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HAL Id: hal-03349646

https://hal-nantes-universite.archives-ouvertes.fr/hal-03349646

Submitted on 31 Oct 2022

Cognition and Neurosciences

Attractive memory: High destination memory for attractive faces

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Research has demonstrated that destination memory (i.e., the ability to remember to whom information was previously told) can be influenced by characteristics (e.g., emotional expressions and age) of the destination. Building on this literature, we investigated whether destination memory can be influenced by the attractiveness of the destination. We invited participants to give information on attractive faces, unattractive faces, or neither-attractive-nor-unattractive faces. On a recognition test, they were invited to decide to whom each piece of information had been previously told. Results demonstrated higher destination memory (1) for attractive faces than for neither-attractive-nor-unattractive faces, and (2) for unattractive faces than for neither-attractive-nor-unattractive faces. We attribute the higher destination memory for attractive and unattractive destinations to their distinctiveness compared with neutrally attractive destinations. We also provide some attentional explanations for the high memory for attractive and unattractive destinations.

Key words: Attractiveness, destination memory, distinctiveness, memory.

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INTRODUCTION

People like attractive faces (Langlois, Kalakanis, Rubenstein, Larson, Hallam & Smoot, 2000). They even tend to attribute positive value to attractive people, which is known as the "what is beautiful is good" principle (Dion, Berscheid & Walster, 1972; Rhodes, 2006). Evidence that facial attractiveness promotes social advantages stems from research demonstrating that, compared with people who are judged to be unattractive, attractive ones are perceived as more noteworthy (Mulford, Orbell, Shatto & Stockard, 1998) and are rated more positively on domains of social appeal and interpersonal competence (Griffin & Langlois, 2006; Langlois *et al*., 2000). The academic and professional performance of attractive people is even perceived more positively, with consequences for their academic success, employment and salary prospects (Agthe, Sporrle & Maner, 2011; Landy & Sigall, 1974; Mobius & Rosenblat, 2006). Attractive people are not only perceived more positively but are also treated better than unattractive people. For instance, people prefer to mate with (Kurzban & Weeden, 2005), date (Stelzer, Desmond & Price, 1987), and hire attractive people rather than unattractive ones (Marlowe, Schneider & Nelson, 1996).

Attractiveness has been found to influence not only social judgments but also memory for faces. Research has demonstrated high facial recognition for attractive faces (Cross, Cross & Daly, 1971; Deblieck & Zaidel, 2003; Marzi & Viggiano, 2010), although other research failed to do so probably due to differences regarding characteristics of faces or methodology (Light, Hollander & Kayra-Stuart, 1981; Wickham & Morris, 2003; Wiese, Altmann & Schweinberger, 2014). However, and based on this research, we investigated whether attractiveness influences destination memory, that is, the ability to remember to whom information was previously told (Gopie, Craik & Hasher, 2010; Gopie & Macleod, 2009; Koriat, Ben-Zur & Sheffer, 1988).

We summarize previous research on the effects of attractiveness on facial recognition, and then review the literature demonstrating how the ability to remember to whom information was previously told (i.e., destination memory) can be influenced by the characteristics of interlocutors. As we show, while research has demonstrated how the characteristics of interlocutors (e.g., emotional expressions and age) influence destination memory, little is known about how their degree of attractiveness influences it. This issue is important as the investigation of effects of attractiveness on destination memory can demonstrate how attractiveness can influence our ability to remember interlocutors in everyday life interactions.

The pioneering study by Ellis, Shepherd and Bruce (1973) demonstrated higher memory for highly attractive than for moderately attractive faces. Participants were exposed to pictures of faces, and recognition tests were given immediately, 6 days, and 35 days after exposure. Results demonstrated a significant decrease in recognition for moderately attractive faces at the 35-day test, but not for faces of high or low attractiveness. The authors suggested that both very attractive and very unattractive faces are characterized by distinctive features that promote facial recognition compared with faces that are averagely attractive. In other words, there was a U-shaped relationship between facial recognition and attractiveness in which faces of average attractiveness were the least distinctive and therefore the most difficult to remember. These findings were replicated by research demonstrating higher recognition for attractive or unattractive faces compared with faces of average attractiveness (Deblieck & Zaidel, 2003), as well as higher and faster recognition of unattractive faces compared with faces of average attractiveness (Marzi & Viggiano, 2010). The effect of face attractiveness on memory can be better understood if one considers the factors that may make a face attractive. Several factors may explain facial attractiveness, such as averageness,

symmetry, sexual dimorphism, and youthfulness (Perrett, Lee, Penton-Voak, Rowland, Yoshikawa, Burt & Akamatsu, 1998; Thornhill & Gangestad, 1993,1999). Furthermore, preferences for attractive faces appear early in development (Langlois, Ritter, Roggman & Vaughn, 1991) and are shared by different cultures (Langlois *et al.*, 2000).

Based on the above-mentioned literature, we investigated whether high recognition is also observed for attractive destinations, that is, do people remember easily whether they have previously told information to attractive interlocutors? Our aim was based on research demonstrating how destination memory can be influenced by social characteristics of the destination. For example, in a study investigating the effect of familiarity on destination memory (El Haj, Omigie & Samson, 2015), participants were invited to give information on pictures depicting faces of familiar people (i.e., celebrities) or unfamiliar people. On a subsequent recognition test, they were invited to decide to whom each piece of information had been previously told. Results showed that destination memory was better for familiar than for unfamiliar people.

In the current study, we extended these findings by examining whether destination memory is influenced by the attractiveness of the destination. We invited participants to give information on attractive, unattractive, and neither-attractive-nor-unattractive faces. On a subsequent recognition test, they had to say to which face they had previously told the information. We expected higher destination memory (1) for attractive faces than for neither-attractive-nor-unattractive faces, and (2) for unattractive faces than for neither-attractive-nor-unattractive faces.

METHOD

Participants

We recruited 41 graduate/undergraduate students from the University of Nantes (21 females and 20 males, *M* age = 22.59, *SD* = 4.72, range of age = 18–33). The sample size was based on previous research on destination memory (El Haj, 2017; El Haj, Omigie, *et al.*, 2015). The sample size was also determined as the maximal number of participants who were willing to participate to the study. Participants provided their informed consent prior to the experiment and completed a form about their age, gender, and history of neurological or psychiatric disorders. This history served to exclude participants with neurological/psychiatric disorders, which was the case of four participants who were excluded from the original sample (*n* = 50). Data of two participants from the original sample were also discarded because they were not French-native speakers, an exclusion based on the argument that some of the study material was verbal (see below). Data of three participants from the original sample were also discarded because they performed two SD below the mean score on the episodic memory task of Grober and Buschke (1987). Note that we used this test to verify that participants have no significant memory decline, this is important because our study deals with memory functioning. On this test, participants had to retain 16 words, each describing an item belonging to a different semantic category; after a 20 s distraction phase, they had to recall as many words as they could, the maximum score being 16 points. The mean score of participants was 12.20 (*SD* = 3.03).

Materials

Materials consisted of 24 French proverbs and 24 colored pictures. Proverbs were chosen according to their familiarity, as controlled in our previous research, and each proverb referred to a complete sentence in formal language (e.g., the pen is mightier than sword, better late than never, when in Rome do as the Romans do). Proverbs with archaic or vernacular language were excluded (El Haj, Omigie, *et al.*, 2015). The pictures depicted eight attractive faces, eight unattractive faces, and eight neither-attractive-nor-unattractive faces. Half of the faces were males and the other half were females. All the pictures were taken from Ebner, Riediger and Lindenberger's (2010) FACES database and represented faces with eye-gaze forward and head position forwards. Half the faces represented females and the other half represented males in order to avoid an own-gender bias (e.g., females may demonstrate better recognition for female faces than for male faces) (Cross *et al.*, 1971; Lewin & Herlitz, 2002; Steffens, Landmann & Mecklenbrauker, 2013; Wright & Sladden, 2003). The faces also depicted people aged between 18 and 33 years old in order to avoid an own-age bias (e.g., young adults may demonstrate better recognition for young faces than for old faces) (Ebner & Johnson, 2009). To avoid effects of emotion (El Haj, Raffard, Antoine & Gely-Nargeot, 2015), faces depicted neutral expressions.

Attractiveness of pictures were rated by a separate sample of 12 graduate/undergraduate students (six females and six males, *M* age = 21.91, *SD* = 4.52) who rated attractiveness on a five-point scale (one = attractive, two = moderately attractive, three = neither-attractive-nor-unattractive, four = moderately unattractive, five = unattractive). We presented the independent sample with a pool of 29 male and 29 female faces, as provided by the FACES database. We kept the eight attractive and eight unattractive faces that were assigned the most attractive/unattractive ratings, we also kept faces that were assigned the most three-point values.

Procedures

Destination memory assessment and response recording were controlled with the software package Psychopy (Peirce, 2007) coupled with a laptop computer and a 17-inch LCD display. Procedures replicated previous research on destination memory (Gopie *et al.*, 2010; Gopie & Macleod, 2009; El Haj, Altman, Bortolon, Capdevielle & Raffard, 2017; Wilu Wilu, Coello & El Haj, 2018). They included a study phase, a distractor task and a recognition phase (see Fig. 1). The study phase included 24 trials, each beginning with a 1-sec white fixation cross followed by a proverb presented in white Times New Roman 40-point font below a (12 × 12 cm) face. After telling each proverb to its corresponding face, participants pressed any key to continue with another white fixation cross for one sec. This procedure was repeated until participants had told 24 proverbs to the eight attractive faces, eight unattractive faces, and eight neither-attractive-nor-unattractive faces. Proverbs were told with no time limit. The correspondence between proverbs and destinations, as well as the order of presentation of the attractive, unattractive, and neither-attractive-nor-unattractive faces, were randomized for all participants. Prior to the study phase, participants were informed that they would tell proverbs to a destination and that their memory for the destination would be tested in a later session.

Immediately after the study phase, participants performed the distractor task that served as a retention interval between the study and recognition phases. In the distractor task, participants had to read aloud strings of three-digit numbers for one min. Afterwards, they proceeded to the recognition phase in which the previously exposed 24 proverbs and faces were paired and presented in random order: 12 intact pairs (four pairs consisting of proverb-attractive face + four pairs consisting of proverb-unattractive faces + four pairs consisting of proverb-neither-attractive-nor-unattractive face) + 12 re-pairings (four pairs consisting of proverb-attractive face + four pairs consisting of proverb-unattractive faces + four pairs consisting of proverb- neither-attractive-nor-unattractive face). Intact and repaired pairs were randomly chosen. Proverb-faces pairs were presented one at a time, with the proverb below the face. For each pair, the participants had to decide whether they had previously told that proverb to that face or not. No time limit was imposed for responses, which constituted in pressing a green key for "yes" responses, and a red key for "no" responses. After each response, a blank screen was displayed
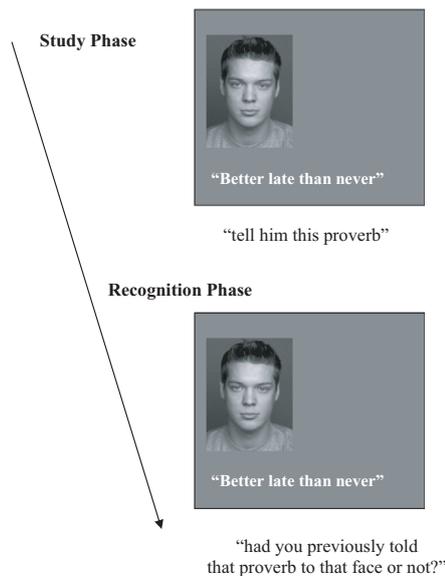
Fig. 1. On the assessment of destination memory, participants were invited to tell information to attractive faces, to unattractive faces, or to neither-attractive-nor-unattractive faces. On a recognition test, they were invited to decide to whom each piece of information had been previously told. *Note*: The image was taken from FACES database.

for 250 ms, followed by the next test trial. As recommended for analyzing recognition memory (Snodgrass & Corwin, 1988), performances on destination memory referred to the proportion of hits (correct "yes" responses) minus the proportion of false alarms (incorrect "yes" responses).

RESULTS

We compared differences in destination memory for attractive faces, unattractive faces, and neither-attractive-nor-unattractive faces. We used non-parametric tests because data were skewed as found with Kolmogorov–Smirnov tests [distribution for destination memory for attractive faces, $D(41) = 0.92$, $p = 0.006$, distribution for destination memory for unattractive faces, $D(41) = 0.89$, $p = 0.001$, distribution for destination memory for neither-attractive-nor-unattractive faces, $D(41) = 0.21$, $p < 0.001$]. Results were provided with effect size: $d = 0.2$ can be considered a small effect size, $d = 0.5$ represents a medium effect size and $d = 0.8$ refers to a large effect size (Cohen, 1988). Note that d was calculated for non-parametric tests according to the recommendations of Rosenthal and DiMatteo (2001).

Note that our sample size had an approximate 98% power. This power was calculated using G*Power and calculation was conducted for Wilcoxon tests based on an estimated probability of making type I error as 0.05, and a medium effect size of 0.5.

High destination memory for attractive and unattractive faces

Score are illustrated in Fig. 2. Wilcoxon tests demonstrated higher destination memory for attractive faces than for neither-attractive-nor-unattractive faces ($Z = -4.49$, $p < 0.001$, Cohen's $d = 1.97$), and higher destination memory for unattractive faces than for neither-attractive-nor-unattractive faces ($Z = -3.20$, $p < 0.01$, Cohen's $d = 1.15$). However, no significant differences were

observed between destination memory for attractive faces and unattractive faces ($Z = -1.31$, $p > 0.1$, Cohen's $d = 0.42$).

DISCUSSION

We investigated whether high destination memory would be observed for attractive interlocutors. To do so, we invited participants to remember whether they had previously given information on attractive faces, to unattractive faces, or to faces that were neither attractive nor unattractive. Results demonstrated higher destination memory (1) for attractive faces than for neither-attractive-nor-unattractive faces, and (2) for unattractive faces than for neither-attractive-nor-unattractive faces.

Previous research has demonstrated higher recognition for attractive or unattractive faces compared with faces of average attractiveness (Deblieck & Zaidel, 2003; Ellis *et al.*, 1973; Marzi & Viggiano, 2010). Our findings extend this research by demonstrating that higher destination memory is observed for attractive or unattractive faces compared with neither-attractive-nor-unattractive faces. When communicating information, people tend to better associate information to attractive or unattractive interlocutors than to neutrally attractive ones. This association may be due to factors such as distinctiveness, attentional, or even neural factors. Regarding distinctiveness, Ellis *et al.* (1973) posited a U-shaped relationship between facial recognition and attractiveness in which faces of average attractiveness were the least distinctive, and consequently the most difficult to remember, compared with very attractive or very unattractive faces. Based on this assumption, we suggest that, compared with neither-attractive-nor-unattractive faces, attractive and unattractive faces are more distinctive, and therefore provide more cues for retrieval.

Our assumption of higher destination memory for attractive or unattractive faces than for neutrally attractive ones is based on the work of Ellis *et al.* (1973), who attributed the poor recognition of faces of average attractiveness to their lack of distinctiveness. The influence of distinctiveness on face recognition was also demonstrated by Valentine (1991), who developed a multidimensional space model to represent faces in which different aspects of faces were represented in different dimensions. The model hypothesizes that, while distinctive faces are far removed from the central tendency, typical faces are close to it. Therefore, the former can be remembered more accurately
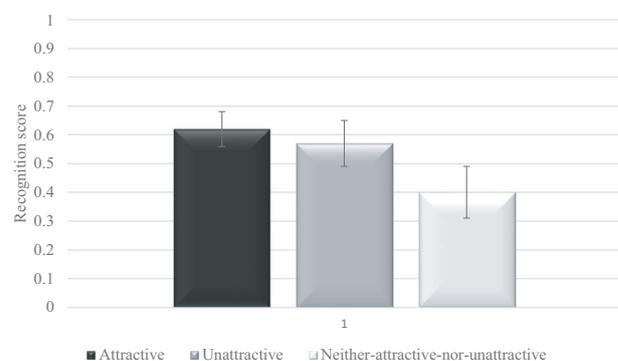

Fig. 2. Recognition scores for attractive faces, unattractive faces, and neither-attractive-nor-unattractive faces.

and rapidly because there are fewer similar faces to confuse the retrieval processes. Although this model provides a useful framework for understanding the effects of distinctiveness on face recognition, no experimental consensus has been reached on the relationship between attractiveness and face recognition. While several studies demonstrated the association between perceived attractiveness and better facial recognition (Cross *et al.*, 1971; Deblieck & Zaidel, 2003; Ellis *et al.*, 1973; Marzi & Viggiano, 2010), other research failed to do so (Light *et al.*, 1981; Lin, Fischer, Johnson & Ebner, 2019; Wickham & Morris, 2003; Wiese *et al.*, 2014). For instance, Wiese *et al.* (2014) reported that facial recognition was higher for unattractive than for attractive faces, even when faces were matched for distinctiveness. According to Wiese *et al.* (2014), faces with highly distinctive features, such as unusually sized or shaped facial features, deviate from an average face, and such a distinction might not have been made in the previous research and could therefore explain the varying results within research on facial attractiveness and memory.

Besides distinctiveness, our findings could be attributed to attentional factors. When telling information, people may devote more attentional resources to attractive or unattractive destinations than to neutrally attractive ones. This assumption can be supported by the fact that destination memory depends on the amount of attentional resources devoted to associating information to its destination at encoding (Gopie & Macleod, 2009). More specifically, destination memory depends on the amount of attentional resources required to transmit the information to the interlocutor. Also, research on face recognition has demonstrated that, when people are presented with attractive and unattractive faces, the former are examined longer and are fixated upon more than the latter (Hoss, Ramsey, Griffin & Langlois, 2005; Maner, Gailliot, Rouby & Miller, 2007). Therefore, it is likely that attractive and unattractive destinations capture and retain more attention than neutrally attractive ones. The attractive and unattractive destinations may capture more attention as they may be more uncommon compared with the neutrally attractive destinations.

At a more proximate level of analysis, neural mechanisms may also underlie our findings. Research on the neural correlates of face processing suggests that exposure to attractive faces activates reward circuitry (Cloutier, Heatherton, Whalen & Kelley, 2008; Kampe, Frith, Dolan & Frith, 2001; Winston, O'Doherty, Kilner, Perrett & Dolan, 2007). The reward circuitry includes brain areas such as the prefrontal cortex (i.e., orbital frontal cortex), the basal ganglia (i.e., ventral striatum, dorsal striatum, and amygdala), the thalamus, the midbrain dopamine neurons (Haber & Knutson, 2010), as well as subregions in the striatum (Liang, Zebrowitz & Zhang, 2010). This circuitry is typically activated during the processing of primary (e.g., food) and secondary (e.g., monetary) rewards (Elliott, Friston & Dolan, 2000). Given the effects of facial attractiveness on neural processing, it is likely that the processing of attractive and unattractive faces involves specific neural circuits that make these destinations more memorable. This hypothesis should be taken into consideration in future research, especially given the paucity of research on the neural basis of destination memory in general (Mugikura, Abe, Ito, Kawasaki, Ueno, Takahashi & Fujii, 2016).

The present findings can be understood within the destination memory framework, which highlights the relationship between destination memory and social cognition (El Haj & Miller, 2018). The framework posits that destination memory may be influenced by social processing, and especially by the familiarity of interlocutors, the stereotypes that are associated with them, and their perceived emotional and cognitive states. The model is based on research demonstrating that destination memory varies as a function of age (El Haj, Raffard, Fasotti & Allain, 2018), familiarity (El Haj, Omigie, *et al.*, 2015), emotional characteristics (El Haj, Fasotti & Allain, 2015; El Haj, Raffard, *et al.*, 2015), and even stereotypes associated with the destination (El Haj, 2017). Research has also demonstrated that destination memory may vary according to whether people are able to infer the cognitive and affective states of the destination. This issue was highlighted by research demonstrating a relationship between destination memory and theory of mind (El Haj, Gely-Nargeot & Raffard, 2015; El Haj, Raffard & Gely-Nargeot, 2016; El Haj, Saloppé & Nandrino, 2018). The authors found that people focus on observing and evaluating the feedback of the destinations, a process that allows them to infer and predict the mental states of destinations and consequently modify the nature of their communication to these destinations in order to better achieve the goals of the communication. While those findings demonstrated how destination memory can be influenced by the characteristics of the destination, the current study goes further by demonstrating that it can also vary as a function of attractiveness of the destination.

A shortcoming of this paper may be the a small but close to medium effect size for the difference between attractive and unattractive faces, which casts doubt on the power of the sample size. Future research can replicate our study design in a larger sample size and, ideally, with parametric tests.

In conclusion, facial attractiveness may confer some social and professional advantages as well as promoting some mating opportunities. It may also result in high facial recognition. As demonstrated in this paper, attractiveness may not only enhance memory for faces but also destination memory. Therefore, attractiveness may shape our memory of social interactions.

CONFLICT OF INTEREST

The authors declare that they have no conflict of interest.

DATA AVAILABILITY STATEMENT

Data will be available upon a reasonable request by email to the first author.

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