was observed, it could be attributed to presenting the two choices during the encoding phase. Results from Study 3 revealed no significant differences between the choice and the no-choice conditions. Overall, the results of our three studies provide important support for the importance of the attentional resources account previously proposed (Gopie & MacLeod, 2009; Johnson & Jefferson, 2018), as well as revealing important insights on how to prevent monitoring flaws, which can potentially be important for developing mechanisms to help older adults better remember previous social interactions, which is notably difficult for that age group (Gopie et al., 2010).

Following this brief description of all the studies conducted for this thesis, Part 2 will present each study individually. The submitted studies will be presented as originally submitted to the respective scientific journals. Furthermore, for each study, we provide details about the journals where the studies were submitted (i.e., JCR and Scopus impact factors and their quartile). In addition, we also indicate the communications in scientific meetings performed for each one of the studies. Finally, a global discussion on this research project's contribution to the destination memory field of study will be reported at the end of this thesis (i.e., PART III: GENERAL DISCUSSION).

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PART II

EMPIRICAL STUDIES

6. Study 1

"Choose it, and Remember it": The Impact of Choice on Destination Memory

This empirical work is currently being reviewed after being submitted to the Scandinavian Journal of Psychology. Note that the original submission did not include the presentation of Bayesian Analyses, which were included in the results sections of this chapter. The Scandinavian Journal of Psychology is an international publication by Wiley-Blackwell in association with the Nordic Psychological Associations. It publishes high-quality manuscripts covering most areas of psychology and the interface of psychology with other areas, such as behavioural sciences, with submissions covering experimental, applied, and clinical psychology with implications for psychological theory, research, and practice. In 2021, according to Scopus, it had a CiteScore of 3.5, a Scimago Journal & Country Rank (SJR) of 0.727, and a Source Normalized Impact per Paper (SNIP) of 1.118. Regarding quartiles, according to the SJR website, it was ranked in Q2 for the topic of Psychology (miscellaneous) and Q1 for Arts and Humanities (miscellaneous). According to Clarivate InCites Journal Citation Reports (JCR), in 2021, this journal was ranked in Q3 for Psychology, Multidisciplinary and its Impact Factor was 2.312.

Reference:

Lima, D., Albuquerque, P. B., & Beato, M. S. (2022). *"Choose it, and remember it": The impact of choice on destination memory*. [Manuscript submitted for publication]. School of Psychology, University of Minho.

In addition, results from this empirical work were partially or fully presented in a poster format at the following scientific events: at the 14th *Encontro Nacional da Associação Portuguesa de Psicologia Experimental* (Évora, Portugal) and at the 15th *Encontro Nacional da Associação Portuguesa de Psicologia Experimental* (Lisbon, Portugal). The results from both experiments of Study 1, in conjunction with the results from Study 2, were presented in an oral communication format at the International APPE SEPEX Meeting, held between the 5th and 7th of May of 2022 at the University of Algarve (Portugal). The instructions and materials used in this study, as well as its Supplemental Materials, can be found in Appendix B.

6.1. Abstract

Destination memory can be defined as the capacity to remember to whom we transmit information. It can be 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 aimed to investigate whether deciding with whom to share a piece of information benefits destination memory. We designed two experiments with different levels of cognitive load, increasing the difficulty 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 influence destination memory. Nonetheless, in Experiment 2, when the cognitive load was increased, an advantage in destination memory was obtained if participants selected the recipient of the information. 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 on recipient, attentional focus, memory

6.2. 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 he or she 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 an essential social skill, and its importance for social interactions cannot be overestimated. 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., not sharing information with a doctor due to a false remembering of a previous report). 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 hypothesised 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 memorise 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 in 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 of the 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.

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 analysed. 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 focused first on explaining how destination memory is part of the episodic memory and later identified the specific mechanisms that influence its performance and predict it. Specifically, the DMF emphasises 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).

Analysing 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 is vastly different 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 labelled 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[3] were presented to the participants, and the goal was to introduce everyday objects (e.g., a toothbrush) into one of them. When analysing 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 the object), participants displayed higher memory for the association between the receiver and the object.

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

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 a 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 generalise 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. 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 line, this work explored whether shifting the attention to the recipient in a different way, through a choice component, was able to 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, during daily communication, a person often can choose with whom they intend to share specific information. We designed Experiment 1 to understand the effects that a choice to whom share information has on destination memory. To determine the influence of a choice component on destination memory, we compared two experimental conditions. 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*).

6.3. 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 hypothesised 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.

6.3.1. Method

6.3.1.1. 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 Ethics Committee of the University of Minho approved the experiment.

6.3.1.2. Materials.

6.3.1.2.1. Facts. Forty Portuguese proverbs (e.g., "*A pressa é inimiga da perfeição*"[4]) 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 memorise 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 categorised 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).

6.3.1.2.2. 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.

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

6.3.1.3. 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.

6.3.1.4. Procedure. First, participants signed an informed consent form and answered a sociodemographic questionnaire. Afterwards, they were seated at a distance of 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).

6.3.1.4.1. 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. Afterwards, 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").

6.3.1.4.2. 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.

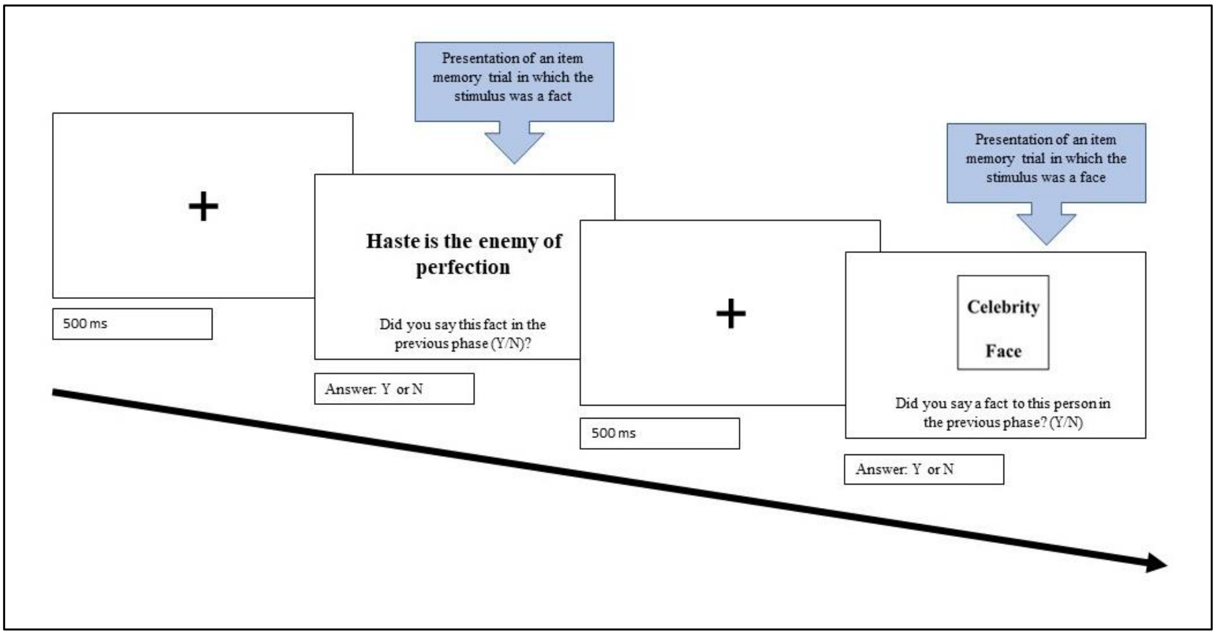
Participants were randomly assigned to one of two conditions: no-choice or choice condition. Participants were not informed that their memory would posteriorly be tested. In the no-choice condition, 30 facts were randomly paired with 30 faces. The participants were instructed to tell each fact to the 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 memorising 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 of them 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 memorising 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 centre of the screen. The participant had to share out loud the fact with the face only once and. afterwards, 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. Afterwards, participants performed two counterbalanced memory tests in the destination memory retrieval phase, the item memory test and the destination memory test.

Figure 1

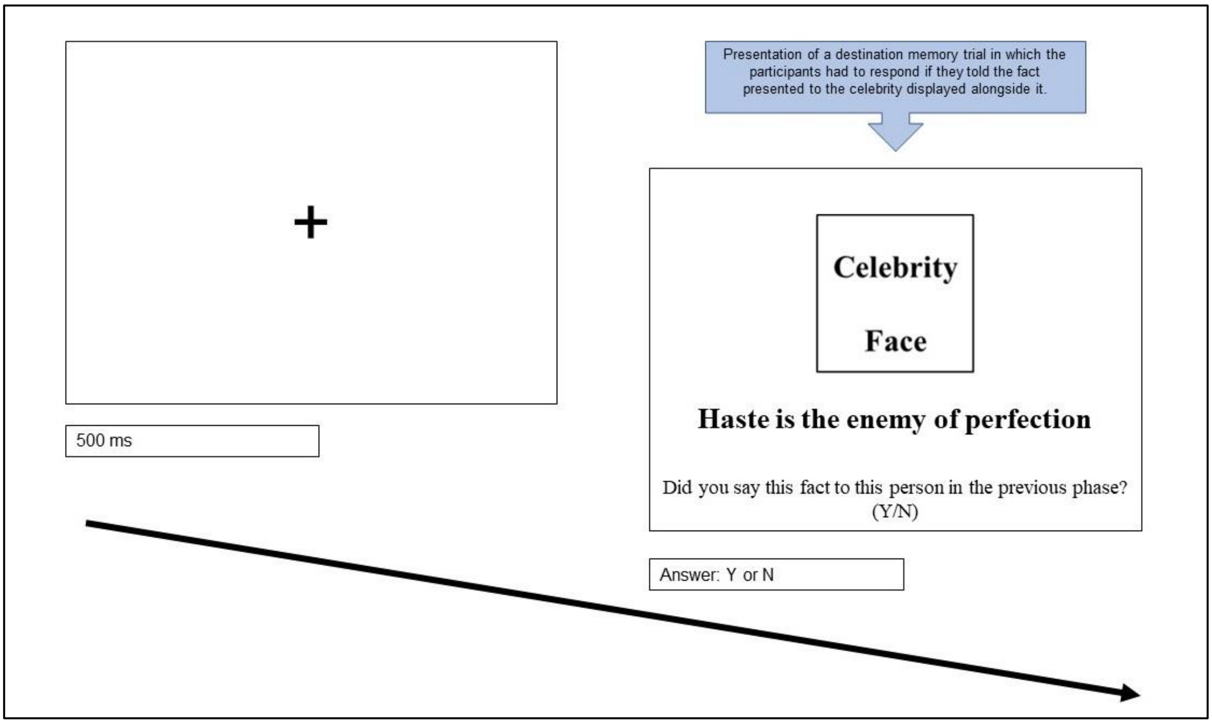
Illustration of a trial on the item memory test used in Study 1



For the item memory test (see Figure 1), 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.

Figure 2

Illustration of a trial on the destination memory test used in Study 1



The destination memory test (see Figure 2) 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. The duration of the entire procedure was approximately 30 minutes.

6.3.2. Results and Discussion

The purpose of the present experiment was to examine how applying a choice on the recipient to whom we share information affected destination memory. The proportion of hits, false alarms, and d' scores was analysed for both the item and destination memory (see Table 1). The item memory test was analysed using a 2 (Choice component: choice vs. no-choice) × 2 (Type of stimuli: facts vs. faces) mixed ANOVA performed on the d' data, with the Choice component as the between-subjects factor and Type of stimuli as the within-subjects factor. For the destination memory test, an independent samples t-test was performed on d' data, comparing the groups that had a choice presented during the encoding phase (i.e., choice condition) with those that did not have any choice available (i.e., no-choice condition).

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 for Study 1

	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)

For all of the analyses mentioned, Bayesian analyses were also conducted using the JASP software (Version 0.11.1, JASP Team, 2019). The Bayes factors are included as additional evidence in support of the alternative and null hypotheses in the analysis. For the Bayesian ANOVA, JASP provides the inclusion of Bayes factors, represented by $BF_{inclusion}$, which quantifies the strength of the evidence of a particular effect that is averaged across models that include the effect (Leding, 2020; Rouder et al., 2017; Schulze et al., 2019). Regarding the Bayesian t-tests, JASP provides the Bayes factors (denoted as BF_{10}). In this case, the Bayes factor quantifies the strength of the evidence in favour of the alternative effect, and a $BF_{10} < 1$ indicates support for the null hypothesis (H_0). In contrast, a $BF_{10} > 1$ supports the alternative hypothesis (H_1).

6.3.2.1. Binding. To determine whether the binding test was a predictor for destination memory, a one-way analysis of covariance (ANCOVA) was conducted to analyse 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, $F(1, 57) = .04$, $p = .84$, $\eta_p^2 < .001$.

6.3.2.2. Item Memory. To analyse 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, $F(1, 58) = 19.95$, $p < .001$, $\eta_p^2 = .26$, $BF_{Inclusion} = 3462.61$, 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, $F(1, 58) = .96$, $p = .332$, $\eta_p^2 = .02$, $BF_{Inclusion} = .33$, we can conclude that a choice component did not influence item memory. Lastly, no interaction Choice component × Type of stimuli was found, $F(1, 58) = .04$, $p = .851$, $\eta_p^2 = .01$, $BF_{Inclusion} = .26$.

6.3.2.3. 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.

Considering the limitations of null hypothesis significance testing (Dienes, 2011), Bayesian analyses were conducted (Cauchy prior, width 0.707) to examine the evidence in favour of the null hypothesis (H_0: no differences in performance between the two destination memory conditions) relative to the choice hypothesis (H_1: having a choice during the encoding phase leads to a difference in destination memory performance) with the memory sensitivity (i.e., d' data) as dependent variable (JASP Team 2019, Version 0.11.1). The Bayes factor of $BF_{10} = .34$ indicates anecdotal evidence for the H_0, that is, no differences in the destination memory performance, regardless of choosing the recipient to whom we share information during the encoding phase of a destination memory procedure.

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 analysing 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 difficulty level of the task to know whether 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 if the attentional shift of resources produced by a choice component influenced destination memory, but this time with a more cognitively demanding experimental design. The changes included in Experiment 2 allowed us to confirm whether the results obtained in Experiment 1 occurred because (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 is not a variable that significantly influences destination memory.

6.4. 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 show us further the influence of a choice component 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.

6.4.1. Method

6.4.1.1. 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.

6.4.1.2. 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).

6.4.1.3. 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.

6.4.2. Results and Discussion

The purpose of the present experiment was once again to examine how applying a choice on the recipient to whom we share information affected destination memory. The proportion of hits, false alarms, and d' scores was analysed for the destination memory (see Table 2). Since we wanted to confirm whether the changes included in Experiment 2 increased the attentional demands, a 2 (Choice component: choice vs. no-choice) × 2 (Experiment: Experiment 1 vs. Experiment 2) two-way ANOVA performed on the d' data was applied, with both of the variables being between-subjects factors. For the destination memory test, an independent samples t-test was performed on d' data, comparing the groups that had a choice presented during the encoding phase (i.e., choice condition) with those that did not have any choice available (i.e., no-choice condition). The criteria used for the Bayesian analyses were the same as described for Experiment 1.

Table 2

Mean proportion (SD) of hits, false alarms, and d' data values to destination memory in Experiment 2 as a function of condition for Study 1

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

6.4.2.1. 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].

Considering the limitations of null hypothesis significance testing (Dienes, 2011), Bayesian analyses were conducted (Cauchy prior, width 0.707) to examine the evidence in favour of the null hypothesis (H_0: no differences in performance between the two destination memory conditions) relative to the choice hypothesis (H_1: having a choice during the encoding phase leads to a difference in destination memory performance) with the memory sensitivity (i.e., d' data) as dependent variable (JASP Team 2019, Version 0.11.1). The Bayes factor of $BF_{10} = 2.950$ indicates anecdotal evidence for the H_1, that is, a difference in the destination memory performance that favours the effect of choice applied in the information of a destination memory procedure.

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.

6.4.2.2. 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, $F(1, 116) = 11.12$, $p = .001$, $\eta_p^2 = .01$, $BF_{Inclusion} = 22.51$, 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, $F(1, 116) = .89$, $p = .346$, $\eta_p^2 = .01$, $BF_{Inclusion} = .29$. Furthermore, we observed a significant Choice component × Experiment interaction, $F(1, 116) = 4.61$, $p = .034$, $\eta_p^2 = .04$, $BF_{Inclusion} = 1.837$. 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].

6.5. General Discussion

Destination memory has important implications for everyday life. Although previous studies (e.g., Gopie & MacLeod, 2009) had shown how the association between the information we transmit and the recipient to whom we share it takes place, the effect of a choice component on destination memory has not yet been studied. Consequently, this work aimed to investigate whether choosing to whom we share a piece of information benefits 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 that people transmit (e.g., facts) to the recipient of such information 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 hypothesised 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).

To ascertain the effect of a choice component on destination memory, we carried out two experiments. 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, analysing 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 to the recipient has positive effects on destination memory, while the opposite happens when the focus of attention is on the information.

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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7. Study 2

Does Memory get Worse if I Choose What to say? The Impact of Choosing Information on Destination Memory

This empirical work is currently being reviewed after being submitted to the Quarterly Journal of Experimental Psychology. This journal is a leading international journal that publishes original articles on any topic within the field of experimental psychology, and it is published by Sage. In 2021, according to Scopus, it had a CiteScore of 3.8, a Scimago Journal & Country Rank (SJR) of 0.898, and a Source Normalized Impact per Paper (SNIP) of 1.030. Regarding quartiles, according to the SJR website, it was ranked in Q2 for the topic of Experimental and Cognitive Psychology, and Q1 for Psychology (miscellaneous). According to Clarivate InCites Journal Citation Reports (JCR), in 2021, this journal was ranked in Q3 for Psychology, Experimental and its Impact Factor was 2.138.

Reference:

Lima, D., Albuquerque, P. B., & Beato, M. S. (2022). *Does memory get worse if I choose what to say? The impact of choosing information on destination memory*. [Manuscript submitted for publication]. School of Psychology, University of Minho.

In addition, results from this empirical work were fully presented in a poster format at the 1st Convenção Psicologia UNorte (Porto, Portugal). The results from Study 2 results, in conjunction with the results from both experiments of Study 1, were presented in an oral communication format at the International APPE SEPEX Meeting, held between the 5th and 7th of May of 2022 at the University of Algarve (Portugal). The instructions and materials used in this study, as well as its Supplemental Materials, can be found in Appendix C.

7.1. Abstract

Destination memory is the ability to remember to whom we transmit information. Several studies showed that choosing the information we want to retain positively impacts different types of memory, although its effect on destination memory is still unknown. In the present study, we aimed to evaluate how choosing the information to transmit can affect destination memory. Sixty participants were divided into two conditions: the choice and the no-choice conditions. Two types of stimuli were used: facts as the information to share; and familiar faces (i.e., celebrities) as the recipients. In the choice condition, participants chose between two facts before sharing one with a familiar face. In the no-choice condition, the choice of the fact was not allowed. The memory for the associations between the facts and the faces, that is, destination memory, was worse in the choice condition than in the no-choice condition. Adding a choice in the information highlights the importance of attentional resources on destination memory performance. Specifically, more attentional resources were redirected to the information by adding a choice component, leading to a worse remembering of the association between the information and the recipient.

Keywords: destination memory, choice on information, attentional focus, memory

7.2. Introduction

In our daily life, we occasionally fail to keep track of the information that we previously shared in our social interactions. This often leads us to share the same information with the same recipient (i.e., the person who listens), causing social embarrassment. As such, the ability to monitor to whom we previously transmitted a certain piece of information is important for effective communication, and the kind of memory that allows this type of monitoring was coined as destination memory (Gopie & MacLeod, 2009). Based on previous studies that evaluated target monitoring (Brown et al., 2006; Koriat et al., 1988, 1991), Gopie and MacLeod (2009) designed an experiment in which destination memory was firstly studied and defined. After that study, destination memory literature focused on understanding if different populations differ in destination memory (e.g., Gopie et al., 2010), as well as the mechanisms that could potentially improve or hamper it (e.g., El Haj et al., 2015).

In their study, Gopie and MacLeod (2009) aimed to understand if the processing of outgoing information (i.e., destination memory) differed from incoming information (i.e., source memory; Johnson et al., 1993) and concluded that it was more challenging to remember what we shared than the information another person shared with us. According to the authors, this could be due to the additional attentional resources required to transmit information. To test this hypothesis, in two experiments, the attentional resources were directed to one of the two types of stimuli manipulated in the destination memory procedure: information or recipient. Interestingly, the results indicated that when the attentional resources were directed to the information, destination memory worsened, while the opposite occurred when the resources were directed to the recipient, in which a destination memory improvement was observed. With their work, Gopie and MacLeod (2009) established that the focus of attentional resources is an important variable for understanding destination memory.

To begin, we will analyse how destination memory is measured in a typical destination memory procedure and thus be able to understand destination memory better. A destination memory study is divided into two distinct phases: encoding and retrieval. In the encoding phase, numerous facts are presented to the participants, and each is shared with a famous face (i.e., a celebrity). This allows participants to create fact-face pairs associations that will be tested during the retrieval phase using two different memory tests: an item memory test, a recognition test applied to assess the memory for individual items (i.e., facts or faces), and a destination memory test, which tested the memory for the associations between the information and the recipients. More specifically, in the destination memory test, fact-face pairs were presented in each trial, and participants answered if they told the fact presented to the face displayed alongside it by using a “yes” or “no” response. While all of the stimuli presented in this test (i.e., facts and faces) were previously studied by the participants, only half of the pairs were previously associated during the encoding, with the other half being reassembled pairs.

Even though the assessment of destination memory is well established (e.g., El Haj et al., 2013; El Haj et al., 2020; Johnson & Jefferson, 2018), a potential limitation has been proposed (Fischer et al., 2015; Lindner et al., 2015). Specifically, it was questioned whether the procedure accurately emulated a real-life conversation. Namely, the participants’ passivity while performing a destination memory procedure was suggested to cause difficulties in remembering outgoing information (El Haj, 2016; El Haj et al., 2016). In this regard, the authors suggested that merely saying a fact to a recipient without performing any additional action, such as choosing the information we transmit or the person to whom we intend to share, is not an accurate simulation of what happens in daily interactions (El Haj, 2016; El Haj et al., 2016). Based on this premise, a way to diminish the participants’ passivity limitation could be choosing the information or the person we intend to share (referred to as the *choice component* hereafter). In daily interactions, we often make choices about the information we share, and these choices reduce the participants’ passivity while performing the task. Precisely, the effect of the choice component regarding the information on a destination memory procedure was a prominent aspect of the present research.

The benefits of choice have been widely documented in previous memory literature (e.g., Coverdale & Nairne, 2019; Izuma & Murayama, 2013; Murty et al., 2015, 2019; Takahashi, 1991; Watanabe & Soraci, 2004). A choice can be defined as the act of choosing between two or more possibilities, and in memory research, a two-option choice is typically presented to understand its effect. For example, Marsh and Hicks (2002) designed a study in which participants chose whom to deliver objects or from whom they wished to receive them, displaying the benefits of an active choice. Specifically, when participants performed an option from where or to where, send or receive the objects, respectively, a better memory of the associations created between the receiver and the object occurred, suggesting that simply adding a choice led to the creation of stronger associations irrespective of the choice presented (i.e., delivering objects to one of two option or receiving them).

Regarding destination memory, the benefits of choice have also been demonstrated in studies that evaluate the effect of self-generated actions on destination memory (El Haj, 2016; El Haj et al., 2016). Aiming to understand if performing self-generated actions improved destination memory, the authors presented two forced-choice options (i.e., a squared white box and a circular black box). A self-generated action can be defined as an action performed by the participant, and in this task, participants distributed 12 everyday objects (e.g., glasses) into two boxes (six objects on each). Having the possibility to choose the recipient led to an improvement in destination memory (see El Haj et al., 2013; Gopie et al., 2010; Gopie & MacLeod, 2009 for a comparison between incoming and outgoing information) and, according to the researchers, the inclusion of a choice component benefits destination memory due to the reduction of the participants' passivity (El Haj, 2016; El Haj et al., 2016). However, it is difficult to generalise these findings to destination memory procedures, namely the one applied by Gopie and MacLeod (2009), since instead of two destinations, these procedures often have more than 40 destinations (e.g., 50 faces - Gopie et al., 2010; Gopie & MacLeod, 2009), and more broadly, these findings are not an accurate representation of social interactions since participants are continually sharing the information with the same two recipients.

Monitoring the information that we transmit daily is an important aspect of communication. Understanding the variables affecting destination memory is essential to help prevent monitoring flaws, especially in older adults, where these failures are more frequent (Gopie et al., 2010). This work aimed to clarify the effect on destination memory of choosing the information we want to share with someone. As mentioned, the benefits of choice on destination memory (El Haj, 2016; El Haj et al., 2016), and memory in general (e.g., Marsh & Hicks, 2002), are well-established. Nevertheless, the importance of the attentional resources on destination memory performance, proposed by Gopie and MacLeod (2009), should also be considered since we expected that a choice would drive the attentional resources to the type of stimuli in which the choice is available.

In the present experiment, we sought to understand the effect of a choice component on destination memory. For this purpose, we compared two experimental conditions. In one of the conditions, the possibility of choice was unavailable during the encoding phase (hereafter, *no-choice condition*), similar to Gopie and MacLeod's (2009) original destination memory procedure. In the other condition, a choice component for the information to transmit was available throughout the encoding phase. When this choice component was applied, participants chose between two facts before sharing them with a familiar face in each experimental trial (hereafter, *choice condition*). Given the strong influence that attentional resources exert on destination memory, according to Gopie and MacLeod (2009), adding a choice on the facts to transmit would direct attentional resources to the information and consequently hamper destination memory performance. Gopie and MacLeod's (2009) conclusions stated that directing more attentional resources to the information hampers the available resources to associate the two types of stimuli available in a destination memory procedure (i.e., information and recipient). As such, we expected that the shift of attentional resources prompted by the choice component would lead more of the participants' attentional resources to the information, and due to that, participants in the choice condition are expected to have more difficulty with the destination memory task when compared to the no-choice condition.

7.3. Method

7.3.1. Participants

Sixty undergraduate students (48 females) participated in this experiment, aged between 18 and 28 years old (M_{age} = 20.45, *SD* = 2.01). This sample size was calculated *a priori* through G*Power (Faul et al., 2007), defining a 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 determined considering destination memory literature (Gopie & MacLeod, 2009, Exp. 2). Participants were Portuguese native speakers with no history of drugs 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.

7.3.2. Design

The independent variables manipulated were: (1) Choice component: choice and no-choice; and (2) Type of stimuli: facts and faces. The choice component was manipulated through a between-subjects design, and the type of stimuli was a within-subjects manipulation.

As mentioned, this experiment aimed to test whether choosing the information to share with a recipient could affect 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 applied on both memory tests: the item memory and the destination memory test.

7.3.3. Materials

7.3.3.1. Facts. One hundred and ten Portuguese proverbs (e.g., *"De boas intenções está o inferno cheio"*, with the approximate English translation being "the road to hell is paved with good intentions") were selected as facts from a previous study (Barros et al., 2021). We choose proverbs as facts considering El Haj et al.'s (2015) suggestion that, by having familiar stimuli in both the information to transmit (i.e., facts) and the recipients (i.e., faces), more cognitive resources are available to memorise the fact-face pairs associations necessary to perform the destination memory task. The proverbs' familiarity was measured using a 5-point Likert scale varying between -2 and 2 (-2 = very unfamiliar proverb; -1 = unfamiliar proverb; 0 = neutral proverb; 1 = familiar proverb; 2 = very familiar proverb), and only proverbs rated above 0 on the familiarity scale were selected (*M* = 1.4; *SD* = .54). Additionally, the proverbs were controlled regarding their emotionality and word extension. Regarding proverbs' emotionality, we choose stimuli evaluated as close as possible to a neutral emotional valence (i.e., zero values), resulting in a pool of selected stimuli ranging between -1 and 1.05 (*M* = .20; *SD* = .55), assessed with a 5-point Likert scale ranging between -2 and 2 (-2 = very negative proverb; -1 = negative proverb; 0 = neutral proverb; 1 = positive proverb; 2 = very positive proverb). Lastly, the extension of the selected proverbs had a mean of 6.75 words (*SD* = 1.68).

7.3.3.2. Faces. Sixty faces of well-known public personalities (e.g., Michael Jackson) were selected from a celebrity database validated for the young adult Portuguese population (Lima et al., 2021). The faces were chosen considering different background categories (Portuguese and International celebrities) and gender (male and female), resulting in four sets of 15 famous faces. Specifically, half of the faces were female and the other half male, with half of the faces in each gender being International and the other half Portuguese. The celebrity pictures in the database were evaluated according to the following variables: (1) recognition, (2) naming accuracy, (3) familiarity, (4) distinctiveness, and (5) age of acquisition (AoA). The faces selected for this experiment had a recognition accuracy higher than 83% (*M* = 97.17; *SD* = 3.61) and naming accuracy above 79% (*M* = 91.69; *SD* = 5.34), with all three other variables (familiarity, distinctiveness, and AoA) controlled, revealing no significant differences between the four sets selected in any of these variables, $F(3, 56) = .33$, $p = .809$, $\eta_p^2 = .01$. All faces were displayed in black and white and had a dimension of 9 × 9 cm.

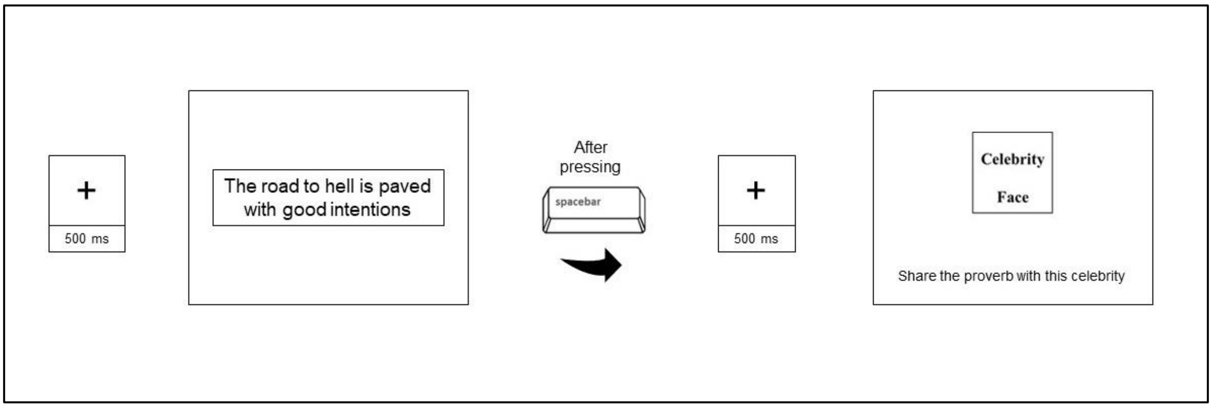
7.3.4. Procedure

This experiment was conducted through a video call using Zoom software (Zoom, 2019). Upon entering the chat room, the control of the researcher's keyboard was transferred to the participant, and the experimental task was presented to the participants through the Xampp software (Friends, 2017). Before learning about the instructions to perform the experiment, participants read the informed consent and selected one of two options: accepting the information presented in the informed consent and beginning the investigation or stopping the experiment immediately if they were uncomfortable with any of the information presented. Besides recording the answer to the informed consent, all of the stimuli presentation and response recording were also controlled with the Xampp software (Friends, 2017).

The destination memory procedure comprised three phases: encoding, interpolation, and retrieval. Moreover, two different memory tests constituted the retrieval phase: the item memory test and the destination memory test.

Figure 3

Illustration of an encoding phase trial in the no-choice condition used in Study 2

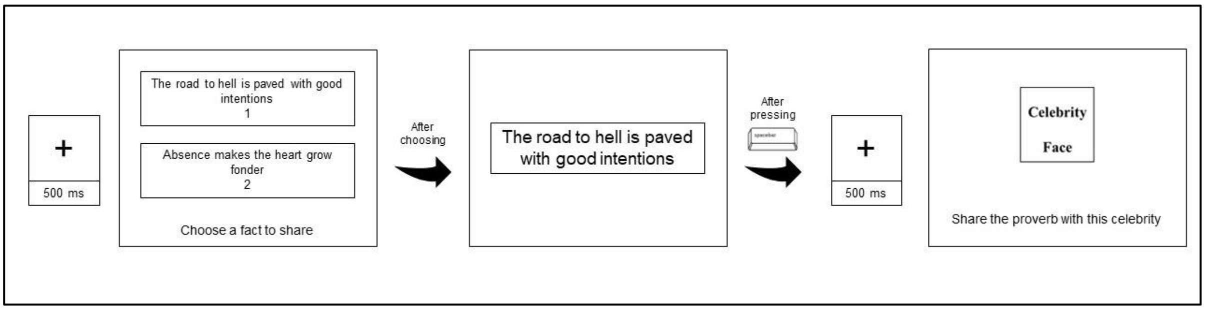


At the beginning of the task, participants were randomly assigned to one of two conditions: choice condition or no-choice condition. Participants were not informed that their memory would later be tested. In the no-choice condition (see Figure 3), 50 facts were randomly paired with 50 faces. Each encoding trial began with a 500 ms black fixation cross ("+") on a white background. Then a fact was presented, and after reading and memorising it silently, the participant pressed the space bar, which resulted in another 500 ms fixation cross, followed by a celebrity face. When the face appeared, 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 50 facts to 50 faces.

In the choice condition, 50 pairs of facts were randomly presented. Consequently, each trial of the encoded phase included two different facts, and the participant had to choose one to share with the recipient. Specifically, at the start of each trial, a 500 ms black fixation cross ("+") was displayed on a white background, followed by the presentation of two facts (font Arial, size: 30), one on the top and one on the bottom of the screen. The participants were asked to select one of them. To choose the fact shown at the top of the screen, participants had to press the key "1", and to choose the fact presented at the bottom of the screen, they needed to press the key "2". Then, the chosen fact would appear at the centre of the screen with increased font size (font Arial, size: 38), and after pressing the space bar, a celebrity was presented for the participant to share the fact aloud with (see Figure 4). Afterwards, participants pressed the space bar again, resulting in a new trial presentation.

Figure 4

Illustration of an encoding phase trial in the choice condition used in Study 2

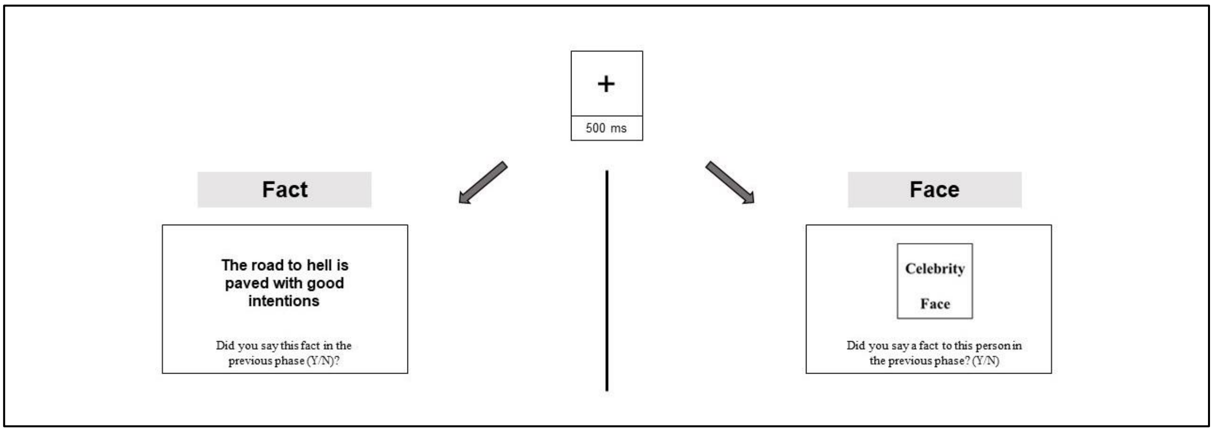


After the encoding phase, participants executed the interpolated phase, which consisted of a distractor test to prevent participants from rehearsing the encoded information. We opted for a visuospatial memory test based on a binding test used by Mitchell et al. (2000). Specifically, participants memorised three letters displayed for one second in different locations on a 3 × 3 grid. After this, a fixation cross was presented for 15 seconds. Subsequently, one of the letters was shown, which could be in the same or a different position. In this final grid, participants had to choose whether the letter was presented in the exact location as before by answering "Y" or "N".

Following the interpolated phase, the participants performed the retrieval phase, consisting of the item memory test and the destination memory test. These memory tests were counterbalanced, with half of the participants completing the item memory first, followed by the destination memory, and the other half performing the tests in the inverted order. 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). Each fact or face appeared accompanied by the question "Did you say this fact in the previous phase? (Y/N)" or "Did you see 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. The fact or face remained visible until the participant answered (see Figure 5). The 20 targets used in the item memory test were not presented in the destination memory test.

Figure 5

Examples of two trials in the item memory task, one for the presentation of a fact and another for the presentation of a face used in Study 2



The destination memory test consisted of an associative memory test, in which 40 fact-face pairs – the remaining 40 facts and faces presented at the encoding phase and not included in the item memory test – were shown in random order. Half of these pairs had been previously associated during the encoding phase, while the other half consisted of random reassemblies of previously studied fact-face pairs. Only the selected facts in the forced choice during the encoding phase were used in the choice condition. Each fact-face pair was presented one at a time, with the fact appearing below the face. Participants answered whether they had told that particular fact to the face presented alongside it in each trial. As in the item memory test, the response keys to execute this test were “Y” and “N”. At the beginning of each trial, a fixation cross was presented for 500 ms, and then a fact-face pair was shown. Each pair remained visible until the participant responded. The complete procedure lasted approximately 40 minutes.

7.4. Results

Table 3

Mean proportion (SD) of hits, false alarms, and d' data values to the item and destination memory as a function of condition for Study 2

	Hits	False Alarms	d'
No-choice Condition			
Item Memory: Facts	.90 (.13)	.07 (.10)	2.70 (.61)
Item Memory: Faces	.87 (.13)	.15 (.16)	2.31 (.69)
Destination Memory	.65 (.13)	.31 (.14)	0.95 (.62)
Choice Condition			
Item Memory: Facts	.73 (.23)	.05 (.11)	2.21 (.77)
Item Memory: Faces	.81 (.20)	.14 (.16)	2.12 (.80)
Destination Memory	.57 (.18)	.38 (.16)	0.55 (.67)

The purpose of the present experiment was to examine how applying a choice to the information we share affected destination memory. The proportion of hits, false alarms, and d' scores was analysed for both the item and destination memory (see Table 3). The item memory test was analysed using a 2 (Choice component: choice vs. no-choice) × 2 (Type of stimuli: facts vs. faces) mixed ANOVA performed on the d' data, with the Choice component as the between-subjects factor and Type of stimuli as the within-subjects factor. For the destination memory test, an independent samples t-test was performed on d' data, comparing the groups that had a choice presented during the encoding phase (i.e., choice condition) with those that did not have any choice available (i.e., no-choice condition).

For all of the analyses mentioned, Bayesian analyses were also conducted using the JASP software (Version 0.11.1, JASP Team, 2019). The Bayes factors are included as additional evidence in support of the alternative and null hypotheses in the analysis. For the Bayesian ANOVA, JASP provides the inclusion of Bayes factors, represented by $BF_{inclusion}$, which quantifies the strength of the evidence of a particular effect that is averaged across models that include the effect (Leding, 2020; Rouder et al., 2017; Schulze et al., 2019). Regarding the Bayesian t-tests, JASP provides the Bayes factors (denoted as BF_{10}). In this case, the Bayes factor quantifies the strength of the evidence in favour of the alternative effect, and a $BF_{10} < 1$ indicates support for the null hypothesis (H_0). In contrast, a $BF_{10} > 1$ supports the alternative hypothesis (H_1).

7.4.1. Item Memory

To analyse whether a choice component applied to the information influenced item memory test, we used a 2 (Choice component: choice vs. no-choice) × 2 (Type of stimuli: facts vs. faces) mixed ANOVA, performed on the d' data, with the Choice component as the between-subjects factor and Type of stimuli as the within-subjects factor. A main effect of Choice component was found, $F(1, 58) = 6.69$, $p = .012$, $\eta_p^2 = .10$, $BF_{Inclusion} = 2.26$. Specifically, item memory was higher in the no-choice condition (*M* = 2.51, *SD* = .67) than in the choice condition (*M* = 2.17, *SD* = .78). Additionally, there was no main effect of Type of stimuli, $F(1, 58) = 3.36$, $p = .072$, $\eta_p^2 = .06$, $BF_{Inclusion} = 1.14$, meaning there was no significant difference between memory for facts and faces regardless of the condition. The Choice component × Type of stimuli interaction was also not observed, $F(1, 58) = 1.21$, $p = .275$, $\eta_p^2 = .02$, $BF_{Inclusion} = .47$.

7.4.2. Destination Memory

To understand whether a choice component on the information could hinder destination memory, an independent samples t-test was performed on d' data. We compared the destination memory of participants who made a choice and those who did not. The analysis revealed that destination memory was significantly lower in the choice condition than in the no-choice condition. In other words, destination memory was depleted when a choice regarding the fact transmitted was applied than when there was no decision regarding which information to share, $t(58) = -2.43$, $p = .018$, *Cohen's d* = -.63, 95 % CI [-.73, -.07].

Considering the limitations of null hypothesis significance testing (Dienes, 2011), Bayesian analyses were conducted (Cauchy prior, width 0.707) to examine the evidence in favour of the null hypothesis (H_0: no differences in performance between the two destination memory conditions) relative to the choice hypothesis (H_1: having a choice during the encoding phase leads to a difference in destination memory performance) with the memory sensitivity (i.e., d' data) as dependent variable (JASP Team 2019, Version 0.11.1). The Bayes factor of $BF_{10} = 2.953$ indicates anecdotal evidence for the H_1, that is, a difference in the destination memory performance that favours the effect of choice applied in the information of a destination memory procedure.

7.5. Discussion

Destination memory is remarkably important for us to maintain successful interpersonal interactions. As so, it is crucial to understand its mechanisms and which variables could potentially decrease or improve it. As we know, the benefits of choice in memory have been widely documented throughout the years (e.g., Coverdale & Nairne, 2019; Izuma & Murayama, 2013; Murty et al., 2015, 2019; Takahashi, 1991; Watanabe & Soraci, 2004), and even in the destination memory field of study, the potential advantages of choice have been suggested (El Haj, 2016; El Haj et al., 2016). Nevertheless, a prominent explanation for destination memory performance is the availability of attentional resources (Gopie & MacLeod, 2009). Specifically, the authors suggested that when the attentional resources of a person transmitting information are focused on the recipient of the information, destination memory improves, and destination memory declines when the resources are shifted to the information itself. In sum, this experiment aimed to clarify whether choosing the information before sharing it with a recipient affects destination memory.

We expected that introducing the choice of the information to share in each trial in the destination memory paradigm would direct the attentional resources to the information, leading to a worse destination memory when compared to simply sharing each piece of information without having any choice. Our destination memory results confirmed our hypothesis, worse destination memory when we have to choose the information to share. Moreover, having a choice regarding the information during the encoding phase also impaired our ability to recognise the individual units of the association (i.e., facts and faces). In other words, when a choice was available during encoding, both an item and destination memory performance decreased compared to having no choice available throughout the encoding phase.

With this procedure, we aimed to address some of the potential limitations observed in the destination memory procedure: eliminating the participants' passivity (El Haj, 2016; El Haj et al., 2016) by introducing a choice component in the procedure; and approaching the destination memory procedure to a real-life social interaction, by allowing the choice of information before sharing it with a recipient. In our experiment, the effect of a choice component applied to the information was tested by comparing two conditions: the choice condition, in which a choice between two different facts was available in each trial of the encoding phase; and the no-choice condition, where a fact was transmitted to a recipient without an available choice. After establishing all the associations between each fact and the recipient (i.e., face), the memory of these associations was then tested.

An item memory test was used to evaluate the memory for the individual units of the fact-face association, that is, the memory for each type of stimuli (facts and faces). This memory test showed a higher item memory in the no-choice condition than in the choice condition, an effect that was not expected since previous literature demonstrated that making choices leads to better memory (e.g., Coverdale & Nairne, 2019). A possible explanation for these results could be the amount of information presented while encoding the information. When more information during the encoding is presented, as it happens in the choice condition, it becomes difficult to recognise both facts and faces. Specifically, in the choice condition, two facts were presented in each trial, meaning that 100 facts were presented in this condition, twice as those in the no-choice condition (50 facts).

Regarding destination memory, we aimed to understand how the application of a choice to the information we transmit can affect what we remember in our subsequent social interactions. Our results showed that the advantage of a choice hinted previously in destination memory literature, in which a destination memory advantage was demonstrated with the choice of objects as recipients (El Haj, 2016; El Haj et al., 2016), did not occur when the choice was applied regarding the information to share. Instead, our hypothesis that destination memory performance would worsen when the attentional resources were shifted to the information, congruent with the importance of the focus of the attentional resources proposed by Gopie and MacLeod (2009), was corroborated by our results. Specifically, when a choice regarding the information was available during each trial of the encoding phase, the memory for the associations created was worse when compared with simply sharing information with a recipient, ultimately leading to worse destination memory.

Destination memory is a type of memory that centrally revolves around social interactions (El Haj & Miller, 2018). In our daily interactions, even when communicating among a group of friends or family, we often make more decisions about the information we transmit, rather than to whom we transmit it. Taking our results into account, being focused on the several options about what we can transmit to another person leads to a lower memory of what we share, which could have important implications, especially in older adults. In this regard, Gopie et al. (2010) confirmed that destination memory compromise is more prominent in older than in young adults. Although the effects of a choice on destination memory are yet to be studied in older adults, our experiment provides an important insight into how to potentially avoid monitoring flaws and further understand how destination memory and social cognition are intertwined (El Haj & Miller, 2018).

Before proceeding, we would like to note that our conclusions are based on previous destination memory literature (e.g., Gopie & MacLeod, 2009; Johnson & Jefferson, 2018), but we did not directly manipulate attention. Future studies could examine the effects of the attentional resources on destination memory, for example, including an explicit instruction to direct the processing to some characteristics of the information or the recipients.

Additionally, our experiment manipulated the effect of choice in memory differently from what was previously applied in memory literature (e.g., Murty et al., 2015, 2019). For example, in Murty et al. (2015, 2019), the condition in which no choice was available still presented two options to the participant; however, the choice was predetermined before its presentation (i.e., the chosen stimuli appeared in a different colour). In our experiment, the main objective was to show that a typical destination memory procedure, such as the one applied by Gopie and MacLeod (2009), could have some limitations that distance it from a real-life conversation. That is why we decided to use a procedure as close as possible to the original procedure but adding a choice component to reduce the participants' passivity. Future research could examine whether including two facts in both choice and no-choice conditions helps to understand better how choice affects destination memory.

In conclusion, the results from the present study may be taken as important and interesting contributions to the destination memory literature. First, we have demonstrated that conditions that occur in real-life interactions (e.g., choosing between two facts to transmit) could affect destination memory, and these are not accounted for in the traditional destination memory assessment. Second, we have confirmed that applying a choice on the information in a destination memory procedure led to worse memory for not only the individual stimuli but also the recollection of the association between the information and its recipient, a finding that contradicts much of the memory literature regarding the benefits of choice (e.g., Coverdale & Nairne, 2019; Murty et al., 2015, 2019). Lastly, we provided further evidence that supports the suggestion given by Gopie and MacLeod (2009) and Johnson and Jefferson (2018) regarding the importance of focusing on the attentional resources while encoding the information to understand destination memory. Specifically, introducing more information in a condition, the choice condition, and, consequently, directing more attentional resources to the information led to a decrease in destination memory (Gopie & MacLeod, 2009; Johnson & Jefferson, 2018).

Finally, despite the benefits of choice highlighted in memory literature (e.g., Marsh & Hicks, 2002), applying a choice component in the information of a destination memory procedure hampers destination memory. By resolving the limitation of the participants' passivity (El Haj, 2016; El Haj et al., 2016) with the introduction of a choice component, we cleared the effect of a choice component on information on a destination memory procedure, showing that attentional resources and how they are shifted throughout the encoding phase are essential variables that should be taken into account for the creation of destination memory procedures.

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8. Study 3

What to say and to Whom? The Effect of Choosing the Information and the Recipient on Destination Memory

This empirical work encompassed the last experiment done for this doctoral thesis. While still in-preparation, since its conclusions are influenced heavily by the two studies described in the previous chapters, I will present Study 3 in the format of a scientific article. The results from this study were fully presented in a poster format at the 11th *Simpósio Nacional de Investigação em Psicologia* (Vila Real, Portugal). The instructions and materials used in this study, as well as its Supplemental Materials, can be found in Appendix D.

Reference:

Lima, D., Albuquerque, P. B., & Beato, M. S. (2022). *What to say and to Whom? The Effect of Choosing the Information and the Recipient on Destination Memory.* [Unpublished manuscript]. School of Psychology, University of Minho.

8.1. Abstract

Destination memory is the ability to remember to whom we transmit certain information and, as such, is essential to withstand successful interpersonal interactions. In the present study, we aimed to evaluate how choosing the information to transmit and the person we share it with (i.e., the recipient) can affect destination memory. Two types of stimuli were used: facts as the information to share; and faces (i.e., celebrities' faces) as the recipients. Participants were divided into two conditions, and in the choice condition, participants chose between two facts and two faces before sharing the selected fact with the chosen face. In the no-choice condition, participants shared a fact with a face, and no choices were available. The results showed no significant differences between the choice and the no-choice conditions in destination memory, the memory for the associations between the facts and the faces. This result highlights the focus of attentional resources while encoding information as a prominent variable to explain subsequent destination memory performance since adding a choice, a variable known to benefit memory, did not alter its performance. Nevertheless, adding choices to the encoding of information ultimately affected memory since higher memory for stimuli in the choice condition than in the no-choice condition was observed when remembering the individual units of the associations (i.e., item memory).

Keywords: destination memory, choice on information, choice on recipient, attentional focus, memory

8.2. Introduction

Numerous encounters occur throughout our day-to-day life, several leading to interpersonal interactions in which information is exchanged. Our episodic memory for these interactions is important for guiding our behaviour in our social circles. Since, in interpersonal interactions, we both share and receive information, this type of episodic memory can be divided into two types of memory related to our communication: source memory and destination memory. Source memory can be defined as the capacity to remember which person shared a piece of specific information with us (Johnson et al., 1993), while destination memory is our capacity to recall with whom a piece of information was previously shared (Gopie & MacLeod, 2009). In both types of memory (i.e., source and destination memory), remembering the association of the information with the person is vital for adequately remembering the interaction.

Destination memory first began being studied in 2009. In that year, Gopie and MacLeod (2009) sought to understand whether the memory of the information a person shares differs from remembering the information transmitted to them. To do so, participants were divided into two conditions: the destination memory condition and the source memory condition. Participants would establish 50 fact-face pairs associations during the encoding phase in both conditions. A fact was first presented to the participants in each trial of the destination memory condition. After encoding it, they shared it out loud with a face or recipient (a celebrity face). In the source memory condition, the presentation order of the stimuli in each trial was reversed, with a face being shown first. Afterwards, when the fact was presented, participants were instructed to read it aloud as if the face presented before was sharing that information with them. After encoding all 50 associations (i.e., fact-face pairs), the participants' memory was tested using two recognition tests: the item memory test and the associative memory test.

In the item memory test, the memory for the individual units of the association (i.e., facts and faces) was analysed. In this memory test, a fact or a face was presented in each trial, and the participants answered whether it was presented during the encoding phase, using a "yes" or "no" response. Twenty of the stimuli presented were targets (10 facts and 10 faces), while the other 20 were fillers (i.e., stimuli that were never shown before to the participant). In the associative memory test, the memory for the associations created between the information or facts and the recipient or faces was assessed, with the presentation of a fact-face pair in each trial. The participants had to answer whether they told the fact to the face displayed alongside it in the destination memory condition. In contrast, in the source memory condition, participants had to respond if the face displayed alongside the fact previously 'told' that specific fact to them during the encoding phase. Half of the pairs appeared as previously associated in the encoding phase, and the other half were reassembled pairs.

In the item memory test, the results demonstrated a significantly higher memory for faces in the source memory condition than in the destination memory condition. Furthermore, the associative memory test results indicated that it was more challenging to remember what we shared with a person (i.e., destination memory) than information that a person shared with us (i.e., source memory). Considering the results of both experimental tests, Gopie and MacLeod (2009) proposed that when transmitting information, a person requires more attentional resources to generate the information. In other words, more attentional resources were focused on the information during encoding, leaving less attentional resources available to encode the association between a certain information and its recipient. To further explore this assumption, two additional experiments were designed in which the attentional resources were directed to the two types of stimuli available: in one of the experiments, the attentional resources were directed to the information, and in the other, to the recipient.

To direct the attentional resources to the information, participants had to share personal information. On the other hand, to direct the resources to the recipient, participants were required to verbalise the face's name before transmitting the fact aloud. With these two experiments, the authors noted that when the attentional resources were directed to the information, destination memory accuracy worsened, while an increase in accuracy was observed when the attentional resources were directed to the recipient. All in all, Gopie and MacLeod (2009) clarified how destination and source memory differed and established the focus of attentional resources while encoding information as an important variable that influences destination memory performance.

This conclusion regarding the focus of attentional resources noted by Gopie and MacLeod (2009) was further broadened in future research on destination memory (see Johnson & Jefferson, 2018 for a study highlighting the importance of attentional resources using a similar methodology). For example, using faces with a distinctive feature, which directed the participants' attentional resources to the recipient (i.e., distinctiveness effect - Hunt, 2006) led to a better destination memory, however only when the design was within-participant (Barros et al., 2021). This happened since the difference between faces with and without distinctive features needed to be clear, and if all the faces had distinctive features, then none of them would be perceived as distinctive (Barros et al., 2021; Hunt, 2006). Destination memory was also affected when faces with different attractiveness were compared

(El Haj & Ndobo, 2021). When comparing destination memory for attractive, unattractive, and neutral faces, the results revealed a better destination memory for attractive and unattractive faces than for neutral faces. The authors (El Haj & Ndobo, 2021) noted that whenever a face had a distinctive feature that led the attentional resources to the recipient, namely attractiveness, destination memory accuracy improved.

Even though the assessment of destination memory proposed by Gopie and MacLeod (2009) was widely accepted and used in numerous destination memory studies in a laboratory setting (e.g., El Haj et al., 2013; El Haj et al., 2020; Johnson & Jefferson, 2018), other studies evaluated destination memory using face-to-face interaction to understand how destination memory would operate in a procedure that is closer to an accurate emulation of a real-life conversation (Fischer et al., 2015; Lindner et al., 2015). In one of these studies (Lindner et al.,2015), participants shared and received information with a real-life person, differently from a typical destination memory assessment, in which participants shared information with a familiar face (i.e., a celebrity face) presented on a computer screen. Interestingly, no differences were reported between destination memory and source memory in these studies (Lindner et al., 2015), a contrasting result to studies that apply a typical destination memory assessment (e.g., Gopie & MacLeod, 2009, in which destination memory accuracy is lower than source memory).

By applying the destination memory procedure using real-life persons as recipients, the researchers (Fischer et al., 2015; Lindner et al., 2015) concluded that the participants' passivity while encoding the information (i.e., merely reading a fact and sharing it with a familiar face on the screen) could be the cause for the lower accuracy observed in the destination memory performance. Other destination memory studies using self-generated actions (El Haj, 2016; El Haj et al., 2016) further support the participants' passivity as a possible limitation of a typical destination memory assessment since presenting an active choice led to a destination memory accuracy similar to source memory.

This experiment focused on understanding if presenting choices, both for the information we share and for the recipient to whom we share the information, influenced destination memory performance. To understand the effect of choice, we developed a design with two experimental conditions: the choice condition and the no-choice condition. In the choice condition, two choices were available in each trial of the encoding phase, one for the information which would be shared and another for the recipient with whom the information was shared. In the no-choice condition, the possibility of choice was unavailable during the encoding phase, akin to the procedure applied by Gopie and MacLeod (2009). Presenting a choice should inadvertently direct the attentional resources to where the choice is presented. As mentioned, a variable that was proven to influence destination memory accuracy was the focus of attentional resources during encoding information (Gopie & MacLeod, 2009; Johnson & Jefferson, 2018). Additionally, presenting two active choices also addresses the limitation pointed to the typical destination procedure regarding the participants' passivity (El Haj, 2016; El Haj et al., 2016; Fischer et al., 2016; Lindner et al., 2016). More specifically, the participants' passivity should diminish in the choice condition by including two active choices while encoding the stimuli presented at the encoding phase of a destination memory procedure.

Based on the results reported in Study 1 and Study 2 (presented in chapters 6 and 7, respectively), we expected that destination memory would not significantly differ when comparing the two conditions. Moreover, this experiment allowed us to understand if choice ultimately affects destination memory and the individual units of the associations, as measured by the item memory. Since implementing choices for both types of stimuli (i.e., facts and faces) should direct additional attentional resources to them, destination memory results could clarify if one of the choices could have a prevalent effect on directing the attentional resources. As for item memory, we expected that a higher memory would be observed on the choice condition, mainly due to the mnemonic benefits of choice (Coverdale & Nairne, 2019) observed for other types of memory (memory for verbal materials – Takahashi, 1991; declarative memory – Murty et al., 2015, 2019).

8.3. Method

8.3.1. Participants

A sample of 60 undergraduate students (48 females) with ages between 18 and 35 years (M_{age} = 20.75, *SD* = 3.01) participated in this experiment. This sample size was calculated *a priori* with the statistical software G*Power (Faul et al., 2007), defining a 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, Exp.2). Participants were Portuguese native speakers with no history of drug or alcohol abuse, psychiatric disorders, and normal or corrected-to-normal vision. Informed consent was obtained from all participants, who received course credits for their participation. The local Ethics Committee approved the experiment.

8.3.2. Design

The independent variables manipulated were: (1) Choice component: choice and no-choice; and (2) Type of stimuli: facts and faces. The choice component was manipulated through a between-subjects design, and the type of stimuli was a within-subjects manipulation.

This experiment aimed to test whether presenting a choice component for both types of stimuli during the encoding phase could affect 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 applied on both memory tests: the item memory and the destination memory test.

8.3.3. Materials

8.3.3.1. Facts. One hundred and ten Portuguese proverbs (e.g., *"Cada macaco no seu galho"*[5]) were selected as facts from a previous study (Barros et al., 2021). We choose proverbs as facts considering El Haj et al.'s (2015) suggestion that, by having familiar stimuli in both the information to transmit (i.e., facts) and the recipients (i.e., faces), more cognitive resources are available to memorise the fact-face pairs associations necessary to perform the destination memory task. The proverbs' familiarity mean was measured using a 5-point Likert scale varying between -2 and 2 (-2 = very unfamiliar proverb; -1 = unfamiliar proverb; 0 = neutral proverb; 1 = familiar proverb; 2 = very familiar proverb), and only proverbs classified above 0 (neutral) were selected (M = 1.4; SD = .54). Additionally, the proverbs were controlled regarding their word extension and emotionality. The chosen proverbs' extensions had a mean of 6.75 words (SD = 1.68). Regarding proverbs' emotionality, we choose stimuli evaluated as close as possible to a neutral emotional valence (i.e., zero), resulting in a pool of selected stimuli ranging between -1 and 1.05 (M = .20; SD = .55) assessed with a 5-point Likert scale ranging between -2 and 2 (-2 = very negative proverb; -1 = negative proverb; 0 = neutral proverb; 1 = positive proverb; 2 = very positive proverb). The wide range of emotionality is justified by the large number of proverbs needed to perform this study. From the 213 proverbs available in the original dataset (Barros et al., 2021), we choose the 110 closer to the neutral emotional valence.

8.3.3.2. Faces. To ensure that the faces used were familiar, 110 faces of well-known public personalities or celebrities (e.g., Johnny Depp) were selected from a celebrity face database validated for the young adult Portuguese population (Lima et al., 2021). The faces were chosen considering two

[5] An approximate English translation of the Portuguese proverb is "*Each monkey to its own branch*".

background categories (Portuguese and international celebrities' faces) and gender (male and female), with these two parameters balanced given the number of images. The celebrity faces of the database were evaluated according to the following variables: (1) recognition, (2) naming accuracy, (3) familiarity, (4) distinctiveness, and (5) age of acquisition (AoA). The faces selected for this experiment had a recognition accuracy higher than 75% (M = 94.98; SD = 5.62) and naming accuracy above 65% (M = 84.93; SD = 9.50), with all three other variables (familiarity, distinctiveness, and AoA) controlled, revealing no significant differences between the four sets selected in any of these variables, $F(3, 106) = .76$, $p = .520$, $\eta_p^2 = .02$. All faces were displayed in black and white and had a dimension of 9 × 9 cm.

8.3.4. Procedure

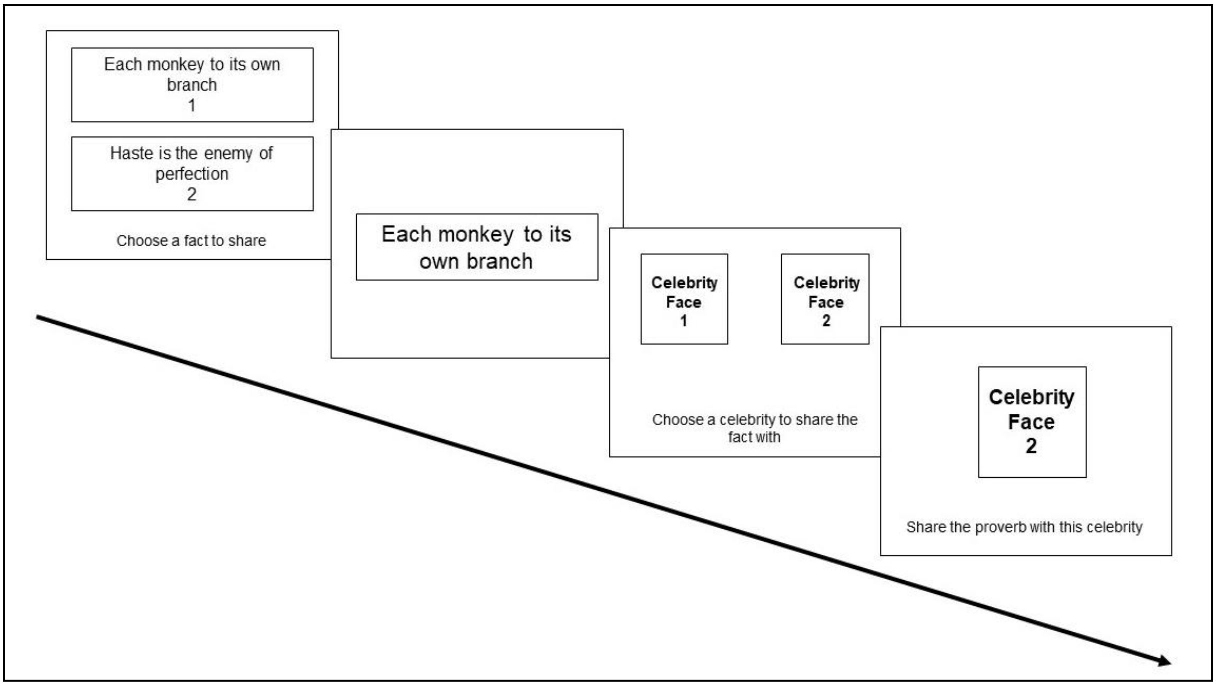
This experiment was conducted online using Zoom software (Zoom, 2019). Upon entering the video call, the experimental task was presented to the participants through the Xampp software (Friends, 2017). After the participants were briefed about how to operate the software, the control of the researcher's keyboard was transferred to them. Before learning about the experiment's instructions, participants read and completed the informed consent. Besides recording the answer to the informed consent, all of the stimuli presentation and response recording were also controlled with the Xampp software (Friends, 2017).

The destination memory procedure comprised three phases: the encoding, interpolated, and retrieval phases. The last phase included two different memory tests: the item memory test and the destination memory test.

At the start of the experiment, participants were randomly assigned to one of two conditions: choice condition or no-choice condition. Participants were not informed that their memory would later be tested. In the no-choice condition, 50 facts were randomly paired with 50 faces. Each encoding trial began with a 500 ms black fixation cross ("+") on a white background. Then a fact was presented, and after reading and memorising it silently, the participant pressed the space bar, which resulted in another 500 ms fixation cross, followed by a celebrity face. When the face appeared, 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 50 facts to 50 faces.

Figure 6

Illustration of an encoding phase trial in the choice condition used in Study 3

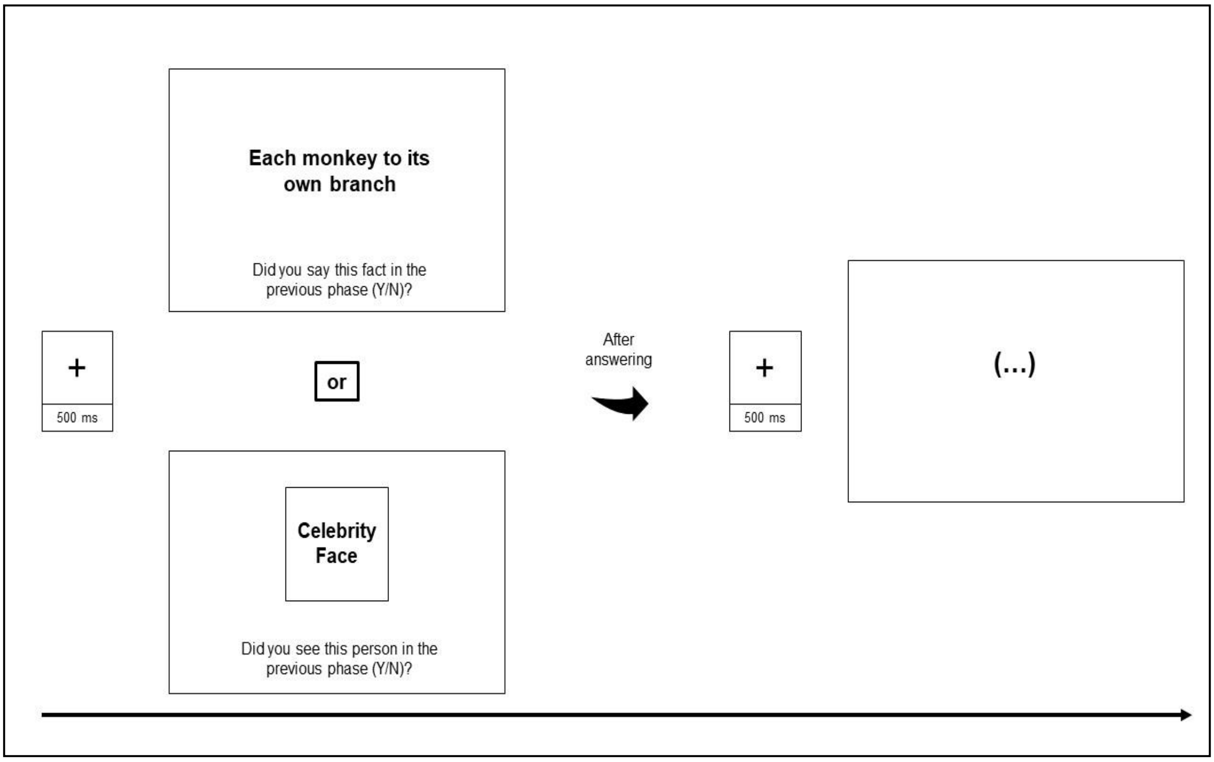


In the choice condition (see Figure 6)., 50 pairs of facts and 50 pairs of faces were randomly presented. Each trial of the encoding phase included two different facts, and the participant had to choose one of them to share with a face or recipient. The participant also had to choose one of two faces to share with it the fact out loud. At the start of each trial, a 500 ms black fixation cross ("+") was displayed on a white background, followed by the presentation of two facts (font Arial, size: 30), one on the top and one on the bottom of the screen. The participants were asked to select one of them. To choose the fact presented at the top of the screen, participants had to press the key “1”; to choose the fact presented at the bottom, they needed to press the key “2”. Then, the chosen fact would appear at the centre of the screen with increased font size (font Arial, size: 38). After pressing the space bar, two different faces were presented to the participant, and they chose one of them to share the fact with. After choosing the face, it appeared in the centre of the screen individually, and the participant had to share out loud the fact with the face only once. Afterwards, participants pressed the space bar again, starting a new trial.

After the encoding phase, participants executed the interpolated phase, which consisted of a distractor test to prevent participants from rehearsing the encoded information. In this experiment, we used a visuospatial memory test based on a binding test by Mitchell et al. (2000). Participants memorised three letters displayed in different locations on a 3 × 3 grid for one second. After this, a fixation cross was presented for 15 seconds. Then, one of the letters was shown, which could be in the same or a different position. In this final grid, participants had to choose whether the letter was presented in the exact location as before by answering “Y” or “N”.

Figure 7

Types of trials displayed in the item memory test, one for the presentation of a fact and another for the presentation of a face used in Study 3



Following the interpolated phase, the participants performed the retrieval phase, consisting of the item memory test and the destination memory test. These memory tests were counterbalanced, with half of the participants completing the item memory first, followed by the destination memory, and the other half performing the tests in the inverted order. For the item memory test (see Figure 7), 40 items (20 facts and 20 faces) were presented randomly. Half of the items were previously presented and selected by the participant in the encoding phase (i.e., targets), and the other half was never presented before (i.e., distractors; 10 facts and 10 faces which were obtained from the initial list of 110 stimuli available for each but were not presented during the encoding phase). Each fact or face appeared accompanied by the question "Did you say this fact in the previous phase? (Y/N)" or "Did you see 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. The fact or face remained visible until the participant answered. The 20 targets used in the item memory test were not presented in the destination memory test.

The destination memory test consisted of an associative memory test, in which 40 fact-face pairs – the 40 facts and faces presented at the encoding phase and not included in the item memory test – were shown in random order. Half of these pairs had been previously associated during the encoding phase, while the other half consisted of random reassemblies of previously studied fact-face pairs. Only the stimuli selected during the encoding phase were used in the choice condition. Each fact-face pair was presented one at a time, with the fact appearing below the face. Participants answered whether they had told that particular fact to the face presented alongside it in each trial. As in the item memory test, the response keys to execute this test were "Y" and "N". At the beginning of each trial, a fixation cross was presented for 500 ms, and then a fact-face pair was shown. Each pair remained visible until the participant responded. The complete procedure lasted approximately 45 minutes.

8.4. Results

Table 4

Mean proportion (SD) of hits, false alarms, and d' data values to the item and destination memory as a function of condition for Study 3

	Hits	**False Alarms**	**d'**
No-choice Condition			
Item Memory: Facts	.78 (.14)	.08 (.07)	2.20 (.57)
Item Memory: Faces	.85 (.12)	.18 (.17)	2.10 (.70)
Destination Memory	.65 (.14)	.34 (.20)	0.94 (.89)
Choice Condition			
Item Memory: Facts	.84 (.11)	.06 (.10)	2.50 (.57)
Item Memory: Faces	.92 (.10)	.11 (.13)	2.59 (.66)
Destination Memory	.67 (.17)	.37 (.18)	0.90 (.75)

The purpose of the present experiment was to examine how applying a choice on both types of stimuli available during the encoding phase (i.e., facts and faces) affected destination memory. The proportion of hits, false alarms, and d' scores was analysed for both the item and destination memory (see Table 4). The item memory test was analysed using a 2 (Choice component: choice vs. no-choice)

× 2 (Type of stimuli: facts vs. faces) mixed ANOVA performed on the d' data, with the Choice component as the between-subjects factor and Type of stimuli as the within-subjects factor. For the destination memory test, an independent samples t-test was performed on d' data, comparing the groups that had two choices presented during the encoding phase (i.e., choice condition) with those that did not have any choice available (i.e., no-choice condition).

For all of the analyses mentioned, Bayesian analyses were also conducted using the JASP software (Version 0.11.1, JASP Team, 2019). The Bayes factors are included as additional evidence in support of the alternative and null hypotheses in the analysis. For the Bayesian ANOVA, JASP provides the inclusion of Bayes factors, represented by $BF_{inclusion}$, which quantifies the strength of the evidence of a particular effect that is averaged across models that include the effect (Leding, 2020; Rouder et al., 2017; Schulze et al., 2019). Regarding the Bayesian t-tests, JASP provides the Bayes factors (denoted as BF_{10}). In this case, the Bayes factor quantifies the strength of the evidence in favour of the alternative effect, and a $BF_{10} < 1$ indicates support for the null hypothesis (H_0). In contrast, a $BF_{10} > 1$ supports the alternative hypothesis (H_1).

8.4.1. Item Memory

To analyse whether a choice component applied to both types of stimuli presented during the encoding phase influenced the memory for the individual units of the association (i.e., item memory), a 2 (Choice component: choice, no-choice) × 2 (Type of stimuli: facts, faces) mixed ANOVA was performed on the d' data, with the Choice component as the between-subjects factor and Type of stimuli as the within-subjects factor. This ANOVA yielded a significant main effect of Choice component, $F(1, 58) = 12.49$, $p < .001$, $\eta_p^2 = .18$, $BF_{Inclusion} = .14.18$. Specifically, the main effect of Choice component indicated that memory for individual stimuli was higher in the choice condition ($M = 2.55$, $SD = .61$) than in the no-choice condition ($M = 2.15$, $SD = .63$). Neither the main effect of Type of stimuli, nor the Choice component x Type of stimuli interaction was significant, $F(1, 58) < .01$, $p = .998$, $\eta_p^2 < .01$, $BF_{Inclusion} = .19$, and $F(1, 58) = .70$, $p = .407$, $\eta_p^2 = .01$, $BF_{Inclusion} = .37$, respectively.

8.4.2. Destination Memory

An independent samples t-test was performed on d' data to understand whether a choice component on facts and faces could affect destination memory. The analysis revealed no significant differences in destination memory between the choice and the no-choice conditions, $t(58) = -.23$, $p = .82$, *Cohen's d* = -.06, 95 % CI [-.47, .38].

Considering the limitations of null hypothesis significance testing (Dienes, 2011), Bayesian analyses were conducted (Cauchy prior, width 0.707) to examine the evidence in favour of the null hypothesis (H_0: no differences in performance between the two destination memory conditions) relative to the choice hypothesis (H_1: having choices during the encoding phase leads to a difference in destination memory performance) with the memory sensitivity (i.e., d' data) as dependent variable (JASP Team 2019, Version 0.11.1). The Bayes factor of $BF_{10} = .27$ indicates moderate evidence for the H_0, that is, no differences in the destination memory performance, regardless of having choices during the encoding phase of a destination memory procedure.

8.5. Discussion

Successful interpersonal interactions are important since they guide our behaviour in the social world (Li & Nie, 2022). As such, successfully remembering the information we share with another person is important to maintain successful interactions. Understanding what variables could potentially affect destination memory can improve the quality of our conversations since it helps us avoid repeating information to the same recipient. With this experiment, we aimed to understand how introducing choices for both types of stimuli (i.e., facts and faces) while creating the associations between them on a destination memory procedure could affect destination memory performance. To do so, we compared two experimental conditions: the choice condition, in which the two choices were available in each trial of the encoding phase; and the no-choice condition, reminiscent of a typical destination memory assessment (Gopie & MacLeod, 2009), where no choices were available, and a fact was transmitted to a recipient without an available choice in every trial.

Furthermore, adding choices to a destination memory procedure makes it more similar to a real-life conversation (e.g., Fischer et al., 2015; Lindner et al., 2015) since, in daily interactions, we often make choices about both what we share and the person to whom we want to share. It also addresses the limitation of a typical destination memory procedure presented by El Haj (2016) and El Haj et al. (2016) regarding the participants' passivity since presenting choices for both types of stimuli presented at encoding should reduce the participants' passivity while performing the task.

Previously, we asserted the effect of a choice component when applied to facts or faces individually (see Study 1 and Study 2) compared to a typical destination memory assessment akin to the one presented by Gopie and MacLeod (2009). When a choice component was applied on the facts, destination memory was worse. In contrast, when a choice component was applied to the faces, an improvement in destination memory was observed. The results of these two studies supported the suggestion provided by Gopie and MacLeod (2009) that, at least in a laboratory setting, the focus of attentional resources during the encoding of the fact-face pairs is an important variable for understanding destination memory performance.

Taking the studies presented in the two previous chapters (i.e., chapters 6 and 7) into account, we expected that destination memory would not significantly differ when comparing the choice and no-choice conditions. Interestingly, this experiment also allowed us to understand if choice, and therefore directing the attentional resources to both the facts and faces, ultimately affects destination memory since, to our knowledge, no other destination memory study tried to increase the attentional resources for both types of stimuli presented during the encoding phase.

Our destination memory test results revealed no differences between the choice and the no-choice conditions. In other words, increasing the attentional resources for both types of stimuli by having two choices while encoding each fact-face pair association did not lead to a better destination memory than having no choices available. This result, in combination with the results for the destination memory tests obtained in Study 1 and Study 2, suggests that destination memory performance is only influenced if the attentional resources are directed individually to one of the types of stimuli available at encoding. Our results provide further support to Gopie and MacLeod's (2009) assumption that the focus of attentional resources is a prevalent variable for the posterior remembering of our fact-face associations, even when diminishing the participants' passivity (El Haj, 2016; El Haj et al., 2016) by adding choices to the encoding process, a variable that was previously associated with memory improvements (Coverdale & Nairne, 2019; Murty et al., 2015, 2019; Takahashi, 1991).

Even so, the benefits of choices for our memory were still verified using this paradigm. In the item memory test, we expected that a higher memory would be observed on the choice condition compared to the no-choice condition. Our item memory results revealed a higher overall accuracy (i.e., the main effect of Choice component) on the choice condition compared to the no-choice condition. It appears that presenting choices while associating the information (i.e., facts) with recipients (i.e., faces) leads to better memory for the individual units of the association. Specifically, although the association of fact-face pairs was not affected by the presentation of two choices during encoding, a better memory was observed for facts that were previously said and for faces that were previously seen.

In conclusion, this experiment supports the focus of attentional resources as an essential variable when applying a destination memory assessment, as noted by previous literature (Gopie & MacLeod, 2009; Johnson & Jefferson, 2018). Additionally, it allowed us to clarify if directing additional attentional resources for both types of stimuli and, in that way, reducing the participants' passivity could have a differential effect on destination memory. The impact of presenting two choices in the encoding phase was observable in the item memory test since having the possibility of choice led to better memory for the individual units of the association. Nevertheless, the memory for the previously created associations (i.e., destination memory) was not affected, supporting Gopie and MacLeod's (2009) suggestion that directing attentional resources to one of the types of stimuli (i.e., fact or face) during encoding is ultimately what affects posterior destination memory performance.

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PART III

GENERAL DISCUSSION

9. The Contribution of the Present Work to Destination Memory Research

This thesis aimed to understand how having choices in what we communicate can influence destination memory. More specifically, this research focused on the effect of choice on the types of stimuli (i.e., facts and/or faces) presented during the encoding phase. We accomplished this by first introducing a choice component on the facts (Study 1) and faces (Study 2), which allowed us to ascertain the influence of choice when applied individually to one of the types of stimuli presented during encoding. We followed those studies with a final experiment (Study 3), where a choice was applied to both facts and faces to fully understand the effects of choice on destination memory. Taking into consideration all experiments of this work, results suggest that: (1) applying a choice influences destination memory, however only when applied on a single type of stimuli available at encoding; (2) the lack of differences when applying a choice to both types of stimuli provide evidence that supports the focus of attentional resources as an essential variable for understanding destination memory; and (3) how we direct the attentional resources during the encoding process may cause different effects on the individual units of the association (i.e., item memory).

This chapter will summarise the main findings from this thesis, interpreting in detail their contributions to the field of destination memory research.

9.1. How Choice Affects Destination Memory When a Single Choice is Presented

Destination memory is a type of memory that has clear implications for our interpersonal interactions, and having successful interactions is an essential aspect of how we guide our behaviour in the social world (Li & Nie, 2022). When monitoring the person to whom we told a certain piece of information fails, it causes social embarrassment. As such, it is important to understand how to avoid these monitoring flaws by understanding the variables that can lead to changes in the destination memory performance. One of the variables present in everyday communication and not accounted for in the typical destination memory procedure (Gopie & MacLeod, 2009) is choice. Previous literature referred that a potential limitation presented in the Gopie and MacLeod procedure (2009) was the passivity experienced by the participants while completing the procedure since social interactions rarely consist of having a unique piece of information to share with a person without any possibility of choice (El Haj, 2016: El Haj et al., 2016).

Choice is an important variable to explore since it reduces the participants' passivity by engaging the participant in a choice whenever a piece of information is transmitted to a recipient, and also approaches the destination memory procedure to real-life interactions. In other words, daily interactions are, by nature, not static or pre-determined. We often have several options regarding what we say and choose our information depending on the person we are speaking to at a given moment. Considering this, we designed Studies 1 and 2 to understand how applying a choice on the information or the recipient can influence destination memory performance. To do so, in Study 1, we applied a choice component on the recipient of information. More specifically, in each trial, the participant first memorised a fact and afterwards selected one of two faces to share the information with. In Study 2, we applied a choice component on the information shared, presenting two facts in each trial and allowing the selection of one of them to transmit to a recipient posteriorly. A between-subjects design was used in all of the experiments of these two studies, with all of them having a choice condition (i.e., when choices were available) and a no-choice condition (i.e., when no choice was available). After establishing all the associations between each fact and the recipient (i.e., face) during the encoding phase, the memory of these associations was then tested using two memory tests: the item memory and the associative memory test (which measured destination memory performance).

We expected that introducing a choice component would direct the attentional resources in each trial to where the choice was proposed. When a choice was available for the facts, the attentional resources would be directed to the information in each trial. The opposite happened when a choice was available for the faces, with attentional resources being directed to the recipient of the information. Gopie and MacLeod (2009) suggested that the focus of attentional resources is an important variable to consider when evaluating destination memory performance. More specifically, across three experiments, the authors found that destination memory decreased when the attentional resources were directed to the information during encoding. However, directing them to the recipient led to an increase in destination memory (Gopie & MacLeod, 2009). This pattern of results was also attained in posterior studies that manipulated the directing of the attentional resources and in other age groups (i.e., older adults; Johnson & Jefferson, 2018). Based on the robust effect on destination memory attributed to the attentional resources, we expected that in Study 1, applying a choice component on the recipient would lead to a better destination memory. In contrast, in Study 2, we expected a decrease in destination memory performance since the attentional resources were directed to the recipient through a choice component.

The results of Study 1 and Study 2 confirmed our hypotheses. They supported the importance of attentional resources since our results match the pattern of results obtained in previous studies (Gopie & MacLeod, 2009; Johnson & Jefferson, 2018). In Study 1, a destination memory improvement was attained when a choice component was applied on the faces. Furthermore, since two experiments were applied in Study 1, with different cognitive demands between them, we understood more deeply the effect of choosing the recipient of our information. In Experiment 2, the number of trials used on the associative memory task was double the number used in Experiment 1, and 10 more choices were presented during the encoding. Even with the higher number of stimuli used in Experiment 2, there were no differences between the choice condition of both experiments, which means that destination memory performance did not significantly decrease when using an experimental task with higher cognitive demands. In contrast, the no-choice condition decreased when comparing Experiments 1 and 2. In other words, even when the number of associations created during the encoding was higher, having a choice assisted in remembering previously created associations, showcasing how directing the attentional resources to the recipient during the encoding aids destination memory performance.

Nevertheless, considering only the results of Study 1, it was unclear if the benefit observed was due to the benefits of choice on memory or the directing of the attentional resources to the recipient. With that in mind, we designed Study 2, in which a choice component was applied to the information. If the effects of our first study can be explained by the widely documented benefits of choice in memory (e.g., Coverdale & Nairne, 2019; Izuma & Murayama, 2013; Murty et al., 2015, 2019; Takahashi, 1991; Watanabe & Soraci, 2004), then our results should demonstrate a destination memory benefit, regardless of where a choice was applied. However, If the variable influencing destination memory during the encoding phase was the attentional resources, then we would expect to find lower destination memory in choice than in no-choice condition.

Study 2 showed a decrease in destination memory when the choice was applied to the information. This decrease corroborated our hypothesis that the directing of attentional resources was the variable that better explains the differences obtained between Studies 1 and 2. More specifically, destination memory decreased when attentional resources were directed to the information. In contrast, the benefits of choice observed for other types of memory (e.g., Coverdale & Nairne, 2019) and hinted in destination memory studies that evaluated self-generated actions (El Haj, 2016; El Haj et al., 2016) did not occur.

In conclusion, Study 1 and Study 2 allowed us to understand the effects of choice when applied to each type of stimuli available during encoding, either facts or faces. Additionally, by adding choices to a destination memory procedure, we address some of the limitations identified in Gopie and MacLeod's (2009) study. First, we reduce the participants' passivity when completing the procedure by using a choice in each encoding trial, making the experimental procedure more engaging and demonstrating that other variables that are not considered in the original destination memory procedure may be affecting destination memory. Second, we approached this procedure to a real-life interaction, adding a variable often present when interacting with other persons. By doing so, we strengthen the suggestion given by Gopie and MacLeod (2009) that, at least in a laboratory setting, the focus of attentional resources when creating fact-face pairs is a variable that can explain shifts in the destination memory performance. Finally, we cleared the effect that a choice component can exert on destination memory, depending on where it is applied, and offered an effective way of manipulating the directing of attentional resources on a destination memory procedure, a variable we consider essential to control when designing new procedures.

9.2. How Choice Affects Destination Memory When two Choices are Presented

After understanding how a choice component can influence destination memory when applied on the information or the recipient individually, in Study 3, we aimed to understand how presenting two choices during the encoding phase, both on the information (i.e., facts) and the recipient (i.e., faces) would affect destination memory. Although presenting two choices should nullify the directing of the attentional resources, since attentional resources are distributed to both types of stimuli through the use of choices, this study also allowed us to understand if choice ultimately has any effect that is not explained by directing of the attentional resources. To our knowledge, no other destination memory studies attempted to increase the attentional resources to both types of stimuli presented during the encoding phase. In other words, by using two choices, more attentional resources will be directed to the information while choosing the fact to transmit, followed by a shift of the attentional resources to the recipient prompted by the choice presented between two faces. Thus, with Study 3, we broaden our understanding of how different applications of choices during the encoding phase of a destination memory task can explain differences in destination memory.

Akin to Studies 1 and 2, two experimental conditions were compared: the choice condition, in which two choices were available in each trial of the encoding phase; and the no-choice condition, where no choices were available, and a fact was transmitted to a recipient without an available choice in every trial. Since the previous studies showcased the importance of focusing on the attentional resources, we hypothesised that destination memory would not significantly differ when comparing the choice and the no-choice condition.

The destination memory results of Study 3 revealed no significant differences regarding destination memory performance between the choice and the no-choice condition. In other words, presenting two choices and, in that way, increasing the attentional resources that each participant allocated to both types of stimuli at different moments of encoding did not lead to a better destination memory compared to having no choices available. This lack of significant differences goes in line with the conclusions of Study 1 and Study 2, highlighting the directing of attentional resources as a prevalent variable for the posterior remembering of our interpersonal interactions. In fact, even when diminishing the participants' passivity (El Haj, 2016; El Haj et al., 2016) by adding two choices to the encoding process, a variable associated with memory improvements (Coverdale & Nairne, 2019; Murty et al., 2015, 2019), our hypothesis that destination memory between the two conditions would not differ was confirmed. In sum, it seems that destination memory performance is only influenced by choice when the attentional resources are directed individually to one of the stimuli available at encoding but not when applied to both types of stimuli simultaneously.

9.3. The Effects of Choice on the Individual Units of the Association

After understanding how the different applications of a choice component affect destination memory, it is important to clarify how it can affect the individual units of the association. To do so, we applied an item memory test in each study. In this recognition memory test, a fact or face was presented, and the objective was to recognise the stimuli presented during the encoding phase.

First, it is important to summarise the results obtained on the item memory test for each study. In Study 1, the item memory was higher for faces, regardless of the presentation of choices during the encoding phase. As for Study 2, no differences were observed regarding the type of stimuli. However, there was a difference between having a choice (i.e., choice condition) and not having any choice (i.e., no-choice condition) available while encoding. Specifically, when a choice was available, the item memory was significantly lower than when no choice was available. Finally, in Study 3, the opposite occurred, with memory for individual units of the association being benefited by the presence of two choices compared to a destination memory procedure without choices.

Focusing first on the effects caused by the choice component, Study 2 showed a higher item memory in the no-choice condition than in the choice condition, a result that was not expected since previous literature showed a robust benefit of choice in memory (Coverdale & Nairne, 2019; Murty et al., 2015, 2018). In their study, Gopie and MacLeod (2009, Experiment 2) observed a worse item memory when the attentional resources were directed to the information. More specifically, there were significant differences in memory for individual facts but not faces. When we compare the results of Study 2 to Gopie and MacLeod's second experiment (2009), although no significant difference was found between the type of stimuli, the decrease in item memory accuracy regarding facts was also notable (M = .73 for the memory for facts on the choice condition vs. M = .90 on the no-choice condition).

A possible explanation for the higher item memory observed could be the amount of information presented during the encoding phase. When more information during the encoding is presented, it becomes more challenging to recognise both facts and faces (see Gopie & MacLeod, 2009; Experiment 2). Specifically, two facts were presented in each trial in the choice condition, meaning that 100 facts were presented in this condition, twice as much as those in the no-choice condition (50 facts). However, if that was the case, then the results of Study 3 should also reflect a lower item memory in the choice condition since more information, as well as more recipients (100 faces in the choice condition vs. 50 in the no-choice condition), were presented to participants in the choice condition. This did not occur since item memory was higher in the choice condition than in the no-choice condition in Study 3.

Another possible explanation could be the extension of the facts we selected for each study. In our studies, each fact had at least four words since we used Portuguese proverbs (Barros et al., 2021). In studies where the benefits of choice on memory were demonstrated (Coverdale & Nairne, 2019; Murty et al., 2015, 2019), the stimuli chosen to be remembered were shorter in extension. For example, in Coverdale and Nairne's (2019) study, participants chose single words to be remembered (e.g., whistle), while in Murty et al. studies (2015, 2019), participants had to visualise objects. In our studies, the facts extension seems to nullify the advantages associated with choice and impair posterior remembering. In future studies, it would be interesting to apply this procedure with single words instead of facts since this would allow us to understand further and compare our results with previous literature on choice (Coverdale & Nairne, 2019; Murty et al., 2015, 2019).

Interestingly, in Study 3, while adding two choices to the encoding phase did not alter destination memory performance, it ultimately affected memory since a higher item memory in the choice condition than in the no-choice condition was observed when remembering the individual units of the associations (i.e., item memory). This could be due to the higher attentional resources being directed to both stimulus types. Specifically, it seems that adding choices to our communication may improve our memory for the elements of the association when we remember them individually (either recording what we said or to whom we said it). However, it does not improve our memory for the fact-face pair association created while sharing a piece of information with someone.

While no significant differences were attained for the main effect of type of stimuli (i.e., if memory for facts significantly differed from memory for faces, regardless of the existence of choices during the encoding process), it is interesting to note that the item memory for facts on Study 3 attained higher d' data values on the choice condition than on the no-choice condition (*M* = 2.50 vs. *M* = 2.20 respectively). The contrary happened in Study 2, in which item memory for facts in the choice condition attained lower d' data values than the no-choice condition (*M* = 2.21 vs. *M* = 2.70, respectively). When we analysed this pattern of results, it seems that the focus of attentional resources might have also influenced how individual units of an association are processed. While more information may lead to worse destination memory in some circumstances (as it occurs when we only present a choice regarding the information we share), in others, it may help us process the individual units of the association more easily (i.e., Study 3). However, more information is needed regarding the results of the item memory test in a destination memory procedure since most of the recent destination memory literature does not apply the item memory test (e.g., El Haj et al., 2015, 2018, 2020; El Haj & Ndobo, 2021).

Finally, in Study 1, no significant differences were found regarding the effect of choice on item memory. However, there was a better item memory for faces than for facts. As mentioned before, the extension of the stimuli we used as information may have influenced the remembering of the individual units of the association. In other words, while we used Portuguese proverbs as facts to ensure that the information was familiar to the participants, we used celebrity pictures as faces, the same type of stimuli applied in other destination memory procedures (El Haj et al., 2013; Gopie et al., 2010; Gopie & MacLeod, 2009). For this reason, while Gopie and MacLeod (2009, Experiment 3) did not attain any differences regarding item memory when the attentional resources were directed to the recipient, it could be that our differences may be explained by the type of information we used throughout the experiments of this thesis. As a final note on Study 1, it is also important to highlight that the number of stimuli processed during the encoding phase of Experiment 1 is lower than the number used in Studies 2 and 3. Since we did not apply an item memory test to Experiment 2 of Study 1 in which the number of stimuli presented during the encoding phase would be equal to the other studies, it is a possibility that the lack of differences in the item memory observed in Study 1 could be due to the lower number of stimuli that were encoded. As such, this limitation of Study 1 should be addressed in future studies on the effect of choice on destination memory.

Concluding, although item memory is no longer measured in recent destination memory studies (El Haj et al., 2015, 2018, 2020; El Haj & Ndobo, 2021), we argue that not gathering the data for the individual units of the associations created at encoding does not allow a complete understanding of the variables introduced on a destination memory procedure. Understanding how the variables applied can influence the processing of the individual units of the association may provide important insights regarding the stimuli selected for each study and allow better optimisation of a destination memory methodology. As such, future studies should consider applying an item memory test in conjunction with an associative memory test, especially when using stimuli that differ from others used in previous literature (e.g., using non-familiar faces, as in El Haj et al., 2015).

10. Limitations and Future Directions

This chapter focuses on the limitations of this thesis and future directions for destination memory research. First, we reflect on a different form to evaluate the effect of choice on destination memory and justify our methodological approach to the work performed in this thesis. Then, we consider the application of a methodology that allows a direct manipulation of attention. Most of our conclusions are based on the directing of attentional resources. However, we did not directly evaluate attention. Finally, we reflect upon the next step regarding the research on the effects of choice on destination memory by proposing an alternative that can further enhance our understanding of this variable.

10.1. Evaluating the Effects of the Number of Stimuli on Choice

In the introduction of this thesis, we reviewed the benefits of having a choice during the encoding process on different types of memory. These robust benefits were described by the *self-choice effect* in early literature, which can be defined as a memory advantage for self-chosen items compared to experimenter-assigned items (Takahashi, 1991). More recently, the enhancing effect of the simple act of choosing was demonstrated in declarative memory (Murty et al., 2015, 2019). Furthermore, the choice was dissociated from the congruity that it might have with its encoding context. In other words, choosing led to a better memory regardless of the match between the selected stimuli and their encoding effect (Coverdale & Nairne, 2019). In sum, simply allowing the participants to choose the stimuli to remember posteriorly and, in that way, increase their perceived control over their learning allows a better consolidation of the information and, consequently, leads to better memory (Coverdale & Nairne, 2019; Murty et al., 2015, 2019).

In this thesis, we manipulated the effect of choice on destination memory to understand if these robust benefits transcended into destination memory. However, our manipulation of how we presented the choice in each experimental procedure occurred differently from what was applied previously. In all of the choice literature described (Coverdale & Nairne, 2019; Murty et al., 2015, 2019; Takahashi, 1991), in one of the conditions, a choice was made between two or more stimuli, similar to what occurs in our choice condition. The difference between these studies and ours emerged in the other condition when no choices were available, where a different number of stimuli was applied in comparison with our no-choice condition. In those procedures (Coverdale & Nairne, 2019; Murty et al., 2015, 2019; Takahashi, 1991), a proportional number of stimuli were presented with the choice made between them being predetermined by the experimenter (e.g., the chosen stimuli appeared in a different colour and the instruction was to choose the coloured stimuli). As such, future research on the effects of choice on destination memory should examine how presenting the same number of stimuli in both the choice and the no-choice conditions affects destination memory and determine if presenting an unbalanced number of stimuli in both conditions, as it occurs in our methodology, could be influencing our results.

Nevertheless, in our thesis, one of our main objectives was to address the limitations attributed to the typical destination memory procedure, as the one applied by Gopie and MacLeod (2009) and demonstrate that there were variables that could make it more ecological or, in other words, more similar to real-life interaction. As such, we opted to compare each of our choice conditions to a typical destination memory procedure and understand if the choice was a variable that should be considered when designing new destination memory procedures.

In fact, by comparing our conditions to a procedure that is widely applied in this area of study (e.g., El Haj et al., 2013, 2020, 2021; Gopie et al., 2010; Gopie & MacLeod, 2009; Johnson & Jefferson, 2018), we argue that the present thesis offers important and interesting contributions to the destination memory literature. First, we have demonstrated that variables that occur in real-life interactions (e.g., choosing between two facts to transmit) could affect destination memory, and these are not accounted for in the typical destination memory assessment (Gopie & MacLeod, 2009). Second, we confirm that applying a choice affects destination memory, both the individual units of the association (i.e., item memory) and the recollection of the association between the information and the recipient. Additionally, we found that under different circumstances, a choice can improve or hamper destination memory, a finding that contradicts the robust benefits associated with the simple act of choosing on memory (e.g., Coverdale & Nairne, 2019; Murty et al., 2015, 2019). Lastly, we provided further support to the explanation given by Gopie and MacLeod (2009), highlighting the importance of understanding where the attentional resources are directed during the encoding phase of a destination memory procedure.

10.2. Introducing a Direct Manipulation of Attention

As mentioned before, a prominent explanation for the variability of results obtained regarding destination memory is the focus of the attentional resources during the encoding process (Gopie & MacLeod, 2009; Johnson & Jefferson, 2018). A possible problem with this explanation is that attention was not manipulated directly in these studies. The same predicament can be attributed to this thesis since we did not directly manipulate attention in our studies.

Future studies on the destination memory area of research could clarify the effects of the attentional resources on destination memory by including explicit instructions to direct the processing to some characteristics of the information or the recipients. For example, each picture could be presented with a frame around it, with frames having two different colours (e.g., green and red). Before the experiment begins, an instruction is added to pay attention to the faces with a green frame but not those with a red one. Other than this methodological change, all of the procedure was equal to the destination memory procedures described before (e.g., Gopie & MacLeod, 2009).

10.3. Evaluating the Item Memory for Unchosen Stimuli

Our thesis allowed us to understand the effects of choice on destination memory. Moreover, it clarified the differential effects of choice when applied to each stimulus available at encoding and when applied to both. Nevertheless, we cannot clearly understand how the unchosen stimuli could affect the conclusions drawn in our study. While it is difficult to evaluate the memory for unchosen stimuli on the destination memory test since we have to choose before creating each of the associations, it would be interesting to understand how the presentation of unchosen stimuli could affect the item memory test.

To do so, future research about the application of choice on destination memory could include one more experimental condition to clarify the influence of the unchosen stimuli. Thus, while the no-choice condition (i.e., a destination memory procedure akin to the one applied by Gopie & MacLeod, 2009) and the choice condition would remain equal, one more condition would be added, in which the item memory for unchosen items would be evaluated. In that condition, the memory for unchosen items would be compared with fillers (i.e., stimuli not presented during encoding), giving us a clear insight into the interference of the unchosen items on the destination memory procedure.

In summary, this thesis provides an important contribution to how choice affects our interpersonal interactions. Successful social interactions are important for our well-being, going as far as guiding our behaviour (Li & Nie, 2022). Thus, future research should focus on understanding the variables that can enhance destination memory and develop strategies and methods that can improve their accuracy through them. This would allow us to provide strategies for people to have a better remembering of their past interactions and would enhance the quality of our social life, whether they are older adults who have difficulties in monitoring the information they transmit (Gopie et al., 2010) or just forgetful people who often repeat the same story to their known ones and faces the social embarrassment of being corrected each time this repetition happens.

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APPENDIXES

Appendix A. Celebrity Database Used in all of the Studies

This empirical work was published in the Journal Behavior Research Methods. This journal is an international publication by Springer Nature, and it publishes articles concerned with the methods, techniques, and instrumentation of research in experimental psychology. In 2021, according to Scopus, it had a CiteScore of 10.7, a Scimago Journal & Country Rank (SJR) of 2.873, and a Source Normalized Impact per Paper (SNIP) of 3.572. Regarding quartiles, according to the SJR website, it was ranked in Q1 for the topic of Experimental and Cognitive Psychology, and also in Q1 for both Psychology (miscellaneous) and Arts and Humanities (miscellaneous). According to Clarivate InCites Journal Citation Reports (JCR), in 2021, this journal was ranked in Q1 for Psychology, Experimental and its Impact Factor was 5.953.

Reference:

Lima, D., Pinto, R., & Albuquerque, P. B. (2021). Recognition and naming test of the Portuguese population for national and international celebrities. *Behavior Research Methods, 53*(6), 2326-2337. https://doi.org/10.3758/s13428-021-01572-y

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A.1. Abstract

Research on familiar faces has been conducted in different countries and resorts to celebrities' faces, stimuli that are highly constrained by geographic context and cultural peculiarities since many celebrities are only famous in particular countries. Despite their relevance to psychological research, there are no normative studies of celebrities' facial recognition in Portugal. In this work, we developed a database with 160 black-and-white pictures of famous persons' faces. The data collection took place in two different studies. In Study 1, participants were asked to recognise and name celebrity faces; while in Study 2, celebrity names were rated for AoA, familiarity, and distinctiveness. Data were gathered from two different samples of Portuguese young adults aged between 18 and 25 years old, and both procedures were performed online through a questionnaire created in Qualtrics software. This database provides ratings of AoA, familiarity, facial distinctiveness, recognition rate, and naming rate for each celebrity, which will allow further selection of celebrities, based on these five attributes, for studies using Portuguese samples. Also, possible relationships between these five variables were analysed and presented, highlighting facial distinctiveness as a predictor for both naming and recognition rate of celebrity faces.

Keywords: famous persons, Portuguese database, celebrity norms

A.2. Introduction

Over the last three decades, databases have proven their value in several domains, and psycholinguistic norms have been collected for a variety of stimuli: words (e.g., the CELEX Database of Baayen et al., 1993; Bird et al., 2001; Coltheart, 1981; Cortese & Fugett, 2004; Gilhooly & Logie, 1980a, 1980b; Morrison et al., 1997; Paivio et al., 1968; Spreen & Schulz, 1966; Stuart et al., 2003); pictures and objects (Alario & Ferrand, 1999; Carroll & White, 1973; Cycowicz et al., 1997; Masterson & Druks, 1998; Szekely et al., 2004); drawings (Snodgrass & Vanderwart, 1980; Vitkovitch & Tyrrell, 1995 but see Alario et al., 2004, for a review of object naming studies); and actions (Bonin et al., 2004; Cuetos & Alija, 2003; Fiez & Tranel, 1997; Masterson & Druks, 1998; Schwitter et al., 2004; Szekely et al., 2005).

Recently, databases of faces have emerged because many researchers use photographs of persons as stimuli to study diverse psychological phenomena: emotion expression identification (Ebner & Johnson, 2009); stereotyping and prejudice (Blair et al., 2004; Livingston & Brewer, 2002); recognition of faces partially occluded with masks (Carbon, 2020; Freud et al., 2020); or interpersonal attraction (Cloutier et al., 2008; Graziano et al., 1993). Some of the databases provide high-resolution standardised pictures of male and female faces, with different ages, ethnicity, and facial emotional expressions (e.g., 10k US Adult Faces Database – Bainbridge et al., 2013; The Chicago Face Database - Ma et al., 2015; FACES Database – Ebner et al., 2010; KDEF Database – Goeleven et al., 2008). These databases can also include physical facial measures (e.g., face size, lip thickness) and subjective attributes (e.g., attractiveness, trustworthiness). Other databases consist of computer-generated faces with several traits also characterised (e.g., competence, dominance, or threat).

Also, the number of databases with pictures of celebrities is steadily increasing, and this emergence has spanned across different countries (France - Bonin et al., 2008; Spain - Marful et al., 2018; Italy - Bizzozero et al., 2007; Rizzo et al., 2002; England - Smith-Spark et al., 2006). This type of stimuli is essential because it allows us to study familiarity using human faces. When we think about familiar faces, we usually refer to our relatives, friends, or co-workers, but to use family and friends' faces for each participant would require creating a unique set of stimuli each time the experiment is implemented, which would be undoable. Therefore, since highly familiar persons vary individually, celebrities' pictures are vastly used as stimuli to emulate such a cohort of familiar persons.

Celebrities' pictures have been widely applied as stimuli in studies of varied areas, with applications in forensic psychology (Greene & Fraser, 2002), neurosciences (Ishai et al., 2002), and cognitive psychology (Cleary & Specker, 2007). For example, these stimuli have been used to understand which facial characteristics are essential for facial identification (e.g., the presence or absence of eyebrows; Sadr et al., 2003).

In the human memory field, this type of stimuli has been used for decades (e.g., Greene & Hodges, 1996). More recently, celebrities' pictures were used in destination memory procedures, a research line investigating the capacity to monitor to whom a person delivers a piece of information (Gopie et al., 2010; Gopie & MacLeod, 2009). The use of celebrities emulates people that we know and to whom we frequently transmit information.

Several models were developed to understand face processing. Those that gather a broad acceptance regarding face processing (Burton et al., 1990; Valentine et al., 1996) acknowledge that seeing a familiar face, such as a celebrity photo, activates a previously stored representation at the face recognition unit (FRU) level. This specific level contains representations of familiar faces attributes. These representations are gathered independently of perceptual features that could hamper the recognition, such as the face position, lighting, or angle.

According to these models, there are four sets of units that work cumulatively to allow face recognition: face recognition units (FRUs), person identification nodes (PINs), semantic information units (SIUs), and lexical input. These models are based on daily face recognition, with the first stage that occurs being face familiarity. This happens at the PINs level, and if a PIN's activation exceeds a given threshold, a face can be recognised without the ability to name it correctly. Afterwards, the semantic information associated with the face becomes available (e.g., a person's occupation); however, there is still an absence of name retrieval. According to this model, general semantic details are easier to access than people's names, making this general information available earlier in the processing stream. This moment in the processing may cause the emergence of a tip-of-the-tongue (TOT) state for a person's name. Sometimes, people have only access to information related to a target word they are trying to retrieve (e.g., Schwartz & Metcalfe, 2011). In the final stage, retrieval of the person's name may finally occur.

When using faces of celebrities as stimuli, it is important to ensure that the photographs presented to the participants are recognisable. More importantly, the participants adequately naming them ensures familiarity with celebrities. Despite this greater difficulty in face naming, Brédart (1993) has demonstrated a positive relationship between celebrity names' rated familiarity and naming accuracy. So, although face naming presents a higher challenge to the participants, we should request a naming task to ensure celebrity familiarity.

In addition to the development of models that explain face recognition and face naming, some variables that influence these processes have also been identified: familiarity, distinctiveness, and age of acquisition. Familiar faces are recognised more accurately than unfamiliar faces (Klatzky & Forrest, 1984), and distinctive faces are better recognised than less distinctive or more typical ones (Knapp et al., 2006). Also observed was an accuracy advantage in face naming for early-acquired over late-acquired famous faces (Smith-Spark & Moore, 2009).

With celebrities' pictures as stimuli in such a wide variety of studies, collecting normative data to depict familiar faces is fundamental. However, the selection of famous people is constrained by the geographic and socio-cultural contexts in which the studies are conducted. Although we can find universally known celebrities, most are only famous in niche contexts. For example, only 2% of the famous people in the British norms (Smith-Spark et al., 2006) appeared later in the French norms (Bonin et al., 2008). This justifies the contribution this work can bring to experimental studies with celebrities' persons to be implemented in Portugal. With that objective in mind, data concerning the face recognition, naming, familiarity, facial distinctiveness, and AoA of 160 celebrities, Portuguese and international and male and female, were gathered from a sample of Portuguese young adults aged between 18 and 25 years old.

The data collection took place in two different studies. In Study 1, participants were asked to recognise and name celebrity faces (e.g., Cristiano Ronaldo). In Study 2, celebrity names were rated for AoA, familiarity, and distinctiveness. Also, possible relationships between these variables were analysed and presented.

A.3. Study 1

The first phase in constructing the celebrity database involves selecting famous people as stimuli. With that in mind, the first step was determining which categories of fame (e.g., actors) were identified to be used. The authors chose a diversity of categories to encompass as many fields of fame as possible, which was also used in previous celebrity databases (Bonin et al., 2008; Smith-Spark et al., 2006). Ten categories were identified, both for national and international celebrities: actors, comedians, football coaches, sports players, athletes, TV hosts, musicians/singers, politicians, influential personalities, and royalty members. After searching the categories on the Internet and considering the celebrities' names most frequently searched in 2019, 160 celebrities were obtained. Study 1 collected the recognition and naming rates for those 160 celebrities.

A.3.1. Method

A.3.1.1. Participants. This study involved 379 participants. Since these norms' main aim is to use them with young adults, we defined age as a participants' inclusion criterion considering the range between 18 and 25 years old. However, since the experiment was conducted online, a wide range of participants' ages was obtained (18 to 62). Of the 379 participants collected, we eliminated 173 who were over 25 years old. The final sample integrated 206 participants (48 males, 156 females, and two others), aged between 18 and 25 years old (M = 22.29; SD = 2.11). The selected participants were randomly assigned into four groups, each recognising and naming a distinct group of famous persons (see Table A.1).

Table A.1

Demographic characteristics of the groups of participants for Experiment 1 of Appendix A

	N	Male	Female	Other	Age
Group A	53	11	41	1	22.28
Group B	53	14	39	-	21.96
Group C	51	8	43	-	22.27
Group D	49	15	33	1	22.67

A.3.1.2. Design. We applied a 2 × 2 within-subjects design, where each participant was required to recognise and name celebrities' faces from both conditions: background (International and Portuguese) and sex (male and female). To avoid the influence of fatigue, each participant had to answer to one of the four lists, each corresponding to only 40 out of 160 faces. While performing the task, the participant engaged in two different answers: an identification decision, in which the participant simply answered if he recognised the face presented; and a naming response, in which the participant wrote the name of the celebrity shown. Our dependent variables are the celebrities' correct recognition rate and naming rate.

A.3.1.3. Materials. The final set of pictures included in the dataset was researched and culled from various Internet resources. All were frontal pictures, measured 9 cm2, and were converted into black and white (when necessary) using Adobe Photoshop CC (Adobe Systems Incorporated, 2014). Given that context affects face recognition (Deffler et al., 2015) and our objective was to access the recognition of faces regardless of the context, the presentation of faces occurred in a background without any distinguishable features.

A total of 160 photos were organised according to two orthogonal categories: Portuguese or International; male and female. All photos are available at https://osf.io/rvc62/?view_only=1f1dd2371d7d4b548c2583e875dcc093.

Lastly, as mentioned before, to reduce the total time that the participants spent on the online response procedure, four sets of 40 photos each were created. Each set contained 10 International female celebrities, 10 International male, 10 Portuguese female, and 10 Portuguese male celebrities.

A.3.1.4. Procedure. Online or web surveys have been increasingly used in psychological research due to their advantages, such as low cost (see Couper, 2000 for a review). We created an online questionnaire in *Qualtrics* software (Qualtrics, 2015) since it allows direct access to many participants. The link to the questionnaire was placed on the social network *Facebook*, and an invitation with the questionnaire link was sent via e-mail to all students attending a university in the north of Portugal.

At the beginning of the experiment, the informed consent and the questionnaire's instructions were presented to the participants. Afterwards, participants had to answer two questions regarding each face. The first question was a yes/no answer where the participant was questioned if he recognised the presented face. The second one was a text entry box in which the participant should write the name of the person presented. There was also an option to leave it blank and skip to the following stimulus if the participant recognised the celebrity but could not name it.

Each participant was randomly assigned to one of the four manipulated sets of photos and rated 40 out of 160 images. The 40 pictures of each set were presented in random order.

A.3.1.5. Analyses. To make sure that participants were engaged in the task, we decided to eliminate all the participants that did not recognise at least 50% of the Portuguese celebrities presented (corresponding to 10 faces shown) and 50% of the International celebrities (10 faces), with 21 participants being eliminated.

Answers were considered wrong when the participants wrote the character's name and not the actor's name, for example, when Johnny Deep was addressed as Jack Sparrow (his character from the movie "Pirates of the Caribbean").

A.3.2. Results and Discussion

Study 1 aimed to provide norms regarding face recognition and face naming of a set of 160 celebrities (both Portuguese and International), supplying rates of recognition and naming tasks for each face. Descriptive statistics corresponding to the recognition and naming rate are presented in Table A.2.

Table A.2

Descriptive statistics for recognition and naming rate for Experiment 1 of Appendix A

	Mean	SD	Median	Minimum	Maximum
Recognition rate (%)	91.41	10.89	94.34	39.22	100.00
Naming rate (%)	77.04	17.12	79.99	21.57	100.00

The celebrity with the lowest recognition rate was recognised by 39.22% of the participants, and the celebrity with the lowest naming rate had an average of 21.57%. There were celebrities with an average of 100%, both in recognition and naming rates. Also, as expected, the faces' average naming rate was lower than the average recognition rate. This result is in line with the face processing models (Burton et al., 1990; Valentine et al., 1996), which established that face naming is more difficult than recognition.

Regarding recognition rate, 142 of the presented faces (*N* = 160) had a recognition rate between 80% and 100%, 13 between 60% and 80%, four between 40% and 60%, and only one face had a recognition rate between 20% and 40%. Considering naming rate, 80 of the presented faces had a naming rate between 80% and 100%, 55 between 60% and 80%, 19 faces between 40% and 60%, and only six faces had a recognition rate between 20% and 40%. The face naming rate and the face recognition rate by background (i.e., International or National) and sex are available in Table A.3.

Table A.3

Number of faces as a function of recognition rate by background and sex for Experiment 1 of Appendix A

Recognition rate (%)	International Male	International Female	National Male	National Female	Total
80-100	34	34	38	36	142
60-80	4	5	1	3	13
Less than 60	2	1	1	1	5
Naming rate (%)	**International Male**	**International Female**	**National Male**	**National Female**	**Total**
80-100	17	21	24	18	80
60-80	16	13	13	13	55
Less than 60	7	6	3	9	25

Table A.3 shows that 142 faces had a recognition rate between 80% and 100%, but only 80 faces had a naming rate between 80% and 100%, emphasising the greater difficulty in the naming task. The large number of faces accurately identified (up to 80%) turns this database an important asset to apply to paradigms that intend to use well-known faces.

A.4. Study 2

As discussed previously, it is essential to have control of several variables known to influence celebrity recognition. To accomplish it, each famous person presented in Study 1 was also rated for AoA, familiarity, and distinctiveness in Study 2. These variables were selected based on previous research and celebrities' face norms (Bonin et al., 2008; Smith-Spark et al., 2006).

A.4.1. Method

A.4.1.1. Participants. This study involved 180 participants (37 males, 143 females; M= 22.68; SD = 2.42). As in Study 1, participants above 25 or below 18 years were excluded (i.e., 37 participants). Participants were randomly assigned to one of four groups, with each one answering to 40 different celebrities. Participants were instructed to rate familiarity, facial distinctiveness, and AoA of each celebrity's name presented. The demographic characteristics of the four groups are presented in Table A.4.

Table A.4

Demographic characteristics of the groups of participants for Experiment 2 of Appendix A

	N	Male	Female	Age
Group A	45	11	34	22.08
Group B	45	12	33	23.51
Group C	45	7	38	22.36
Group D	45	7	38	22.78

A.4.1.2. Design. We applied a within-subjects design in which the independent variables were the same as the ones used in Study 1. To each participant, both Portuguese and International, as well as male and female celebrities, were presented. However, differently from Study 1, in which we evaluate celebrity faces' recognition and naming, each participant answered three new measures previously considered in other celebrity faces databases (Bonin et al., 2008; Marful et al., 2018; Smith-Spark et al., 2006). Familiarity, expressing the number of times the participants heard about the celebrity throughout their life, was measured using a Likert scale that ranges from 1 – never to 7 – more than once every day. Facial distinctiveness, evaluating if celebrity facial features were easy or hard to recognise, was measured using a Likert scale ranging from 1 – typical, hard-to-spot face to 7 – distinctive, easy-to-spot face. Finally, AoA, where participants wrote, using a text entry box, the age, in years, in which they believed they had first become aware of each famous person.

A.4.1.3. Materials. The celebrities presented in Study 2 were the same as the ones shown in Study 1. However, instead of photos, a celebrity name was presented in each trial. As in Study 1, to reduce the total time that the participants spent in their participation, four sets of 40 names were created. The distribution of the sets was the same as performed for Study 1.

A.4.1.4. Procedure. The COVID-19 pandemic has made the use of online/web surveys even more pertinent, offering an alternative in which social contact is limited and the advantages mentioned before, such as the low cost of applying these research procedures (for a review, see Couper, 2000). The online questionnaire was created in the *Qualtrics* software (Qualtrics, 2015). The participants' recruitment was implemented by sharing the questionnaire link on social networks and e-mail to all the students attending a university in the north of Portugal.

At the beginning of the study, the informed consent and the questionnaire's instructions were presented to the participants. In each of the trials, participants were exposed to a celebrity name and had to answer three different questions: how many times in their lifetime they had heard, seen, read about, or otherwise been reminded of each of the celebrities (familiarity); how easy each celebrity would be to recognise from just his or her facial features (distinctiveness); and how old they were when they had first become aware of each famous person (AoA). When participants did not know the celebrity, they were instructed to leave the AoA question blank or merely write a "0" to signal that they did not recognise the celebrity's name. Each participant was randomly assigned to one of the four lists of 40 celebrities' names.

A.4.2. Results and Discussion

Descriptive statistics regarding familiarity, facial distinctiveness, and AoA are presented in Table A.5. In our study, the level of familiarity (*M* = 2.84) was slightly lower than other celebrities' databases (Smith-Spark et al., 2006: *M* = 3.92; Bonin et al., 2008: *M* = 2.98; Marful et al., 2018: *M* = 3.16). On the other hand, the facial distinctiveness mean (*M* = 5.17) was higher than other similar databases (Smith-Spark et al., 2006: *M* = 3.67; Marful et al., 2018: *M* = 4.89). Nevertheless, our results are very similar to those presented by Bonin et al. (2008), which attained a mean of 5.41 in their study.

Table A.5

Descriptive statistics for familiarity, facial distinctiveness, and AoA for Experiment 2 of Appendix A

	Mean	SD	Median	Minimum	Maximum
Familiarity (1-7)	2.84	.60	2.79	1.47	5.11
Facial distinctiveness (1-7)	5.17	.85	5.30	2.67	6.67
AoA (Years)	13.27	2.12	12.98	9.27	19.31

Regarding AoA mean (*M* = 13.27), we also compared our values with other celebrities' databases. Although we employed a different data collection procedure from the one used by Bonin et al. (2008), but equal to the data collection procedure used by Marful et al. 2018, our study means was similar to what was reported in the other databases, where the AoA means were around 12/13 years old.

It is also interesting to note that most faces were judged as distinctive (i.e., half of the celebrities had a facial distinctiveness rate above 5.30 on a Likert scale from 1 to 7). The mean ratings (i.e., recognition, naming, familiarity, distinctiveness, and AoA) for each celebrity are presented in Table A.7.

To detect possible relationships between our dependent variables, we ran bivariate Pearson correlations considering recognition rate, naming rate, familiarity, facial distinctiveness, and AoA. The software used for the data analysis was JASP 0.11.1 (JASP Team, 2019). Table A.6 shows a comparison of the results obtained in our study with the results of the same correlations obtained in other celebrities' databases (Bonin et al., 2008; Marful et al., 2018; Smith-Spark et al., 2006).

In our study, we found that the recognition rate was positively and significantly correlated with familiarity, $r(158) = .39$, $p < .001$, naming rate, $r(158) = .72$, $p < .001$, and facial distinctiveness, $r(158) = .54$, $p < .001$. There was a higher recognition rate for higher familiar and distinctive faces. Additionally, participants who were capable of naming a celebrity answered "yes" in the recognition task. This result was expected since participants needed first to recognise a celebrity to name it posteriorly. Furthermore, a negative correlation was observed between recognition rate and AoA, $r(158) = -.16$, $p = .05$. This last result regarding recognition rate and AoA reveals that celebrities acquired early in life were better recognised than those later in life.

Again, and like other celebrity databases (Bonin et al., 2008; Marful et al., 2018; Smith-Spark et al., 2006), we did not find a significant correlation between familiarity and AoA, but found that familiarity (known as the subjective frequency in some studies) was positively correlated with facial distinctiveness, $r(158) = .78$, $p < .001$, and naming rate, $r(158) = .62$, $p < .001$. Celebrities who were more frequently encountered were perceived as more distinctive and more easily named. We also found that naming rate was positively correlated with facial distinctiveness, $r(158) = .78$, $p < .001$, and negatively with AoA, $r(158) = - 31$, $p < .001$, which is consistent with what was observed in the other databases mentioned. Celebrities acquired early, and distinctive celebrities were more easily named. Lastly, a significant negative correlation was found between AoA and facial distinctiveness, $r(158) = -311$, $p < .001$. Famous people acquired early in life were considered more facially distinctive.

Table A.6

Bivariate (Pearson) correlations: Comparison with other celebrity databases of Appendix A

	Our study		**Smith-Spark et al. (2006)**		**Bonin et al. (2008)**		**Marful et al. (2018)**	
	r	*p*	*r*	*p*	*r*	*p*	*r*	*p*
Recognition rate vs Familiarity	.39	< .001	-	-	-	-	-	-
Recognition rate vs Naming rate	.72	< .001	-	-	-	-	-	-
Recognition rate vs Facial distinctiveness	.54	< .001	-	-	-	-	-	-
Recognition rate vs AoA	-.16	0.05	-	-	-	-	-	-
Familiarity vs Naming rate	.62	.001	.32	<.001	.45	<.01	.49	<.01
Familiarity vs Facial distinctiveness	.78	< .001	.93	<.001	.54	<.01	.18	<.05
Familiarity vs AoA	-.14	n.s	-.07	n.s	.04	n.s.	.43	<.01
Naming rate vs Facial distinctiveness	.78	< .001	.30	<.001	.85	<.01	.54	<.01
Naming rate vs AoA	-.31	< .001	-.14	<.001	- .49	<.01	-.16	n.s.
Facial distinctiveness vs AoA	-.34	< .001	-.05	n.s.	-.43	<.01	-.37	<.01

Two multiple regression analyses were also carried out in this study to determine which variables can predict recognition and naming rate. Firstly, a multiple regression was applied to face recognition rate as the dependent variable, and familiarity, AoA, and facial distinctiveness were considered as factors. Secondly, we conducted a multiple regression with the same factors but using face naming rate as the dependent variable. Results of the first multiple regression indicated that a significant collective effect was found between the familiarity, AoA, facial distinctiveness, and recognition rate, $F(3, 156) = 21.89$, $p < .001$, $R^2 = .30$, meaning that the three factors are indeed related to face recognition rate. However, upon further examination, only facial distinctiveness, $t(156) = 5.51$, $p < .001$, was a significant predictor in the model, meaning that facial distinctiveness is the only factor that can predict the face recognition rate performance.

In the second multiple regression analysis, we also found a collective significant effect between the familiarity, AoA, facial distinctiveness, and naming rate, $F(3, 156) = 80.33$, $p < .001$, $R^2 = .61$. Upon further examination, only facial distinctiveness, $t(156) = 8.21$, $p < .001$, was a significant predictor in the model.

A.5. General Discussion

The data reported in this article will allow researchers to select highly recognisable stimuli for Portuguese young adults. This will facilitate the ease with which the listed stimuli can be matched on five important attributes. The database provides ratings of AoA, familiarity, facial distinctiveness, recognition rate, and naming rate for each celebrity.

These norms can be expected to stand as a valuable tool for different research areas since celebrities' pictures have been widely applied as stimuli in studies of varied areas, including human memory (Gopie & MacLeod, 2009). Considering an applied context, this database can be used in tests for the assessment of patients with traumatic brain injury, aphasias, amnesia, and/or dementia – tests of famous face naming are particularly useful in the early detection of some diseases since these patients typically present sensitivity for names at the onset of the disease (i.e., have greater difficulty in the naming of familiar faces; Semenza et al., 2000). However, when performing tests with different age groups and/or psychiatric populations, validation should first be applied using this set of face images (Rizzo et al., 2002).

Although this study adopts an extensive set of celebrities from a wide range of categories (e.g., actors, comedians, athletes, politicians, among others), there are some limitations associated with databases of faces that use a set of celebrities. As mentioned before, the first limitation is one of the drives for this study: celebrity norms are highly constrained by geographic context (Marful et al., 2018) because some celebrities are famous only in particular countries. Knowledge and fame of celebrities shift between countries, which on the one hand, justifies the necessity of databases appropriated for each population, but, on the other hand, limits the usage of this database to studies with Portuguese participants. So, this database will help studies be implemented in Portugal since it was validated for usage with this population. However, the international celebrity pictures used in this study (and made available through the OSF) could be posteriorly validated for other nations, giving this current database the potentiality of a universal application as long as the validation is carried out thoroughly.

Nevertheless, as stated before, and despite the relevance of familiar faces for psychological research, there are no normative studies for celebrities in Portugal, which explains this database's relevance and importance. It is also important to underline that this database should be used with young adults since our sample was constituted of participants with an age interval of 18 to 25 years old. However, this limitation does not weaken this database, as most studies are conducted at universities and, therefore, with young adults. In future research, a database where data gathering is achieved using older adults could allow its application in varied age groups.

Nevertheless, it provides a validated database of celebrity faces for use in the Portuguese population and marks an important first step in standardising procedures that use this type of stimuli. Lastly, it provides a set of pictures to be used in future studies that aim to add those crucial measures to the data provided in this study.

Table A.7

Recognition rate, naming rate, familiarity, facial distinctiveness and AoA of 160 celebrities of Appendix A

Background	Sex	Name	Recognition rate (%)	Naming rate (%)	Familiarity M (SD)	Facial Distinctiveness M (SD)	AoA M (SD) [N]
International	Male	Barack Obama	100.00	100.00	3.24 (1.17)	6.38 (1.15)	14.02 (4.34) [45]
International	Male	Michael Jackson	100.00	100.00	2.91 (1.22)	6.33 (1.37)	10.2 (3.47) [45]
International	Male	Donald Trump	100.00	97.96	4.64 (1.32)	6.64 (0.83)	17.73 (3.04) [45]
International	Male	Steve Jobs	100.00	86.27	2.53 (0.81)	4.91 (1.98)	15.27 (2.69) [44]
International	Male	Papa Francisco	100.00	83.02	3.31 (1.26)	5.22 (1.77)	16.87 (3.9) [45]
International	Male	Jackie Chan	100.00	79.25	2.62 (1.21)	5.6 (1.81)	10.36 (3.48) [44]
International	Male	Morgan Freeman	100.00	69.39	2.49 (1.22)	5.38 (2.2)	12.97 (3.94) [38]
International	Male	Justin Bieber	98.11	96.23	3.02 (1.2)	5.93 (1.32)	13.16 (3.44) [45]
International	Male	Leonardo DiCaprio	98.11	88.68	3.13 (0.87)	6.2 (1.16)	11.16 (3.63) [45]
International	Male	George Clooney	98.11	77.36	2.56 (0.78)	5.89 (1.77)	11.69 (2.79) [45]
International	Male	Johnny Deep	98.04	92.16	3.07 (1.21)	6.22 (1.26)	13.59 (3.32) [44]
International	Male	Paul Walker	98.04	70.59	2.58 (1.18)	5.42 (1.85)	14.52 (3.55) [44]
International	Male	Brad Pitt	97.96	93.88	3.16 (1.15)	5.84 (1.46)	10.77 (2.98) [44]
International	Male	Bruno Mars	96.23	94.34	3.02 (1.47)	5.49 (1.78)	13.29 (4.29) [45]
International	Male	Tom Cruise	96.23	69.81	2.64 (0.91)	5.36 (1.73)	12.33 (2.85) [45]
International	Male	Dwayne Johnson	96.08	80.39	2.51 (1.22)	4.91 (2.4)	15.1 (3.18) [40]

Background	Sex	Name	Recognition rate (%)	Naming rate (%)	Familiarity M (SD)	Facial Distinctiveness M (SD)	AoA M (SD) [N]
International	Male	Vladimir Putin	96.08	78.43	2.8 (0.92)	4.91 (2.4)	16.25 (2.89) [44]
International	Male	David Beckham	95.92	87.76	2.56 (0.92)	5.27 (1.85)	12.56 (3.11) [45]
International	Male	Adolf Hitler	94.34	92.45	3.27 (1.48)	6.16 (1.51)	10.89 (2.57) [44]
International	Male	Steve Jobs	100.00	86.27	2.53 (0.81)	4.91 (1.98)	15.27 (2.69) [44]
International	Male	Justin Timberlake	94.12	90.20	2.87 (1.16)	5.29 (1.79)	12.42 (2.88) [45]
International	Male	Eminem	92.45	88.68	3.31 (1.56)	4.84 (2.02)	12.2 (2.81) [44]
International	Male	Nicolas Cage	91.84	55.10	2.09 (0.85)	4.02 (2.21)	14.33 (2.99) [39]
International	Male	Bradley Cooper	90.20	56.86	2.71 (0.82)	5.29 (1.73)	17.87 (3.29) [44]
International	Male	Robert Downey Jr.	90.20	50.98	1.8 (1.06)	3.36 (2.43)	16.38 (4) [37]
International	Male	Will Smith	88.68	73.58	2.67 (0.93)	5.36 (1.97)	13.3 (3.64) [44]
International	Male	Jim Carrey	88.68	60.38	2.27 (0.96)	4.47 (2.22)	13.55 (3.55) [38]
International	Male	Neymar	88.24	82.35	2.91 (1.26)	5.4 (1.91)	16.49 (3.57) [45]
International	Male	Ryan Reynolds	87.76	63.27	2.27 (1.32)	3.73 (2.34)	16.08 (4.12) [38]
International	Male	Martin Luther King	84.91	66.04	2.56 (1.03)	5.2 (1.87)	12.85 (2.41) [41]
International	Male	Jared Leto	84.91	62.26	2.42 (1.14)	4.8 (2.22)	14.33 (3.37) [40]
International	Male	Ryan Gosling	84.91	47.17	2.04 (1.15)	3.67 (2.53)	16.06 (3.48) [35]

Background	Sex	Name	Recognition rate (%)	Naming rate (%)	Familiarity M (SD)	Facial Distinctiveness M (SD)	AoA M (SD) [N]
International	Male	Lionel Messi	83.02	83.02	3.44 (1.41)	5.93 (1.63)	12.44 (2.81) [43]
International	Male	Ronaldinho	81.13	71.70	2.07 (0.99)	3.8 (2.48)	13.13 (3.93) [40]
International	Male	Elvis Presley	81.13	67.92	2.44 (1.08)	5.22 (1.82)	12.02 (3.88) [44]
International	Male	Freddie Mercury	79.59	75.51	3.09 (1.52)	5.24 (1.94)	12.49 (3.14) [45]
International	Male	George W. Bush	77.55	67.35	1.87 (0.73)	3.18 (2)	13.63 (4.14) [38]
International	Male	Enrique Iglesias	71.43	63.27	2.4 (1.03)	3.51 (2.06)	13.51 (3.57) [43]
International	Male	Samuel L. Jackson	67.92	28.30	2.58 (1.18)	4.96 (2.39)	13.13 (4.66) [39]
International	Male	Kurt Cobain	56.60	49.06	2.33 (1.13)	4.47 (2.34)	13.67 (4.43) [39]
International	Male	Pelé	39.22	21.57	2.04 (0.64)	3.22 (1.95)	14.02 (4.04) [43]
International	Female	Adele	100.00	100.00	3.51 (1.2)	5.6 (1.84)	15.91 (3.87) [45]
International	Female	Amy Winehouse	100.00	96.23	1.93 (1.16)	4.53 (2.73)	12.34 (3) [44]
International	Female	Michelle Obama	100.00	94.12	3 (1.13)	5.98 (1.54)	15.27 (2.88) [45]
International	Female	Ellen DeGeneres	100.00	86.79	2.93 (1.78)	4.96 (2.4)	15.51 (3.07) [37]
International	Female	Rihanna	98.11	98.11	3.51 (1.39)	6.18 (1.39)	11.4 (3.81) [45]
International	Female	Princesa Diana	98.11	94.34	2.51 (1.25)	5.36 (2.11)	10.02 (3.61) [44]
International	Female	Rainha Elizabeth	98.11	92.45	2.91 (1.02)	5.53 (1.97)	10.9 (3.92) [41]
International	Female	Selena Gomez	97.96	91.84	2.82 (0.89)	5.73 (1.56)	11.89 (3.66) [44]
International	Female	Angelina Jolie	96.23	92.45	3.16 (0.93)	6.38 (1.32)	10.41 (3.19) [44]
International	Female	Nicki Minaj	96.23	79.25	2.93 (1.1)	5.8 (1.55)	15.48 (3.97) [44]
International	Female	Jennifer Aniston	96.23	73.58	3.22 (1.62)	5.31 (2.09)	12.45 (2.85) [40]
International	Female	Jennifer Lopez	96.08	90.20	3.31 (1.35)	5.98 (1.16)	12.05 (3.74) [44]
International	Female	Kim Kardashian	96.08	84.31	3.69 (1.53)	5.73 (1.9)	16.53 (2.97) [45]
International	Female	Sandra Bullock	96.08	62.75	2.31 (0.87)	4.87 (2.12)	15.05 (3.35) [43]
International	Female	Shakira	95.92	87.76	3 (1.02)	6.2 (1.16)	10.78 (3.05) [45]
International	Female	Pink	94.34	88.68	2.56 (1.06)	5 (2.3)	12.29 (2.57) [42]
International	Female	Ariana Grande	94.34	77.36	3.51 (1.41)	6.02 (1.44)	15.8 (4.07) [44]
International	Female	Madonna	94.12	88.24	2.89 (1.17)	5.56 (1.89)	12.09 (3.5) [44]
International	Female	Emma Watson	94.12	76.47	2.78 (1.02)	4.98 (1.9)	13.8 (3.33) [44]
International	Female	Oprah Winfrey	93.88	83.67	2.56 (0.81)	5.44 (1.57)	14.5 (3.28) [44]
International	Female	Beyoncé	92.45	86.79	3.36 (1.13)	6.4 (1.03)	11.32 (2.64) [44]
International	Female	Angela Merkel	90.57	86.79	3.33 (1.24)	5.22 (1.72)	15.07 (3.24) [43]
International	Female	Julia Roberts	90.57	58.49	2.71 (1.47)	4.96 (2.09)	13.85 (3.58) [40]
International	Female	Cameron Diaz	90.57	47.17	2.47 (1.34)	4.69 (2.1)	12.24 (3.74) [38]
International	Female	Taylor Swift	88.68	84.91	2.98 (1.01)	5.87 (1.47)	13.56 (3.16) [45]
International	Female	Marilyn Monroe	88.68	81.13	2.71 (1.42)	6.31 (1.46)	12.21 (3.38) [43]
International	Female	Hilary Clinton	88.68	73.58	2.62 (1.21)	4.73 (2.13)	15.5 (2.94) [42]

Background	Sex	Name	Recognition rate (%)	Naming rate (%)	Familiarity M (SD)	Facial Distinctiveness M (SD)	AoA M (SD) [N]
Portuguese	Male	José Mourinho	100.00	96.23	3.42 (1.42)	5.62 (1.64)	11.11 (3.3) [44]
Portuguese	Male	Angélico Vieira	100.00	95.92	2.84 (1.58)	5.62 (1.76)	10.7 (3) [43]
Portuguese	Male	Eusébio	100.00	95.92	2.42 (1.1)	5.71 (1.66)	11.02 (3.55) [45]
Portuguese	Male	Ricardo Quaresma	100.00	94.34	2.84 (1.04)	5.73 (1.8)	12.05 (3.79) [43]
Portuguese	Male	Marcelo Rebelo de Sousa	100.00	94.12	4.47 (1.32)	6.6 (1.1)	14.49 (3.17) [43]
Portuguese	Male	António Costa	100.00	90.57	5.11 (1.58)	5.89 (1.58)	17.09 (2.99) [44]
Portuguese	Male	César Mourão	100.00	90.20	3.44 (1.06)	5.91 (1.55)	16.02 (4.33) [45]
Portuguese	Male	Bruno de Carvalho	100.00	89.80	2.67 (1)	4.56 (1.79)	18.38 (2.94) [45]
Portuguese	Male	Ricardo Araújo Pereira	100.00	89.80	3.69 (1.31)	6.02 (1.23)	12.71 (3.65) [45]
Portuguese	Male	João Baião	100.00	85.71	3.76 (1.54)	5.76 (1.68)	11.83 (3.79) [42]
Portuguese	Male	José Carlos Malato	100.00	79.59	2.53 (1.14)	4.73 (2.13)	11.81 (3.46) [42]
Portuguese	Male	João Paulo Rodrigues	100.00	73.58	2.51 (1.14)	4.64 (2.37)	13.93 (3.6) [40]
Portuguese	Male	Manuel Luís Goucha	98.11	96.23	3.8 (1.56)	6.2 (1.41)	11.34 (3.91) [44]
Portuguese	Male	Herman José	98.11	94.34	2.67 (1)	5.6 (1.85)	10.84 (3.47) [43]
Portuguese	Male	Fernando Mendes	98.11	86.79	3.89 (1.54)	6.18 (1.59)	9.27 (4.13) [44]
Portuguese	Male	Michael Carreira	98.11	84.91	2.51 (0.87)	5 (1.92)	13.59 (4.26) [44]
Portuguese	Male	Nicolau Breyner	98.11	79.25	2.69 (1.18)	5.67 (1.67)	11.37 (3.85) [43]

ckground	Sex	Name	Recognition rate (%)	Naming rate (%)	Familiarity M (SD)	Facial Distinctiveness M (SD)	AoA M (SD) [N]
International	Female	Katy Perry	87.76	83.67	3.24 (1.33)	5.4 (1.59)	12.98 (3.95) [44]
International	Female	Britney Spears	86.79	75.47	2.8 (0.97)	5.76 (1.65)	11.07 (3.07) [44]
International	Female	Megan Fox	86.27	66.67	2.22 (1.11)	4.53 (2.28)	15.61 (3.95) [41]
International	Female	Mariah Carey	86.27	62.75	2.67 (1.24)	4.62 (2.22)	12.18 (3.8) [44]
International	Female	Demi Lovato	85.71	81.63	2.93 (1.5)	5.02 (2.01)	11.52 (3.95) [44]
International	Female	Christina Aguilera	82.35	62.75	2.53 (1.1)	4.42 (2.03)	13.47 (3.49) [43]
International	Female	Kate Middleton	81.13	66.04	2.98 (1.62)	4.93 (2.03)	15 (3.63) [42]
International	Female	Anne Frank	79.59	77.55	2.71 (1.53)	4.47 (1.9)	12.12 (2.43) [43]
International	Female	Halle Berry	79.59	34.69	1.51 (0.73)	2.76 (2.24)	16.48 (4.1) [31]
International	Female	Scarlett Johansson	77.55	55.10	2.44 (0.94)	4.89 (2.17)	14.98 (3.24) [40]
International	Female	Lady Gaga	75.47	71.70	3.42 (1.36)	5.78 (1.74)	12.09 (4.03) [43]
International	Female	Jessica Alba	71.43	44.90	1.89 (1.09)	3.51 (2.17)	15.56 (3.83) [36]
International	Female	Serena Williams	42.86	32.65	1.91 (0.73)	3.71 (2.18)	15.81 (3.83) [42]
Portuguese	Male	Cavaco Silva	100.00	100.00	3.18 (1.4)	5.42 (1.96)	12.05 (2.95) [44]
Portuguese	Male	Cristiano Ronaldo	100.00	100.00	4.8 (1.41)	6.67 (0.77)	11.26 (3.81) [43]
Portuguese	Male	José Sócrates	100.00	98.11	3.27 (1.4)	5.91 (1.56)	12.35 (3.88) [43]
Portuguese	Male	Tony Carreira	100.00	98.11	2.69 (0.73)	6 (1.45)	9.33 (3.18) [45]
Portuguese	Male	Salvador Sobral	100.00	97.96	2.38 (0.75)	5.78 (1.22)	18.09 (3.05) [45]

Background	Sex	Name	Recognition rate (%)	Naming rate (%)	Familiarity M (SD)	Facial Distinctiveness M (SD)	AoA M (SD) [N]
Portuguese	Female	Cristina Ferreira	100.00	100.00	4.89 (1.39)	6.42 (0.89)	12.72 (4.18) [43]
Portuguese	Female	Teresa Guilherme	100.00	98.04	3.07 (1.19)	6.27 (1.36)	12.22 (3.1) [45]
Portuguese	Female	Luciana Abreu	100.00	97.96	3.36 (1.52)	5.93 (1.25)	10.27 (3.83) [44]
Portuguese	Female	Mariza	100.00	96.23	2.93 (1.14)	6.22 (1.2)	12.67 (3.46) [43]
Portuguese	Female	Fátima Lopes	100.00	94.34	3.71 (1.65)	6.02 (1.34)	10.4 (4.01) [43]
Portuguese	Female	Daniela Ruah	100.00	91.84	2.73 (1.01)	5.31 (1.72)	13.12 (3.33) [43]
Portuguese	Female	Bárbara Guimarães	100.00	89.80	2.71 (1.18)	5.64 (1.42)	11.49 (4.46) [45]
Portuguese	Female	Cláudia Vieira	100.00	89.80	3.29 (1.36)	5.38 (1.72)	11.09 (3.24) [44]
Portuguese	Female	Rita Pereira	98.11	98.11	3.49 (1.49)	5.91 (1.69)	11.55 (3.97) [44]
Portuguese	Female	Júlia Pinheiro	98.11	86.79	3.64 (1.64)	5.91 (1.38)	11.32 (4.42) [44]
Portuguese	Female	Catarina Furtado	98.11	75.47	3.11 (1.3)	5.42 (1.88)	11.47 (4.05) [43]
Portuguese	Female	Mariana Monteiro	98.04	72.55	3.07 (1.59)	5.04 (2.12)	13.21 (3.5) [43]
Portuguese	Female	Diana Chaves	97.96	91.84	3.22 (1.49)	5.73 (1.44)	11.53 (3.49) [45]
Portuguese	Female	Simone de Oliveira	97.96	75.51	2.38 (0.83)	5.51 (1.79)	11.55 (3.21) [44]
Portuguese	Female	Judite de Sousa	96.23	81.13	3.38 (1.54)	5.6 (1.64)	12.23 (4.13) [43]
Portuguese	Female	Sara Matos	96.23	77.36	2.69 (1.41)	4.8 (2.15)	14.54 (4.02) [41]
Portuguese	Female	Sara Sampaio	96.08	90.20	3.49 (1.34)	6.24 (1.15)	16.38 (2.9) [45]
Portuguese	Female	Jéssica Athayde	94.34	81.13	2.73 (1.14)	4.6 (2.22)	13.95 (4.37) [42]

Background	Sex	Name	Recognition rate (%)	Naming rate (%)	Familiarity M (SD)	Facial Distinctiveness M (SD)	AoA M (SD) [N]
Portuguese	Male	Luís Figo	98.04	92.16	2.62 (1.23)	5.24 (1.67)	10.78 (3.97) [45]
Portuguese	Male	Quim Barreiros	98.04	90.20	3.29 (1.2)	6.44 (1.22)	9.27 (3.27) [44]
Portuguese	Male	Pedro Teixeira	97.96	83.67	3.62 (1.48)	5.27 (2.02)	11.7 (3.36) [43]
Portuguese	Male	Diogo Morgado	96.23	73.58	2.8 (1.16)	5.78 (1.57)	13.4 (3.75) [43]
Portuguese	Male	Rui Unas	96.08	82.35	3.27 (1.36)	6.13 (1.27)	14.67 (3.29) [45]
Portuguese	Male	Ricardo Pereira	96.08	62.75	2.89 (1.25)	5.02 (2.22)	12.86 (4.02) [43]
Portuguese	Male	Jorge Gabriel	96.08	60.78	2.62 (1.34)	4.18 (2.19)	12.48 (4.17) [40]
Portuguese	Male	Ruy de Carvalho	94.34	71.70	2.8 (1.25)	5.11 (2.3)	10.55 (4.52) [42]
Portuguese	Male	Diogo Piçarra	93.88	87.76	3.22 (1.11)	5.47 (1.52)	16.91 (2.87) [45]
Portuguese	Male	Lourenço Ortigão	92.45	77.36	3.38 (1.72)	5.49 (1.87)	13.2 (3.87) [44]
Portuguese	Male	José Fidalgo	92.45	60.38	1.93 (0.86)	4.16 (2.46)	14.45 (3.86) [38]
Portuguese	Male	Diogo Infante	91.84	40.82	1.87 (0.84)	3.44 (2.41)	15.19 (3.7) [37]
Portuguese	Male	Nani	90.57	79.25	2.31 (0.9)	4.36 (2.29)	12.93 (3.98) [42]
Portuguese	Male	Nélson Évora	90.20	78.43	2.42 (0.78)	5.18 (1.85)	14.44 (3.92) [45]
Portuguese	Male	Pinto da Costa	84.91	73.58	3.07 (1.37)	5.2 (2.15)	10.32 (3.84) [44]
Portuguese	Male	José Saramago	82.35	70.59	2.56 (0.76)	4.64 (2.01)	13.61 (2.47) [44]
Portuguese	Male	João Pedro Pais	71.70	56.60	2.16 (0.82)	3.69 (2.35)	12.24 (4.67) [41]
Portuguese	Male	Zeca Afonso	49.06	39.62	2.16 (0.64)	3.67 (2.02)	11.73 (3.21) [44]

Background	Sex	Name	Recognition rate (%)	Naming rate (%)	Familiarity M (SD)	Facial Distinctiveness M (SD)	AoA M (SD) [N]
Portuguese	Female	Dânia Neto	94.34	73.58	2.62 (1.67)	4.56 (2.35)	15.03 (4.9) [39]
Portuguese	Female	Dalila Carmo	94.12	45.10	2.02 (1.06)	3.62 (2.31)	14.13 (4.26) [39]
Portuguese	Female	Carolina Deslandes	93.88	87.76	3.09 (1.2)	5.16 (1.86)	17.76 (3.43) [45]
Portuguese	Female	Oceana Basílio	93.88	61.22	2.36 (1.11)	4.31 (2.15)	14.73 (3.54) [41]
Portuguese	Female	Carolina Patrocínio	92.45	86.79	3.27 (1.5)	5.64 (1.86)	12.18 (4.28) [44]
Portuguese	Female	Iva Domingues	92.45	75.47	2.44 (1.08)	4.62 (2.19)	12.18 (3.99) [40]
Portuguese	Female	Soraia Chaves	92.16	58.82	2.04 (0.6)	4.6 (2.25)	14 (3.24) [43]
Portuguese	Female	Sofia Alves	92.16	39.22	1.47 (0.69)	2.67 (2.17)	16.35 (4.87) [34]
Portuguese	Female	Sónia Araújo	91.84	61.22	2.33 (0.88)	4.04 (1.94)	12.7 (3.6) [43]
Portuguese	Female	Alexandra Lencastre	90.57	83.02	3.29 (1.62)	6.07 (1.51)	10.07 (3.99) [43]
Portuguese	Female	Joana Duarte	90.57	58.49	2.36 (1.28)	3.78 (2.37)	12.33 (4.54) [36]
Portuguese	Female	Marisa Cruz	89.80	65.31	2.44 (1.14)	4.42 (2.02)	13.07 (3.55) [43]
Portuguese	Female	Ana Malhoa	88.68	83.02	2.56 (0.92)	4.89 (2.17)	9.95 (3.73) [42]
Portuguese	Female	Dolores Aveiro	88.68	79.25	2.84 (1.11)	5.31 (1.76)	13.86 (3.79) [44]
Portuguese	Female	Fernanda Serrano	88.68	56.60	2.33 (1.21)	4.51 (2.31)	12.49 (4.34) [41]
Portuguese	Female	Rita Ferro Rodrigues	86.27	66.67	2.36 (1.23)	4.18 (2.09)	15.19 (4.12) [42]
Portuguese	Female	Maria João Bastos	83.02	45.28	2.49 (1.41)	4.36 (2.26)	13.13 (3.57) [38]
Portuguese	Female	Sofia Ribeiro	81.13	64.15	2.53 (1.27)	4.6 (2.29)	13.5 (3.24) [38]
Portuguese	Female	Carolina Torres	77.36	62.26	1.69 (0.73)	3.44 (2.15)	17.05 (3.98)[38]
Portuguese	Female	Carolina Loureiro	72.55	49.02	3.6 (1.54)	5.38 (1.85)	19.31 (4.31) [45]
Portuguese	Female	Kelly Bailey	67.92	58.49	2.82 (1.75)	4.82 (2.33)	17.61 (3.72) [38]
Portuguese	Female	Amália Rodrigues	52.94	49.02	2.89 (1.32)	4.93 (1.7)	10.1 (3.53) [42]

Note: The table shows international celebrities first and then national celebrities, with male celebrities followed by female celebrities. In the variable AoA, the number between the squared brackets is the number of participants who answered the question. Those who answered 0 or did not answer were removed from the calculation.

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Appendix B. Instructions and Stimuli Used in Study 1

B.1. Instructions Used in Study 1

Table B.1.1

Instructions for Experiment 1

Experiment phase		**Instruction**
General Instructions	Choice Condition	A fact will be displayed in the centre of the screen, and you will have to memorise it. After doing so, press the <Spacebar> to continue. After memorising the fact, you must choose whom you want to tell it to, selecting one of the two faces presented. To choose one of them, press the key <1> if you want to say it to the person shown on the left or the key <2> if you want to say it to the person shown on the right. After your choice, the celebrity's face appears in the centre of the screen, and you must say the previously memorised fact out loud. After doing so, press the <Spacebar> to continue. Do you understand the instructions? If you have any questions, please call the investigator. If you understand and are ready to begin, press the <Spacebar>.
	No-Choice Condition	A fact will be displayed in the centre of the screen, and you will have to memorise it. After doing so, press the <Spacebar> to continue. Afterwards, a celebrity face will appear in the centre of the screen. When the picture appears, you must say the previously memorised fact out loud to the celebrity. After doing so, press the <Spacebar> to continue. Do you understand the instructions? If you have any questions, please call the investigator. If you understand and are ready to begin, press the <Spacebar>.
Instruction whenever a choice was available for the participant to make		Choose between these two faces to whom you want to transmit the fact.
Interpolated phase (i.e., binding test)		In this test, three letters, one at a time, will be presented in a grid that contains 9 different squares. Each letter will be displayed for 1 second. In the centre square, no letters will be presented throughout the entire test. Your objective is to memorise not only the letter that appears on the screen but also the square in which it appears. After the three letters appear, a fixation cross will be displayed for 8 seconds in the centre of the screen. After the fixation cross, a new grid with a single letter will be presented, and you must answer whether or not the letter you are viewing was presented in that specific square. If the letter appears in the same location as before, press the <S> key. In case the displayed letter was previously displayed in a different location, you must respond with the <N> key (Two examples of answers were presented to the participant).

	Do you understand the instructions? If you have any questions, please call the investigator. If you understand and are ready to begin, press the <Spacebar>.
Item memory	At this stage of the procedure, you must identify whether the fact or face has already been presented before. To do so, you should choose the <S> key if you have already seen the fact or face before or the <N> key if you think that the stimulus (fact or face) has not been presented to you before. If you understand the instructions and are ready to start this phase, press the <Spacebar>.
Destination memory	At this stage of the procedure, you must answer whether you said the fact displayed in the image to the face presented alongside it. If you said the presented fact to the face presented alongside it, you must respond by pressing the <S> key. If you have not, you must press the <N> key. If you understand the instructions and are ready to start this phase, press the <Spacebar>.

Note: Instructions translated from European Portuguese. If you would like the original instructions, please contact the author.

Table B.1.2

Instructions for Experiment 2

Experiment phase		Instruction
General Instructions	Choice Condition	A fact will be displayed in the centre of the screen, and you will have to memorise it. After doing so, press the <Spacebar> to continue. After memorising the fact, you must choose whom you want to tell it to, selecting one of the two faces presented. To choose one of them, press the key <1> if you want to say it to the person shown on the left or the key <2> if you want to say it to the person shown on the right. After your choice, the celebrity's face appears in the centre of the screen, and you must say the previously memorised fact out loud. After doing so, press the <Spacebar> to continue. Do you understand the instructions? If you have any questions, please call the investigator. If you understand and are ready to begin, press the <Spacebar>.
	No-Choice Condition	A fact will be displayed in the centre of the screen, and you will have to memorise it. After doing so, press the <Spacebar> to continue. Afterwards, a celebrity face will appear in the centre of the screen. When the picture appears, you must say the previously memorised fact out loud to the celebrity. After doing so, press the <Spacebar> to continue. Do you understand the instructions? If you have any questions, please call the investigator. If you understand and are ready to begin, press the <Spacebar>.
Instruction whenever a choice was available for the participant to make		Choose between these two faces to whom you want to transmit the fact.
Interpolated phase (i.e., binding test)		In this test, three letters, one at a time, will be presented in a grid that contains 9 different squares. Each letter will be displayed for 1 second. In the centre square, no letters will be presented throughout the entire test. Your objective is to memorise not only the letter that appears on the screen but also the square in which it appears. After the three letters appear, a fixation cross will be displayed for 15 seconds in the centre of the screen. After the fixation cross, a new grid with a single letter will be presented, and you must answer whether or not the letter you are viewing was presented in that specific square. If the letter appears in the same location as before, press the <S> key. In case the displayed letter was previously displayed in a different location, you must respond with the <N> key (Two examples of answers were presented to the participant). Do you understand the instructions? If you have any questions, please call the investigator. If you understand and are ready to begin, press the <Spacebar>.
Destination memory		At this stage of the procedure, you must answer whether you said the fact

	displayed in the image to the face presented alongside it. If you said the presented fact to the face presented alongside it, you must respond by pressing the <S> key. If you have not, you must press the <N> key. If you understand the instructions and are ready to start this phase, press the <Spacebar>.

Note: Instructions translated from European Portuguese. If you would like the original instructions, please contact the author.

B.2. Stimuli Used in Study 1

Table B.2.1

Facts used in Study 1 (Experiment 1 and Experiment 2)

Facts	Extension	Familiarity Range: Between -2 and 2	Emotional Valence Range: Between -2 and 2
A pressa é inimiga da perfeição	6	1.95	0.45
A vozes loucas, orelhas moucas	5	1	0.25
Águas passadas não movem Moinhos	5	1.45	0.35
Amigos, amigos, negócios à parte	5	1.95	0.15
Apanha-se mais depressa um mentiroso do que um coxo	9	1.9	0.25
Cada maluco com a sua mania	6	1.15	0.5
Cada um puxa a brasa para a sua sardinha	9	1.6	0.1
Cão que ladra não morde	5	1.8	0.4
Dá Deus nozes, a quem não tem dentes	8	1.7	-0.4
Diz-me com quem andas, dir-te-ei quem és	7	1.9	0.1
Entre marido e mulher não metas a colher	8	1.75	-0.25
Há mar e mar, há ir e voltar	8	1.2	0.65
Longe da vista, longe do coração	6	1.9	-0.2
Mulher e sardinha querem-se da pequenina	6	1.65	0.15
Não adianta chorar sobre o leite derramado	7	1.55	0.4
Não deites foguetes antes da festa	6	1.7	0.3
Não ponhas o carro à frente dos bois	8	1.8	0.2
Não se fazem omeletes sem partir ovos	7	1.1	0.4
Nem tudo o que vem à rede é peixe	9	1.2	0.15
No meio está a virtude	5	1.9	0.5
O fruto proibido é o mais apetecido	7	1.9	0.4
O mau é ter mais olhos do que barriga	9	1.3	-0.55
O último a rir é o que ri melhor	9	1.95	0.55
Olho por olho, dente por dente	6	1.85	-0.3
Os amigos são para as ocasiões	6	1.35	0.55
Paga o justo pelo pecador	5	1.65	-0.6
Para baixo todos os Santos ajudam	6	1.45	0.3
Para grandes males, grandes remédios	5	1.65	0.3
Para palavras loucas, orelhas moucas	5	1.35	0.1
Patrão fora, feriado na loja	5	1.4	0.3
Perdido por cem, perdido por mil	9	1.75	-0.1
Preso por ter cão e preso por não ter	9	1.45	-0.4
Quando a esmola é grande, o pobre desconfia	8	1.85	-0.6
Quem anda à chuva, molha-se	5	1.95	0.15

Quem brinca com o fogo queima-se	6	1.9	-0.35
Quem conta um conto, acrescenta-lhe um ponto	7	1.9	-0.35
Quem está vivo, sempre aparece	5	1.8	0.45
Quem sai aos seus não degenera	6	1.9	0.25
Quem vê caras não vê corações	6	1.95	-0.6
Zangam-se as comadres, descobrem-se as verdades	6	1.75	-0.45

Note: Facts selected from a destination memory study (Barros et al., 2021)

Table B.2.2

Faces used in Experiment 1

Faces	Face Recognition (%)	Face Naming (%)	Familiarity M(SD)	Face Distinctiveness M(SD)	AoA M(SD)
Adele	100	100	3.51 (1.2)	5.6 (1.84)	15.91 (3.87)
Alexandra Lencastre	90.57	83.02	3.29 (1.62)	6.07 (1.51)	10.07 (3.99)
Amy Winehouse	100	96.23	1.93 (1.16)	4.53 (2.73)	12.34 (3)
Ana Malhoa	88.68	83.02	2.56 (0.92)	4.89 (2.17)	9.95 (3.73)
Angela Merkel	90.57	86.79	3.33 (1.24)	5.22 (1.72)	15.07 (3.24)
Angélico Vieira	100	95.92	2.84 (1.58)	5.62 (1.76)	10.7 (3)
Angelina Jolie	96.23	92.45	3.16 (0.93)	6.38 (1.32)	10.41 (3.19)
António Costa	100	90.57	5.11 (1.58)	5.89 (1.58)	17.09 (2.99)
Barack Obama	100	100	3.24 (1.17)	6.38 (1.15)	14.02 (4.34)
Bárbara Guimarães	100	89.8	2.71 (1.18)	5.64 (1.42)	11.49 (4.46)
Beyoncé	92.45	86.79	3.36 (1.13)	6.4 (1.03)	11.32 (2.64)
Brad Pitt	97.96	93.88	3.16 (1.15)	5.84 (1.46)	10.77 (2.98)
Bruno Mars	96.23	94.34	3.02 (1.47)	5.49 (1.78)	13.29 (4.29)
Carolina Deslandes	93.88	87.76	3.09 (1.2)	5.16 (1.86)	17.76 (3.43)
Carolina Patrocínio	92.45	86.79	3.27 (1.5)	5.64 (1.86)	12.18 (4.28)
Cavaco Sílva	100	100	3.18 (1.4)	5.42 (1.96)	12.05 (2.95)
César Mourão	100	90.2	3.44 (1.06)	5.91 (1.55)	16.02 (4.33)
Cláudia Vieira	100	89.8	3.29 (1.36)	5.38 (1.72)	11.09 (3.24)
Cristiano Ronaldo	100	100	4.8 (1.41)	6.67 (0.77)	11.26 (3.81)
Cristina Ferreira	100	100	4.89 (1.39)	6.42 (0.89)	12.72 (4.18)
Daniela Ruah	100	91.84	2.73 (1.01)	5.31 (1.72)	13.12 (3.33)
David Beckham	95.92	87.76	2.56 (0.92)	5.27 (1.85)	12.56 (3.11)

Diana Chaves	97.96	91.84	3.22 (1.49)	5.73 (1.44)	11.53 (3.49)
Diogo Piçarra	93.88	87.76	3.22 (1.11)	5.47 (1.52)	16.91 (2.87)
Dwayne Johnson	96.08	80.39	2.51 (1.22)	4.91 (2.4)	15.1 (3.18)
Ellen DeGeneres	100	86.79	2.93 (1.78)	4.96 (2.4)	15.51 (3.07)
Eminem	92.45	88.68	3.31 (1.56)	4.84 (2.02)	12.2 (2.81)
Eusébio	100	95.92	2.42 (1.1)	5.71 (1.66)	11.02 (3.55)
Fátima Lopes	100	94.34	3.71 (1.65)	6.02 (1.34)	10.4 (4.01)
George Clooney	98.11	77.36	2.56 (0.78)	5.89 (1.77)	11.69 (2.79)
Herman José	98.11	94.34	2.67 (1)	5.6 (1.85)	10.84 (3.47)
Jackie Chan	100	79.25	2.62 (1.21)	5.6 (1.81)	10.36 (3.48)
Jennifer Lopez	96.08	90.2	3.31 (1.35)	5.98 (1.16)	12.05 (3.74)
Johnny Deep	98.04	92.16	3.07 (1.21)	6.22 (1.26)	13.59 (3.32)
José Mourinho	100	96.23	3.42 (1.42)	5.62 (1.64)	11.11 (3.3)
José Sócrates	100	98.11	3.27 (1.4)	5.91 (1.56)	12.35 (3.88)
Judite de Sousa	96.23	81.13	3.38 (1.54)	5.6 (1.64)	12.23 (4.13)
Júlia Pinheiro	98.11	86.79	3.64 (1.64)	5.91 (1.38)	11.32 (4.42)
Justin Bieber	98.11	96.23	3.02 (1.2)	5.93 (1.32)	13.16 (3.44)
Justin Timberlake	94.12	90.2	2.87 (1.16)	5.29 (1.79)	12.42 (2.88)
Katy Perry	87.76	83.67	3.24 (1.33)	5.4 (1.59)	12.98 (3.95)
Kim Kardashian	96.08	84.31	3.69 (1.53)	5.73 (1.9)	16.53 (2.97)
Leonardo DiCaprio	98.11	88.68	3.13 (0.87)	6.2 (1.16)	11.16 (3.63)
Lionel Messi	83.02	83.02	3.44 (1.41)	5.93 (1.63)	12.44 (2.81)
Luciana Abreu	100	97.96	3.36 (1.52)	5.93 (1.25)	10.27 (3.83)
Luís Figo	98.04	92.16	2.62 (1.23)	5.24 (1.67)	10.78 (3.97)
Madonna	94.12	88.24	2.89 (1.17)	5.56 (1.89)	12.09 (3.5)
Manuel Luís Goucha	98.11	96.23	3.8 (1.56)	6.2 (1.41)	11.34 (3.91)

Marcelo Rebelo de Sousa	100	94.12	4.47 (1.32)	6.6 (1.1)	14.49 (3.17)
Mariza	100	96.23	2.93 (1.14)	6.22 (1.2)	12.67 (3.46)
Michael Jackson	100	100	2.91 (1.22)	6.33 (1.37)	10.2 (3.47)
Neymar	88.24	82.35	2.91 (1.26)	5.4 (1.91)	16.49 (3.57)
Oprah Winfrey	93.88	83.67	2.56 (0.81)	5.44 (1.57)	14.5 (3.28)
Papa Francisco	100	83.02	3.31 (1.26)	5.22 (1.77)	16.87 (3.9)
Pink	94.34	88.68	2.56 (1.06)	5 (2.3)	12.29 (2.57)
Princesa Diana	98.11	94.34	2.51 (1.25)	5.36 (2.11)	10.02 (3.61)
Quim Barreiros	98.04	90.2	3.29 (1.2)	6.44 (1.22)	9.27 (3.27)
Rainha Elizabeth	98.11	92.45	2.91 (1.02)	5.53 (1.97)	10.9 (3.92)
Ricardo Araújo Pereira	100	89.8	3.69 (1.31)	6.02 (1.23)	12.71 (3.65)
Ricardo Quaresma	100	94.34	2.84 (1.04)	5.73 (1.8)	12.05 (3.79)
Rihanna	98.11	98.11	3.51 (1.39)	6.18 (1.39)	11.4 (3.81)
Rita Pereira	98.11	98.11	3.49 (1.49)	5.91 (1.69)	11.55 (3.97)
Salvador Sobral	100	97.96	2.38 (0.75)	5.78 (1.22)	18.09 (3.05)
Sara Sampaio	96.08	90.2	3.49 (1.34)	6.24 (1.15)	16.38 (2.9)
Selena Gomez	97.96	91.84	2.82 (0.89)	5.73 (1.56)	11.89 (3.66)
Shakira	95.92	87.76	3 (1.02)	6.2 (1.16)	10.78 (3.05)
Steve Jobs	100	86.27	2.53 (0.81)	4.91 (1.98)	15.27 (2.69)
Taylor Swift	88.68	84.91	2.98 (1.01)	5.87 (1.47)	13.56 (3.16)
Teresa Guilherme	100	98.04	3.07 (1.19)	6.27 (1.36)	12.22 (3.1)
Tony Carreira	100	98.11	2.69 (0.73)	6 (1.45)	9.33 (3.18)

Note: Faces were selected from a celebrity database validated for the young adult Portuguese population (Lima et al., 2021). At the time of submission of the article, the data for familiarity, face distinctiveness, and age of acquisition (AoA) was still being gathered, which is why they are not mentioned in Study 1 but presented here.

Table B.2.3

Faces used in Experiment 2

Faces	Face Recognition (%)	Face Naming (%)	Familiarity M(SD)	Face Distinctiveness M(SD)	AoA M(SD)
Adele	100	100	3.51 (1.2)	5.6 (1.84)	15.91 (3.87)
Alexandra Lencastre	90.57	83.02	3.29 (1.62)	6.07 (1.51)	10.07 (3.99)
Amy Winehouse	100	96.23	1.93 (1.16)	4.53 (2.73)	12.34 (3)
Ana Malhoa	88.68	83.02	2.56 (0.92)	4.89 (2.17)	9.95 (3.73)
Angela Merkel	90.57	86.79	3.33 (1.24)	5.22 (1.72)	15.07 (3.24)
Angélico Vieira	100	95.92	2.84 (1.58)	5.62 (1.76)	10.7 (3)
Angelina Jolie	96.23	92.45	3.16 (0.93)	6.38 (1.32)	10.41 (3.19)
António Costa	100	90.57	5.11 (1.58)	5.89 (1.58)	17.09 (2.99)
Barack Obama	100	100	3.24 (1.17)	6.38 (1.15)	14.02 (4.34)
Bárbara Guimarães	100	89.8	2.71 (1.18)	5.64 (1.42)	11.49 (4.46)
Beyoncé	92.45	86.79	3.36 (1.13)	6.4 (1.03)	11.32 (2.64)
Brad Pitt	97.96	93.88	3.16 (1.15)	5.84 (1.46)	10.77 (2.98)
Bruno Mars	96.23	94.34	3.02 (1.47)	5.49 (1.78)	13.29 (4.29)
Carolina Deslandes	93.88	87.76	3.09 (1.2)	5.16 (1.86)	17.76 (3.43)
Carolina Patrocínio	92.45	86.79	3.27 (1.5)	5.64 (1.86)	12.18 (4.28)
Cavaco Sílva	100	100	3.18 (1.4)	5.42 (1.96)	12.05 (2.95)
Cláudia Vieira	100	89.8	3.29 (1.36)	5.38 (1.72)	11.09 (3.24)
Cristiano Ronaldo	100	100	4.8 (1.41)	6.67 (0.77)	11.26 (3.81)
Cristina Ferreira	100	100	4.89 (1.39)	6.42 (0.89)	12.72 (4.18)
Daniela Ruah	100	91.84	2.73 (1.01)	5.31 (1.72)	13.12 (3.33)
David Beckham	95.92	87.76	2.56 (0.92)	5.27 (1.85)	12.56 (3.11)
Demi Lovato	85.71	81.63	2.93 (1.5)	5.02 (2.01)	11.52 (3.95)

Diana Chaves	97.96	91.84	3.22 (1.49)	5.73 (1.44)	11.53 (3.49)
Dolores Aveiro	88.68	79.25	2.84 (1.11)	5.31 (1.76)	13.86 (3.79)
Dwayne Johnson	96.08	80.39	2.51 (1.22)	4.91 (2.4)	15.1 (3.18)
Ellen DeGeneres	100	86.79	2.93 (1.78)	4.96 (2.4)	15.51 (3.07)
Eminem	92.45	88.68	3.31 (1.56)	4.84 (2.02)	12.2 (2.81)
Eusébio	100	95.92	2.42 (1.1)	5.71 (1.66)	11.02 (3.55)
Fátima Lopes	100	94.34	3.71 (1.65)	6.02 (1.34)	10.4 (4.01)
Fernando Mendes	98.11	86.79	3.89 (1.54)	6.18 (1.59)	9.27 (4.13)
Freddie Mercury	79.59	75.51	3.09 (1.52)	5.24 (1.94)	12.49 (3.14)
George Clooney	98.11	77.36	2.56 (0.78)	5.89 (1.77)	11.69 (2.79)
Herman José	98.11	94.34	2.67 (1)	5.6 (1.85)	10.84 (3.47)
Jackie Chan	100	79.25	2.62 (1.21)	5.6 (1.81)	10.36 (3.48)
Jennifer Lopez	96.08	90.2	3.31 (1.35)	5.98 (1.16)	12.05 (3.74)
Jessica Athayde	94.34	81.13	2.73 (1.14)	4.6 (2.22)	13.95 (4.37)
João Baião	100	85.71	3.76 (1.54)	5.76 (1.68)	11.83 (3.79)
Johnny Deep	98.04	92.16	3.07 (1.21)	6.22 (1.26)	13.59 (3.32)
José Carlos Malato	100	79.59	2.53 (1.14)	4.73 (2.13)	11.81 (3.46)
José Mourinho	100	96.23	3.42 (1.42)	5.62 (1.64)	11.11 (3.3)
José Sócrates	100	98.11	3.27 (1.4)	5.91 (1.56)	12.35 (3.88)
Judite de Sousa	96.23	81.13	3.38 (1.54)	5.6 (1.64)	12.23 (4.13)
Júlia Pinheiro	98.11	86.79	3.64 (1.64)	5.91 (1.38)	11.32 (4.42)
Justin Bieber	98.11	96.23	3.02 (1.2)	5.93 (1.32)	13.16 (3.44)
Justin Timberlake	94.12	90.2	2.87 (1.16)	5.29 (1.79)	12.42 (2.88)
Katy Perry	87.76	83.67	3.24 (1.33)	5.4 (1.59)	12.98 (3.95)
Kim Kardashian	96.08	84.31	3.69 (1.53)	5.73 (1.9)	16.53 (2.97)
Leonardo DiCaprio	98.11	88.68	3.13 (0.87)	6.2 (1.16)	11.16 (3.63)

Lionel Messi	83.02	83.02	3.44 (1.41)	5.93 (1.63)	12.44 (2.81)
Luciana Abreu	100	97.96	3.36 (1.52)	5.93 (1.25)	10.27 (3.83)
Luís Figo	98.04	92.16	2.62 (1.23)	5.24 (1.67)	10.78 (3.97)
Madonna	94.12	88.24	2.89 (1.17)	5.56 (1.89)	12.09 (3.5)
Manuel Luís Goucha	98.11	96.23	3.8 (1.56)	6.2 (1.41)	11.34 (3.91)
Marcelo Rebelo de Sousa	100	94.12	4.47 (1.32)	6.6 (1.1)	14.49 (3.17)
Marilyn Monroe	88.68	81.13	2.71 (1.42)	6.31 (1.46)	12.21 (3.38)
Mariza	100	96.23	2.93 (1.14)	6.22 (1.2)	12.67 (3.46)
Michael Carreira	98.11	84.91	2.51 (0.87)	5 (1.92)	13.59 (4.26)
Michael Jackson	100	100	2.91 (1.22)	6.33 (1.37)	10.2 (3.47)
Neymar	88.24	82.35	2.91 (1.26)	5.4 (1.91)	16.49 (3.57)
Oprah Winfrey	93.88	83.67	2.56 (0.81)	5.44 (1.57)	14.5 (3.28)
Papa Francisco	100	83.02	3.31 (1.26)	5.22 (1.77)	16.87 (3.9)
Pedro Teixeira	97.96	83.67	3.62 (1.48)	5.27 (2.02)	11.7 (3.36)
Pink	94.34	88.68	2.56 (1.06)	5 (2.3)	12.29 (2.57)
Princesa Diana	98.11	94.34	2.51 (1.25)	5.36 (2.11)	10.02 (3.61)
Quim Barreiros	98.04	90.2	3.29 (1.2)	6.44 (1.22)	9.27 (3.27)
Rainha Elizabeth	98.11	92.45	2.91 (1.02)	5.53 (1.97)	10.9 (3.92)
Ricardo Araújo Pereira	100	89.8	3.69 (1.31)	6.02 (1.23)	12.71 (3.65)
Rihanna	98.11	98.11	3.51 (1.39)	6.18 (1.39)	11.4 (3.81)
Rita Pereira	98.11	98.11	3.49 (1.49)	5.91 (1.69)	11.55 (3.97)
Ronaldinho	81.13	71.7	2.07 (0.99)	3.8 (2.48)	13.13 (3.93)
Rui Unas	96.08	82.35	3.27 (1.36)	6.13 (1.27)	14.67 (3.29)
Sara Matos	96.23	77.36	2.69 (1.41)	4.8 (2.15)	14.54 (4.02)
Sara Sampaio	96.08	90.2	3.49 (1.34)	6.24 (1.15)	16.38 (2.9)
Selena Gomez	97.96	91.84	2.82 (0.89)	5.73 (1.56)	11.89 (3.66)

Shakira	95.92	87.76	3 (1.02)	6.2 (1.16)	10.78 (3.05)
Steve Jobs	100	86.27	2.53 (0.81)	4.91 (1.98)	15.27 (2.69)
Taylor Swift	88.68	84.91	2.98 (1.01)	5.87 (1.47)	13.56 (3.16)
Teresa Guilherme	100	98.04	3.07 (1.19)	6.27 (1.36)	12.22 (3.1)
Tony Carreira	100	98.11	2.69 (0.73)	6 (1.45)	9.33 (3.18)
Will Smith	88.68	73.58	2.67 (0.93)	5.36 (1.97)	13.3 (3.64)

Note: Faces were selected from a celebrity database validated for the young adult Portuguese population (Lima et al., 2021). At the time of submission of the article, the data for familiarity, face distinctiveness, and age of acquisition (AoA) was still being gathered, which is why they are not mentioned in Study 1 but presented here.

B.3. Availability of Data and Materials

All the materials, databases, and statistical analysis used in this study are available at https://osf.io/fs5ab/.

B.4. References

Barros, C., Albuquerque, P. B., Pinto, R., & El Haj, M. (2021). The effect of distinctive facial features on destination memory. *Scandinavian Journal of Psychology*. *62*(4), 502-509. https://doi.org/10.1111/sjop.12734

Lima, D., Pinto, R., & Albuquerque, P. B. (2021). Recognition and naming test of the Portuguese population for national and international celebrities. *Behavior Research Methods, 53*(6), 2326-2337. https://doi.org/10.3758/s13428-021-01572-y

Appendix C. Instructions and Stimuli Used in Study 2

C.1. Instructions Used in Study 2

Table C.1.1

Instructions used in Study 2

Experiment phase		Instruction
General Instructions	Choice Condition	Initially, two facts will be displayed, and you will have to select one of them to say aloud later. To do so, you must press key <1> if you want to choose the fact shown at the top or key <2> if you want to select the fact shown below. After choosing the fact, it will appear in the centre of the screen, and you must memorise it. After doing so, press the <Spacebar> to continue. Afterwards, a celebrity face will appear in the centre of the screen. When the picture appears, you must say the previously memorised fact out loud to the celebrity. After doing so, press the <Spacebar> to continue. Do you understand the instructions? If you have any questions, please call the investigator. If you understand and are ready to begin, press the <Spacebar>.
	No-Choice Condition	A fact will be displayed in the centre of the screen, and you will have to memorise it. After doing so, press the <Spacebar> to continue. Afterwards, a celebrity face will appear in the centre of the screen. When the picture appears, you must say the previously memorised fact out loud to the celebrity. After doing so, press the <Spacebar> to continue. Do you understand the instructions? If you have any questions, please call the investigator. If you understand and are ready to begin, press the <Spacebar>.
Instruction whenever a choice was available for the participant to make		Choose one of these facts to memorise.
Interpolated phase (i.e., binding test)		In this test, three letters, one at a time, will be presented in a grid that contains 9 different squares. Each letter will be displayed for 1 second. In the centre square, no letters will be presented throughout the entire test. Your objective is to memorise not only the letter that appears on the screen but also the square in which it appears. After the three letters appear, a fixation cross will be displayed for 15 seconds in the centre of the screen. After the fixation cross, a new grid with a single letter will be presented, and you must answer whether or not the letter you are viewing was presented in that specific square. If the letter appears in the same location as before, press the <S> key. In case the displayed letter was previously displayed in a different location, you must respond with the <N> key (Two examples of answers were presented to the participant).

	Do you understand the instructions? If you have any questions, please call the investigator. If you understand and are ready to begin, press the <Spacebar>.
Item memory	At this stage of the procedure, you must identify whether the fact or face has already been presented before. To do so, you should choose the <S> key if you have already seen the fact or face before or the <N> key if you think that the stimulus (fact or face) has not been presented to you before. If you understand the instructions and are ready to start this phase, press the <Spacebar>.
Destination memory	At this stage of the procedure, you must answer whether you said the fact displayed in the image to the face presented alongside it. If you said the presented fact to the face presented alongside it, you must respond by pressing the <S> key. If you have not, you must press the <N> key. If you understand the instructions and are ready to start this phase, press the <Spacebar>.

Note: Instructions translated from European Portuguese. If you would like the original instructions, please contact the author.

C.2. Stimuli Used in Study 2

Table C.2.1

Facts used in Study 2

Facts	**Extension**	**Familiarity** **Range: Between -2 and 2**	**Emotional Valence** **Range: Between -2 and 2**
A cavalo dado não se olha o dente	8	0.8	0.55
A galinha da vizinha é sempre melhor que a minha	10	1.05	-0.75
A justiça tarda mas não falha	6	1.35	0.8
A noite é boa conselheira	5	0.8	1
A ocasião faz o ladrão	5	1.4	-0.85
A preguiça é a mãe de todos os vícios	9	0.95	-1
A pressa é inimiga da perfeição	6	1.95	0.45
A quem tudo quer saber, nada se lhe diz	9	0.05	-0.35
A roupa suja lava-se em casa	6	0.6	-0.5
A vozes loucas, orelhas moucas	5	1	0.25
Água mole em pedra dura, tando dá até que fura	10	1.95	0.8
Águas passadas não movem moinhos	5	1.45	0.35
Amigos, amigos, negócios à parte	5	1.95	0.15
Amor com amor se paga	5	1.6	1.05
Apanha-se mais depressa um mentiroso do que um coxo	9	1.9	0.25
Boda molhada, boda abençoada	4	1.35	1.05
Burro velho, não aprende línguas	5	1	-0.7
Cada cabeça sua sentença	4	0.65	-0.35
Cada macaco no seu galho	5	1.75	0.7
Cada maluco com a sua mania	6	1.15	0.5
Cada um puxa a brasa para a sua sardinha	9	1.6	0.1
Cada um sabe de si e Deus sabe de todos	10	0.65	-0.3
Cão que ladra não morde	5	1.8	0.4
Com o fogo não se brinca	6	1.9	-0.2
Dá Deus nozes, a quem não tem dentes	8	1.7	-0.4
De boas intenções, está o Inferno cheio	7	1.75	-1
De médico e de louco, todos temos um pouco	9	0.55	0.55
De pequenino se torce o pepino	6	1.7	1
Depressa e bem, não há quem	6	1.5	0.2
Deus escreve direito, por linhas tortas	6	1.65	0.85
Deus quer, o Homem sonha, a obra nasce	8	1.5	1.05
Diz-me com quem andas, dir-te-ei quem és	7	1.9	0.1
Em Abril águas mil	4	1.8	0
Em casa de ferreiro, espeto de pau	7	0.6	-0.3

Em Roma, faz como os romanos	6	0.9	0.05
Entre marido e mulher não metas a colher	8	1.75	-0.25
Filho de peixe sabe nadar	5	1.85	1.05
Filhos criados, trabalhos dobrados	4	1.3	0.2
Gato escaldado, de água fria tem medo	7	0.4	-0.6
Há mar e mar, há ir e voltar	8	1.2	0.65
Ladrão que rouba a ladrão tem cem anos de perdão	10	1.7	0
Longe da vista, longe do coração	6	1.9	-0.2
Mais depressa se apanha um mentiroso que um coxo	9	2	0.65
Mais vale cair em graça, do que ser engraçado	9	0	0.15
Mais vale um pássaro na mão, que dois a voar	10	2	1
Mãos frias, coração quente, amor para sempre	7	1.3	0.9
Mudam-se os tempos, mudam-se as vontades	6	1.8	0.7
Mulher e sardinha querem-se da pequenina	6	1.65	0.15
Não adianta chorar sobre o leite derramado	7	1.55	0.4
Não deites foguetes antes da festa	6	1.7	0.3
Não deixes para amanhã o que podes fazer hoje	9	2	0.7
Não há amor como o primeiro	6	1.6	-0.1
Não há atalho sem trabalho	5	0.2	0.7
Não há bela sem senão	5	0.9	-0.1
Não há duas sem três	5	1.95	0.2
Não há fumo sem fogo	5	1.65	-0.05
Não há pior cego do que aquele que não quer ver	11	1.7	-0.25
Não há regra sem excepção	5	1.75	0.2
Não ponhas o carro à frente dos bois	8	1.8	0.2
Não se fazem omeletes sem partir ovos	7	1.1	0.4
Nem só de pão vive o homem	7	0.4	-0.1
Nem tudo o que abana cai	6	0.75	0.5
Nem tudo o que vem à rede é peixe	9	1.2	0.15
Ninguém está bem com a sorte que tem	8	0.95	-0.3
No Carnaval nada parece mal	5	1.3	0.7
No meio está a virtude	5	1.9	0.5
No poupar é que está o ganho	7	1.6	0.9
Nunca digas desta água não beberei	6	1.6	0.7
O fruto proibido é o mais apetecido	7	1.9	0.4
O mau é ter mais olhos do que barriga	9	1.3	-0.55
O primeiro milho é para os pardais	7	0.95	0.1
O segredo é a alma do negócio	7	1.95	0.75
O último a rir é o que ri melhor	9	1.95	0.55
Olho por olho, dente por dente	6	1.85	-0.3
Olhos que não vêm, coração que não sente	8	1.8	-0.1
Os amigos são para as ocasiões	6	1.35	0.55
Paga o justo pelo pecador	5	1.65	-0.6
Para baixo todos os Santos ajudam	6	1.45	0.3
Para bom entendedor, meia palavra basta	6	2	0.8

Para grandes males, grandes remédios	5	1.65	0.3
Para palavras loucas, orelhas moucas	5	1.35	0.1
Patrão fora, feriado na loja	5	1.4	0.3
Pela boca morre o peixe	5	0.65	-0.6
Perdido por cem, perdido por mil	9	1.75	-0.1
Por morrer uma andorinha não acaba a primavera	8	0	0.65
Preso por ter cão e preso por não ter	9	1.45	-0.4
Quando a esmola é grande, o pobre desconfia	8	1.85	-0.6
Quem anda à chuva, molha-se	5	1.95	0.15
Quem brinca com o fogo queima-se	6	1.9	-0.35
Quem conta um conto, acrescenta-lhe um ponto	7	1.9	-0.35
Quem desconfia, não é de confiar	6	0	-0.9
Quem diz a verdade, não merece castigo	7	1.9	1
Quem diz tudo o que quer, ouve o que não gosta	11	1.5	-0.3
Quem está vivo, sempre aparece	5	1.8	0.45
Quem mais jura, mais mente	5	1.95	-0.75
Quem não deve, não teme	5	1.75	0.85
Quem não se sente, não é filho de boa gente	10	0.85	-0.1
Quem não tem cão caça com gato	7	1.65	0.75
Quem não tem dinheiro não tem vícios	7	0.75	0.3
Quem sai aos seus não degenera	6	1.9	0.25
Quem te avisa, teu amigo é	6	1.95	0.9
Quem torto nasce, tarde ou nunca se endireita	8	1.45	-0.95
Quem vê caras não vê corações	6	1.95	-0.6
Roma e Pavia não se fizeram num dia	8	0.05	0.25
Todos os caminhos vão dar a Roma	7	1.95	0.7
Tristezas não pagam dívidas	4	1.3	0.3
Tudo está bem, quando acaba em bem	7	1.85	1
Uma mentira repetida mil vezes torna-se verdade	7	1.25	-0.7
Viver não custa, o que custa é saber viver	9	0.85	0.15
Zangam-se as comadres, descobrem-se as verdades	6	1.75	-0.45

Note: Facts selected from a destination memory study (Barros et al., 2021)

Table C.2.2

Faces used in Study 2

Faces	Face Recognition (%)	Face Naming (%)	Familiarity M(SD)	Face Distinctiveness M(SD)	AoA M(SD)
Adele	100	100	3.51 (1.2)	5.6 (1.84)	15.91 (3.87)
Alexandra Lencastre	90.57	83.02	3.22 (1.49)	6.07 (1.51)	10.07 (3.99)
Amy Winehouse	100	96.23	1.93 (1.16)	4.53 (2.73)	12.34 (3)
Angela Merkel	90.57	86.79	3.33 (1.24)	5.22 (1.72)	15.07 (3.24)
Angelina Jolie	96.23	92.45	3.16 (0.93)	6.38 (1.32)	10.41 (3.19)
Bárbara Guimarães	100	100	3.24 (1.17)	6.38 (1.15)	14.02 (4.34)
Barack Obama	100	89.8	2.71 (1.18)	5.64 (1.42)	11.49 (4.46)
Beyoncé	92.45	86.79	3.36 (1.13)	6.4 (1.03)	11.32 (2.64)
Brad Pitt	97.96	93.88	3.16 (1.15)	5.84 (1.46)	10.77 (2.98)
Bruno Mars	96.23	94.34	3.02 (1.47)	5.49 (1.78)	13.29 (4.29)
Carolina Deslandes	93.88	87.76	3.22 (1.49)	5.16 (1.86)	17.76 (3.43)
Carolina Patrocínio	92.45	86.79	3.22 (1.49)	5.64 (1.86)	12.18 (4.28)
Cavaco Silva	100	100	3.18 (1.4)	5.42 (1.96)	12.05 (2.95)
César Mourão	100	90.2	3.44 (1.06)	5.91 (1.55)	16.02 (4.33)
Cláudia Vieira	100	89.8	3.29 (1.36)	5.38 (1.72)	11.09 (3.24)
Cristiano Ronaldo	100	100	4.8 (1.41)	6.67 (0.77)	11.26 (3.81)
Cristina Ferreira	100	100	4.89 (1.39)	6.42 (0.89)	12.72 (4.18)
Daniela Ruah	100	91.84	2.73 (1.01)	5.31 (1.72)	13.12 (3.33)
David Beckham	95.92	87.76	2.56 (0.92)	5.27 (1.85)	12.56 (3.11)
Diana Chaves	97.96	91.84	3.22 (1.49)	5.73 (1.44)	11.53 (3.49)
Diogo Piçarra	93.88	87.76	3.22 (1.11)	5.47 (1.52)	16.91 (2.87)
Donald Trump	100	97.96	4.64 (1.32)	6.64 (0.83)	17.73 (3.04)

Eminem	92.45	88.68	3.31 (1.56)	4.84 (2.02)	12.2 (2.81)
Fátima Lopes	100	94.34	3.71 (1.65)	6.02 (1.34)	10.4 (4.01)
Herman José	98.11	94.34	2.67 (1)	5.6 (1.85)	10.84 (3.47)
Jackie Chan	100	79.25	2.62 (1.21)	5.6 (1.81)	10.36 (3.48)
Jennifer Lopez	96.08	90.2	3.31 (1.35)	5.98 (1.16)	12.05 (3.74)
João Baião	100	85.71	3.76 (1.54)	5.76 (1.68)	11.83 (3.79)
Johnny Depp	98.04	92.16	3.07 (1.21)	6.22 (1.26)	13.59 (3.32)
José Mourinho	100	96.23	3.42 (1.42)	5.62 (1.64)	11.11 (3.3)
Júlia Pinheiro	98.11	86.79	3.64 (1.64)	5.91 (1.38)	11.32 (4.42)
Justin Bieber	98.11	96.23	3.02 (1.2)	5.93 (1.32)	13.16 (3.44)
Justin Timberlake	94.12	90.2	2.87 (1.16)	5.29 (1.79)	12.42 (2.88)
Leonardo Dicaprio	98.11	88.68	3.13 (0.87)	6.2 (1.16)	11.16 (3.63)
Lionel Messi	83.02	83.02	3.44 (1.41)	5.93 (1.63)	12.44 (2.81)
Luciana Abreu	100	97.96	3.36 (1.52)	5.93 (1.25)	10.27 (3.83)
Luís Figo	98.04	92.16	2.62 (1.23)	5.24 (1.67)	10.78 (3.97)
Madonna	94.12	88.24	2.89 (1.17)	5.56 (1.89)	12.09 (3.5)
Manuel Luís Goucha	98.11	96.23	3.8 (1.56)	6.2 (1.41)	11.34 (3.91)
Marcelo Rebelo de Sousa	100	94.12	4.47 (1.32)	6.6 (1.1)	14.49 (3.17)
Mariza	100	96.23	2.93 (1.14)	6.22 (1.2)	12.67 (3.46)
Michael Jackson	100	100	2.91 (1.22)	6.33 (1.37)	10.2 (3.47)
Michelle Obama	100	94.12	3 (1.13)	5.98 (1.54)	15.27 (2.88)
Neymar	88.24	82.35	2.91 (1.26)	5.4 (1.91)	16.49 (3.57)
Pedro Teixeira	97.96	83.67	3.62 (1.48)	5.27 (2.02)	11.7 (3.36)
Pink	94.34	88.68	2.56 (1.06)	5 (2.3)	12.29 (2.57)
Princesa Diana	98.11	94.34	2.51 (1.25)	5.36 (2.11)	10.02 (3.61)
Quim Barreiros	98.04	90.2	3.29 (1.2)	6.44 (1.22)	9.27 (3.27)

Rainha Elizabeth	98.11	92.45	2.91 (1.02)	5.53 (1.97)	10.9 (3.92)
Ricardo Quaresma	100	94.34	2.84 (1.04)	5.73 (1.8)	12.05 (3.79)
Rihanna	98.11	98.11	3.51 (1.39)	6.18 (1.39)	11.4 (3.81)
Rita Pereira	98.11	98.11	3.49 (1.49)	5.91 (1.69)	11.55 (3.97)
Rui Unas	96.08	82.35	3.27 (1.36)	6.13 (1.27)	14.67 (3.29)
Sara Sampaio	96.08	90.2	3.22 (1.49)	6.24 (1.15)	16.38 (2.9)
Selena Gomez	97.96	91.84	2.82 (0.89)	5.73 (1.56)	11.89 (3.66)
Shakira	95.92	87.76	3 (1.02)	6.2 (1.16)	10.78 (3.05)
Steve Jobs	100	86.27	2.53 (0.81)	4.91 (1.98)	15.27 (2.69)
Taylor Swift	88.68	84.91	2.98 (1.01)	5.87 (1.47)	13.56 (3.16)
Teresa Guilherme	100	98.04	3.07 (1.19)	6.27 (1.36)	12.22 (3.1)
Tony Carreira	100	98.11	2.69 (0.73)	6 (1.45)	9.33 (3.18)

Note: Faces were selected from a celebrity database validated for the young adult Portuguese population (Lima et al., 2021).

C.3. Availability of Data and Materials

All the materials, databases, and statistical analysis used in this study are available at https://osf.io/7ayd8/

C.4. References

Barros, C., Albuquerque, P. B., Pinto, R., & El Haj, M. (2021). The effect of distinctive facial features on destination memory. *Scandinavian Journal of Psychology*. *62*(4), 502-509. https://doi.org/10.1111/sjop.12734

Lima, D., Pinto, R., & Albuquerque, P. B. (2021). Recognition and naming test of the Portuguese population for national and international celebrities. *Behavior Research Methods, 53*(6), 2326-2337. https://doi.org/10.3758/s13428-021-01572-y

Appendix D. Instructions and Stimuli Used in Study 3

D.1. Instructions Used in Study 3

Table D.1.1

Instructions used in Study 3

Experiment phase		Instruction
General Instructions	Choice Condition	Initially, two facts will be displayed, and you will have to select one of them to say aloud later. To do so, you must press key <1> if you want to choose the fact shown at the top or key <2> if you want to select the fact shown below. After choosing the fact, it will appear in the centre of the screen, and you must memorise it. After doing so, press the <Spacebar> to continue. After memorising the fact, you must choose whom you want to tell it to, selecting one of the two faces presented. To choose one of them, press the key <1> if you want to say it to the person shown on the left or the key <2> if you want to say it to the person shown on the right. After your choice, the celebrity's face appears in the centre of the screen, and you must say the previously memorised fact out loud. After doing so, press the <Spacebar> to continue. Do you understand the instructions? If you have any questions, please call the investigator. If you understand and are ready to begin, press the <Spacebar>.
	No-Choice Condition	A fact will be displayed in the centre of the screen, and you will have to memorise it. After doing so, press the <Spacebar> to continue. Afterwards, a celebrity face will appear in the centre of the screen. When the picture appears, you must say the previously memorised fact out loud to the celebrity. After doing so, press the <Spacebar> to continue. Do you understand the instructions? If you have any questions, please call the investigator. If you understand and are ready to begin, press the <Spacebar>.
Instruction whenever a choice was available for the participant to make		Whenever a choice between two facts was presented: Choose one of these facts to memorise.
		Whenever a choice between two faces was presented: Choose between these two faces to whom you want to transmit the fact.
Interpolated phase (i.e., binding test)		In this test, three letters, one at a time, will be presented in a grid that contains 9 different squares. Each letter will be displayed for 1 second. In the centre square, no letters will be presented throughout the entire test. Your objective is to memorise not only the letter that appears on the screen but also the square in which it appears. After the three letters appear, a fixation cross will be displayed for 15 seconds in the centre of the screen. After the fixation cross, a new grid with a single letter will be presented, and you must answer whether or not the letter you are viewing was presented in that specific square.

	If the letter appears in the same location as before, press the <S> key. In case the displayed letter was previously displayed in a different location, you must respond with the <N> key (Two examples of answers were presented to the participant). Do you understand the instructions? If you have any questions, please call the investigator. If you understand and are ready to begin, press the <Spacebar>.
Item memory	At this stage of the procedure, you must identify whether the fact or face has already been presented before. To do so, you should choose the <S> key if you have already seen the fact or face before or the <N> key if you think that the stimulus (fact or face) has not been presented to you before. If you understand the instructions and are ready to start this phase, press the <Spacebar>.
Destination memory	At this stage of the procedure, you must answer whether you said the fact displayed in the image to the face presented alongside it. If you said the presented fact to the face presented alongside it, you must respond by pressing the <S> key. If you have not, you must press the <N> key. If you understand the instructions and are ready to start this phase, press the <Spacebar>.

Note: Instructions translated from European Portuguese. If you would like the original instructions, please contact the author.

D.2. Stimuli Used in Study 3

Table D.2.1

Facts used in Study 3

Facts	Extension	Familiarity Range: Between -2 and 2	Emotional Valence Range: Between -2 and 2
A cavalo dado não se olha o dente	8	0.8	0.55
A galinha da vizinha é sempre melhor que a minha	10	1.05	-0.75
A justiça tarda mas não falha	6	1.35	0.8
A noite é boa conselheira	5	0.8	1
A ocasião faz o ladrão	5	1.4	-0.85
A preguiça é a mãe de todos os vícios	9	0.95	-1
A pressa é inimiga da perfeição	6	1.95	0.45
A quem tudo quer saber, nada se lhe diz	9	0.05	-0.35
A roupa suja lava-se em casa	6	0.6	-0.5
A vozes loucas, orelhas moucas	5	1	0.25
Água mole em pedra dura, tando dá até que fura	10	1.95	0.8
Águas passadas não movem Moinhos	5	1.45	0.35
Amigos, amigos, negócios à parte	5	1.95	0.15
Amor com amor se paga	5	1.6	1.05
Apanha-se mais depressa um mentiroso do que um coxo	9	1.9	0.25
Boda molhada, boda abençoada	4	1.35	1.05
Burro velho, não aprende línguas	5	1	-0.7
Cada cabeça sua sentença	4	0.65	-0.35
Cada macaco no seu galho	5	1.75	0.7
Cada maluco com a sua mania	6	1.15	0.5
Cada um puxa a brasa para a sua sardinha	9	1.6	0.1
Cada um sabe de si e Deus sabe de todos	10	0.65	-0.3
Cão que ladra não morde	5	1.8	0.4
Com o fogo não se brinca	6	1.9	-0.2
Dá Deus nozes, a quem não tem dentes	8	1.7	-0.4
De boas intenções, está o Inferno cheio	7	1.75	-1
De médico e de louco, todos temos um pouco	9	0.55	0.55
De pequenino se torce o pepino	6	1.7	1
Depressa e bem, não há quem	6	1.5	0.2
Deus escreve direito, por linhas tortas	6	1.65	0.85
Deus quer, o Homem sonha, a obra nasce	8	1.5	1.05
Diz-me com quem andas, dir-te-ei quem és	7	1.9	0.1
Em Abril águas mil	4	1.8	0
Em casa de ferreiro, espeto de pau	7	0.6	-0.3

Em Roma, faz como os Romanos	6	0.9	0.05
Entre marido e mulher não metas a colher	8	1.75	-0.25
Filho de peixe sabe nadar	5	1.85	1.05
Filhos criados, trabalhos dobrados	4	1.3	0.2
Gato escaldado, de água fria tem medo	7	0.4	-0.6
Há mar e mar, há ir e voltar	8	1.2	0.65
Ladrão que rouba a ladrão tem cem anos de perdão	10	1.7	0
Longe da vista, longe do coração	6	1.9	-0.2
Mais depressa se apanha um mentiroso que um coxo	9	2	0.65
Mais vale cair em graça, do que ser engraçado	9	0	0.15
Mais vale um pássaro na mão, que dois a voar	10	2	1
Mãos frias, coração quente, amor para sempre	7	1.3	0.9
Mudam-se os tempos, mudam-se as vontades	6	1.8	0.7
Mulher e sardinha querem-se da pequenina	6	1.65	0.15
Não adianta chorar sobre o leite derramado	7	1.55	0.4
Não deites foguetes antes da festa	6	1.7	0.3
Não deixes para amanhã o que podes fazer hoje	9	2	0.7
Não há amor como o primeiro	6	1.6	-0.1
Não há atalho sem trabalho	5	0.2	0.7
Não há bela sem senão	5	0.9	-0.1
Não há duas sem três	5	1.95	0.2
Não há fumo sem fogo	5	1.65	-0.05
Não há pior cego do que aquele que não quer ver	11	1.7	-0.25
Não há regra sem excepção	5	1.75	0.2
Não ponhas o carro à frente dos bois	8	1.8	0.2
Não se fazem omeletes sem partir ovos	7	1.1	0.4
Nem só de pão vive o homem	7	0.4	-0.1
Nem tudo o que abana cai	6	0.75	0.5
Nem tudo o que vem à rede é peixe	9	1.2	0.15
Ninguém está bem com a sorte que tem	8	0.95	-0.3
No Carnaval nada parece mal	5	1.3	0.7
No meio está a virtude	5	1.9	0.5
No poupar é que está o ganho	7	1.6	0.9
Nunca digas desta água não beberei	6	1.6	0.7
O fruto proibido é o mais apetecido	7	1.9	0.4
O mau é ter mais olhos do que barriga	9	1.3	-0.55
O primeiro milho é para os pardais	7	0.95	0.1
O segredo é a alma do negócio	7	1.95	0.75
O último a rir é o que ri melhor	9	1.95	0.55
Olho por olho, dente por dente	6	1.85	-0.3
Olhos que não vêm, coração que não sente	8	1.8	-0.1
Os amigos são para as ocasiões	6	1.35	0.55
Paga o justo pelo pecador	5	1.65	-0.6
Para baixo todos os Santos ajudam	6	1.45	0.3
Para bom entendedor, meia palavra basta	6	2	0.8

Para grandes males, grandes remédios	5	1.65	0.3
Para palavras loucas, orelhas moucas	5	1.35	0.1
Patrão fora, feriado na loja	5	1.4	0.3
Pela boca morre o peixe	5	0.65	-0.6
Perdido por cem, perdido por mil	9	1.75	-0.1
Por morrer uma andorinha não acaba a Primavera	8	0	0.65
Preso por ter cão e preso por não ter	9	1.45	-0.4
Quando a esmola é grande, o pobre desconfia	8	1.85	-0.6
Quem anda à chuva, molha-se	5	1.95	0.15
Quem brinca com o fogo queima-se	6	1.9	-0.35
Quem conta um conto, acrescenta-lhe um ponto	7	1.9	-0.35
Quem desconfia, não é de confiar	6	0	-0.9
Quem diz a verdade, não merece castigo	7	1.9	1
Quem diz tudo o que quer, ouve o que não gosta	11	1.5	-0.3
Quem está vivo, sempre aparece	5	1.8	0.45
Quem mais jura, mais mente	5	1.95	-0.75
Quem não deve, não teme	5	1.75	0.85
Quem não se sente, não é filho de boa gente	10	0.85	-0.1
Quem não tem cão caça com gato	7	1.65	0.75
Quem não tem dinheiro não tem vícios	7	0.75	0.3
Quem sai aos seus não degenera	6	1.9	0.25
Quem te avisa, teu amigo é	6	1.95	0.9
Quem torto nasce, tarde ou nunca se endireita	8	1.45	-0.95
Quem vê caras não vê corações	6	1.95	-0.6
Roma e Pavia não se fizeram num dia	8	0.05	0.25
Todos os caminhos vão dar a Roma	7	1.95	0.7
Tristezas não pagam dívidas	4	1.3	0.3
Tudo está bem, quando acaba em bem	7	1.85	1
Uma mentira repetida mil vezes torna-se verdade	7	1.25	-0.7
Viver não custa, o que custa é saber viver	9	0.85	0.15
Zangam-se as comadres, descobrem-se as verdades	6	1.75	-0.45

Note: Facts selected from a destination memory study (Barros et al., 2021)

Table D.2.2

Faces used in Study 3

Faces	Face Recognition (%)	Face Naming (%)	Familiarity M(SD)	Face Distinctiveness M(SD)	AoA M(SD)
Adele	100	100	3.51 (1.2)	5.6 (1.84)	15.91 (3.87)
Alexandra Lencastre	90.57	83.02	3.29 (1.62)	6.07 (1.51)	10.07 (3.99)
Amy Winehouse	100	96.23	1.93 (1.16)	4.53 (2.73)	12.34 (3)
Ana Malhoa	88.68	83.02	2.56 (0.92)	4.89 (2.17)	9.95 (3.73)
Angela Merkel	90.57	86.79	3.33 (1.24)	5.22 (1.72)	15.07 (3.24)
Angélico Vieira	100	95.92	2.84 (1.58)	5.62 (1.76)	10.7 (3)
Angelina Jolie	96.23	92.45	3.16 (0.93)	6.38 (1.32)	10.41 (3.19)
Ariana Grande	94.34	77.36	3.51 (1.41)	6.02 (1.44)	15.8 (4.07)
Barack Obama	100	100	3.24 (1.17)	6.38 (1.15)	14.02 (4.34)
Bárbara Guimarães	100	89.8	2.71 (1.18)	5.64 (1.42)	11.49 (4.46)
Beyoncé	92.45	86.79	3.36 (1.13)	6.4 (1.03)	11.32 (2.64)
Brad Pitt	97.96	93.88	3.16 (1.15)	5.84 (1.46)	10.77 (2.98)
Britney Spears	86.79	75.47	2.8 (0.97)	5.76 (1.65)	11.07 (3.07)
Bruno Mars	96.23	94.34	3.02 (1.47)	5.49 (1.78)	13.29 (4.29)
Carolina Deslandes	93.88	87.76	3.09 (1.2)	5.16 (1.86)	17.76 (3.43)
Carolina Patrocínio	92.45	86.79	3.27 (1.5)	5.64 (1.86)	12.18 (4.28)
Catarina Furtado	98.11	75.47	3.11 (1.3)	5.42 (1.88)	11.47 (4.05)
Cavaco Sílva	100	100	3.18 (1.4)	5.42 (1.96)	12.05 (2.95)
Cláudia Vieira	100	89.8	3.29 (1.36)	5.38 (1.72)	11.09 (3.24)
Cristiano Ronaldo	100	100	4.8 (1.41)	6.67 (0.77)	11.26 (3.81)
Cristina Ferreira	100	100	4.89 (1.39)	6.42 (0.89)	12.72 (4.18)
Dânia Neto	94.34	73.58	2.62 (1.67)	4.56 (2.35)	15.03 (4.9)

Daniela Ruah	100	91.84	2.73 (1.01)	5.31 (1.72)	13.12 (3.33)
David Beckham	95.92	87.76	2.56 (0.92)	5.27 (1.85)	12.56 (3.11)
Demi Lovato	85.71	81.63	2.93 (1.5)	5.02 (2.01)	11.52 (3.95)
Diana Chaves	97.96	91.84	3.22 (1.49)	5.73 (1.44)	11.53 (3.49)
Diogo Morgado	96.23	73.58	2.8 (1.16)	5.78 (1.57)	13.4 (3.75)
Diogo Piçarra	93.88	87.76	3.22 (1.11)	5.47 (1.52)	16.91 (2.87)
Dolores Aveiro	88.68	79.25	2.84 (1.11)	5.31 (1.76)	13.86 (3.79)
Donald Trump	100	97.96	4.64 (1.32)	6.64 (0.83)	17.73 (3.04)
Dwayne Johnson	96.08	80.39	2.51 (1.22)	4.91 (2.4)	15.1 (3.18)
Ellen DeGeneres	100	86.79	2.93 (1.78)	4.96 (2.4)	15.51 (3.07)
Elvis Presley	81.13	67.92	2.44 (1.08)	5.22 (1.82)	12.02 (3.88)
Eminem	92.45	88.68	3.31 (1.56)	4.84 (2.02)	12.2 (2.81)
Emma Watson	94.12	76.47	2.78 (1.02)	4.98 (1.9)	13.8 (3.33)
Eusébio	100	95.92	2.42 (1.1)	5.71 (1.66)	11.02 (3.55)
Fátima Lopes	100	94.34	3.71 (1.65)	6.02 (1.34)	10.4 (4.01)
Fernando Mendes	98.11	86.79	3.89 (1.54)	6.18 (1.59)	9.27 (4.13)
Freddie Mercury	79.59	75.51	3.09 (1.52)	5.24 (1.94)	12.49 (3.14)
George Clooney	98.11	77.36	2.56 (0.78)	5.89 (1.77)	11.69 (2.79)
George W. Bush	77.55	67.35	1.87 (0.73)	3.18 (2)	13.63 (4.14)
Herman José	98.11	94.34	2.67 (1)	5.6 (1.85)	10.84 (3.47)
Hilary Clinton	88.68	73.58	2.62 (1.21)	4.73 (2.13)	15.5 (2.94)
Iva Domingues	92.45	75.47	2.44 (1.08)	4.62 (2.19)	12.18 (3.99)
Jackie Chan	100	79.25	2.62 (1.21)	5.6 (1.81)	10.36 (3.48)
Jennifer Aniston	96.23	73.58	3.22 (1.62)	5.31 (2.09)	12.45 (2.85)
Jennifer Lopez	96.08	90.2	3.31 (1.35)	5.98 (1.16)	12.05 (3.74)
Jessica Athayde	94.34	81.13	2.73 (1.14)	4.6 (2.22)	13.95 (4.37)

João Baião	100	85.71	3.76 (1.54)	5.76 (1.68)	11.83 (3.79)
João Paulo Rodrigues	100	73.58	2.51 (1.14)	4.64 (2.37)	13.93 (3.6)
Johnny Deep	98.04	92.16	3.07 (1.21)	6.22 (1.26)	13.59 (3.32)
José Carlos Malato	100	79.59	2.53 (1.14)	4.73 (2.13)	11.81 (3.46)
José Mourinho	100	96.23	3.42 (1.42)	5.62 (1.64)	11.11 (3.3)
José Sócrates	100	98.11	3.27 (1.4)	5.91 (1.56)	12.35 (3.88)
Judite de Sousa	96.23	81.13	3.38 (1.54)	5.6 (1.64)	12.23 (4.13)
Júlia Pinheiro	98.11	86.79	3.64 (1.64)	5.91 (1.38)	11.32 (4.42)
Justin Bieber	98.11	96.23	3.02 (1.2)	5.93 (1.32)	13.16 (3.44)
Justin Timberlake	94.12	90.2	2.87 (1.16)	5.29 (1.79)	12.42 (2.88)
Katy Perry	87.76	83.67	3.24 (1.33)	5.4 (1.59)	12.98 (3.95)
Kim Kardashian	96.08	84.31	3.69 (1.53)	5.73 (1.9)	16.53 (2.97)
Lady Gaga	75.47	71.7	3.42 (1.36)	5.78 (1.74)	12.09 (4.03)
Leonardo DiCaprio	98.11	88.68	3.13 (0.87)	6.2 (1.16)	11.16 (3.63)
Lionel Messi	83.02	83.02	3.44 (1.41)	5.93 (1.63)	12.44 (2.81)
Lourenço Ortigão	92.45	77.36	3.38 (1.72)	5.49 (1.87)	13.2 (3.87)
Luciana Abreu	100	97.96	3.36 (1.52)	5.93 (1.25)	10.27 (3.83)
Luís Figo	98.04	92.16	2.62 (1.23)	5.24 (1.67)	10.78 (3.97)
Madonna	94.12	88.24	2.89 (1.17)	5.56 (1.89)	12.09 (3.5)
Manuel Luís Goucha	98.11	96.23	3.8 (1.56)	6.2 (1.41)	11.34 (3.91)
Marcelo Rebelo de	100	94.12	4.47 (1.32)	6.6 (1.1)	14.49 (3.17)
Mariana Monteiro	98.04	72.55	3.07 (1.59)	5.04 (2.12)	13.21 (3.5)
Marilyn Monroe	88.68	81.13	2.71 (1.42)	6.31 (1.46)	12.21 (3.38)
Marisa Cruz	89.8	65.31	2.44 (1.14)	4.42 (2.02)	13.07 (3.55)
Mariza	100	96.23	2.93 (1.14)	6.22 (1.2)	12.67 (3.46)
Martin Luther King	84.91	66.04	2.56 (1.03)	5.2 (1.87)	12.85 (2.41)

Megan Fox	86.27	66.67	2.22 (1.11)	4.53 (2.28)	15.61 (3.95)
Michael Carreira	98.11	84.91	2.51 (0.87)	5 (1.92)	13.59 (4.26)
Michael Jackson	100	100	2.91 (1.22)	6.33 (1.37)	10.2 (3.47)
Morgan Freeman	100	69.39	2.49 (1.22)	5.38 (2.2)	12.97 (3.94)
Nani	90.57	79.25	2.31 (0.9)	4.36 (2.29)	12.93 (3.98)
Nélson Évora	90.2	78.43	2.42 (0.78)	5.18 (1.85)	14.44 (3.92)
Neymar	88.24	82.35	2.91 (1.26)	5.4 (1.91)	16.49 (3.57)
Nicki Minaj	96.23	79.25	2.93 (1.1)	5.8 (1.55)	15.48 (3.97)
Nicolau Breyner	98.11	79.25	2.69 (1.18)	5.67 (1.67)	11.37 (3.85)
Oprah Winfrey	93.88	83.67	2.56 (0.81)	5.44 (1.57)	14.5 (3.28)
Papa Francisco	100	83.02	3.31 (1.26)	5.22 (1.77)	16.87 (3.9)
Paul Walker	98.04	70.59	2.58 (1.18)	5.42 (1.85)	14.52 (3.55)
Pedro Teixeira	97.96	83.67	3.62 (1.48)	5.27 (2.02)	11.7 (3.36)
Pink	94.34	88.68	2.56 (1.06)	5 (2.3)	12.29 (2.57)
Pinto da Costa	84.91	73.58	3.07 (1.37)	5.2 (2.15)	10.32 (3.84)
Princesa Diana	98.11	94.34	2.51 (1.25)	5.36 (2.11)	10.02 (3.61)
Quim Barreiros	98.04	90.2	3.29 (1.2)	6.44 (1.22)	9.27 (3.27)
Rainha Elizabeth	98.11	92.45	2.91 (1.02)	5.53 (1.97)	10.9 (3.92)
Ricardo Araújo Pereira	100	89.8	3.69 (1.31)	6.02 (1.23)	12.71 (3.65)
Rihanna	98.11	98.11	3.51 (1.39)	6.18 (1.39)	11.4 (3.81)
Rita Ferro Rodrigues	86.27	66.67	2.36 (1.23)	4.18 (2.09)	15.19 (4.12)
Rita Pereira	98.11	98.11	3.49 (1.49)	5.91 (1.69)	11.55 (3.97)
Ronaldinho	81.13	71.7	2.07 (0.99)	3.8 (2.48)	13.13 (3.93)
Rui Unas	96.08	82.35	3.27 (1.36)	6.13 (1.27)	14.67 (3.29)
Sara Matos	96.23	77.36	2.69 (1.41)	4.8 (2.15)	14.54 (4.02)
Sara Sampaio	96.08	90.2	3.49 (1.34)	6.24 (1.15)	16.38 (2.9)

Selena Gomez	97.96	91.84	2.82 (0.89)	5.73 (1.56)	11.89 (3.66)
Shakira	95.92	87.76	3 (1.02)	6.2 (1.16)	10.78 (3.05)
Simone de Oliveira	97.96	75.51	2.38 (0.83)	5.51 (1.79)	11.55 (3.21)
Steve Jobs	100	86.27	2.53 (0.81)	4.91 (1.98)	15.27 (2.69)
Taylor Swift	88.68	84.91	2.98 (1.01)	5.87 (1.47)	13.56 (3.16)
Teresa Guilherme	100	98.04	3.07 (1.19)	6.27 (1.36)	12.22 (3.1)
Tom Cruise	96.23	69.81	2.64 (0.91)	5.36 (1.73)	12.33 (2.85)
Tony Carreira	100	98.11	2.69 (0.73)	6 (1.45)	9.33 (3.18)
Vladimir Putin	96.08	78.43	2.8 (0.92)	4.91 (1.94)	16.25 (2.89)
Will Smith	88.68	73.58	2.67 (0.93)	5.36 (1.97)	13.3 (3.64)

Note: Faces were selected from a celebrity database validated for the young adult Portuguese population (Lima et al., 2021).

D.3. Availability of Data and Materials

All of the materials used in this study and all of the databases and statistical analysis are available at https://osf.io/t94dq/

D.4. References

Barros, C., Albuquerque, P. B., Pinto, R., & El Haj, M. (2021). The effect of distinctive facial features on destination memory. *Scandinavian Journal of Psychology*. *62*(4), 502-509. https://doi.org/10.1111/sjop.12734

Lima, D., Pinto, R., & Albuquerque, P. B. (2021). Recognition and naming test of the Portuguese population for national and international celebrities. *Behavior Research Methods, 53*(6), 2326-2337. https://doi.org/10.3758/s13428-021-01572-y

Appendix E. Thesis' Ethical Approval

The project for this thesis received the ethical approval for experiments with humans by the Ethics committee for Human and Social Sciences of the University of Minho (SECSH 037/2018), as shown below.

Universidade do Minho

Conselho de Ética

Conselho de Ética - Ciências Sociais e Humanas

Identificação do documento: SECSH 037/2018

Título do projeto: Alcances e limites da memória de destino: Estudo de variáveis associadas à informação e ao destinatário

Investigador(a) Responsável: Pedro B. Albuquerque (Universidade do Minho, Portugal)

Outros Investigadores: Maria Soledad Beato (Docente, Universidade de Salamanca, Espanha); Mohamad El_Haj (Docente, Universidade de Lille, França); Diogo Lima (Estudante, Universidade do Minho, Portugal); Catarina Barros (Estudante, Universidade do Minho, Portugal); Marina Hintze (Estudante, Universidade do Minho, Portugal)

PARECER

O Conselho de Ética analisou o processo relativo ao projeto de investigação acima identificado, intitulado Alcances e limites da memória de destino: Estudo de variáveis associadas à informação e ao destinatário.

Os documentos apresentados revelam que o projeto obedece aos requisitos exigidos para as boas práticas na investigação com humanos, em conformidade com as normas nacionais e internacionais que regulam a investigação em Ciências Sociais e Humanas.

Face ao exposto, o Conselho de Ética nada tem a opor à realização do projeto, emitindo o seu parecer favorável.

Braga, 07 de setembro de 2018.

A Presidente

Assinado por : **GRACIETTE TAVARES DIAS**
Num. de Identificação Civil: BI071230157
Data: 2018.09.28 10:25:36 GMT Daylight Time

CARTÃO DE CIDADÃO