

**Romantic relationship status biases memory of faces of attractive opposite-sex others: Evidence from a reverse-correlation paradigm**

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## Abstract

Previous research has demonstrated that, presumably as a way to protect one's current romantic relationship, individuals involved in a heterosexual romantic relationship tend to give lower attractiveness ratings to attractive opposite-sex others as compared to uninvolved individuals (i.e., the *derogation effect*). The present study importantly extends this research by examining whether romantic relationship status actually biases memory for the facial appearance of attractive (vs. unattractive) mates. To address this issue, we used a reverse-correlation technique (Mangini & Biederman, 2004), originally developed to get a visual approximation of an individual's internal representation of a target category or person. In line with the derogation effect, results demonstrated that romantically involved (vs. uninvolved) individuals indeed held a less attractive memory of a previously encountered attractive mate's face. Interestingly, they also held a more attractive memory of an *unattractive* mate's face as compared to uninvolved individuals. This latter finding may suggest that romantically involved (as compared to uninvolved) individuals differentiate opposite-sex others along the attractiveness dimension less.

## 1. Introduction

A steady and satisfying romantic relationship often provides a source of comfort, pleasure, and safety (among other things). However, the maintenance of a romantic relationship is not always guaranteed, one of the important reasons being that appealing attractive alternative partners may threaten the stability of the relationship. Indeed, recent figures show that “someone else” is the leading reason for break up (at least in the Netherlands; CBS, 2009), and extramarital affairs are the number one reason for divorce across 160 cultures (Betzig, 1989). Given the potential benefits of a long-lasting romantic relationship for an individual’s psychological and physical well-being (House, Landis, & Umberson, 1988), it may be beneficial for people to resist attractive others. Moreover, from an evolutionary viewpoint, maintaining a long-term romantic relationship provides important reproductive benefits (e.g., through mutual care for offspring) – especially so for females (Buss & Schmitt, 1993). Therefore, psychological mechanisms may have evolved to ward off potential relationship threat from alternative mates (Gonzaga, Keltner, Londahl, & Smith, 2001).

One such mechanism might be that individuals who are long-term oriented towards their current partner devalue the attractiveness of alternative mates. Past research indeed has found that individuals involved in a heterosexual romantic relationship tend to rate the attractiveness of opposite-sex others as lower than singles (i.e., the derogation effect: Lydon, Fitzsimons, & Naidoo, 2003; Ritter, Karremans, & van Schie, 2010; Simpson, Gangestad, & Lerma, 1990). For example, Simpson and colleagues (1990) had their participants rate pictures of attractive opposite-sex others in magazines, and found that those involved in a heterosexual romantic relationship give

significantly lower attractiveness ratings than uninvolved participants.

Subsequent research has suggested that indeed romantically involved participants devalue the attractiveness of attractive potential partners, rather than singles enhancing attractive others (Lydon et al., 2003; Ritter et al., 2010).

An interesting question is whether the derogation effect merely occurs when explicitly asking involved individuals to provide attractiveness ratings, or whether such an effect extends to biased images in memory of attractive alternative mates. Put differently, when thinking of an attractive opposite-sex other, does relationship status actually influence the image one has in mind when thinking of him or her? From a relationship protection point of view, having in mind a less attractive image of a potential alternative mate may be highly functional. For example, an individual having in mind a less attractive image of a potential alternative mate may be less likely to have lingering thoughts about the alternative, may be less likely to envision having a relationship with him or her, and may be less likely to seek out contact with this person. Thus, having a less attractive image of the alternative in memory might be a particularly effective way of protecting one's current relationship.

Importantly, previous findings demonstrating that involved individuals' attractiveness *ratings* of alternative mates tend to be lower does not necessarily imply that involved individuals have a less attractive image of the alternative in memory. For example, it is possible that in previous studies normative pressures – at least to some extent – have contributed to lower attractiveness ratings given by romantically involved participants (Ritter et al., 2010), while privately holding mental images of the alternative mate that were equally attractive as those of their single counterparts. The main goal of the present study was to

examine whether relationship status indeed influences the facial appearance of potential mates in memory.

To this end, we used a reverse-correlation image classification technique, developed by Mangini and Biederman (2004; see also Todorov, Dotsch, Wigboldus, & Said, in press). This task is designed to get a visual approximation of an individual's internal representation of a target category or target person. In a first demonstration and validation of this technique, Mangini and Biederman (2004) instructed their participants, on a large number of trials, to classify noisy faces as either resembling Tom Cruise or John Travolta. The underlying base face of the images was always the same face, a morph between the faces of Tom Cruise and John Travolta, with different random noise superimposed in every trial. By averaging the noise patterns of all stimuli that were classified as 'Tom Cruise,' and by superimposing this average noise pattern to the base image, the resulting image – the classification image – indeed resembled Tom Cruise. The classification image of John Travolta indeed better resembled John Travolta. Importantly, the classification images depicted what visual information participants employed in order to make the John Travolta or Tom Cruise classification. Follow-up studies demonstrated that the paradigm also worked well for visualizing other categories, such as emotional expressions (happy versus unhappy), and gender.

Important for the purposes of the current research, Dotsch, Wigboldus, Langner, and van Knippenberg (2008) recently demonstrated that this technique may be used to reveal potential biases in individuals' mental face representations of a target category. Using this technique, these authors found that more prejudiced participants generated classification images of an outgroup

member that looked more criminal and unreliable (as judged by independent raters) as compared to participants who were less prejudiced. This finding suggests that perceiver characteristics (i.e., their level of prejudice) may be associated with biased mental representations of outgroup members' faces. Similarly, in the current research we may expect that a perceiver's current romantic relationship status (involved vs. uninvolved) would be associated with biased images in memory of opposite-sex alternatives.

Specifically, in the present study, we used a reverse correlation procedure to tap into participants' memory for faces of opposite-sex alternatives. We instructed romantically involved and uninvolved participants to select, on a number of trials, one of two noisy images that best resembled an opposite-sex other they had seen earlier in the study. This person had been either attractive or unattractive (see below). Averaging the noise patterns of the selected images (details of the procedure are discussed in the method section), resulted in a classification image which approximated a participants' memory of the previously seen person. Independent raters then rated the attractiveness of the classification images. According to the derogation hypothesis, the classification image of the attractive mate generated by romantically involved participants should be less attractive than the image generated by uninvolved participants.

It is important to note that, by examining biased memory using the reverse-correlation technique, the study also addresses a potential limitation of prior research on the derogation effect, as briefly alluded to above. Our use of the reverse correlation paradigm is less susceptible to social desirability or demand characteristics as compared to explicit ratings of attractiveness. It should be

clear that, in the present study, participants themselves do not need to judge attractiveness – in fact no reference to attractiveness is made whatsoever.

Finally, most previous studies on the derogation effect examined only responses to *attractive* mates, while less attractive mates were typically not included in the design (Bazzini & Shaffer, 1999; Lydon, Meana, Sepinwall, Richards, & Mayman, 1999; Lydon et al., 2003; but see Simpson et al., 1990). Hence, we also examined romantically involved and uninvolved participants' memory of *unattractive* mates. According to the reasoning underlying the derogation effect, romantically involved individuals would not necessarily devalue unattractive mates, as they do not pose a potential threat to the current relationship.

## **2. Experiment**

### **2.1. Method**

*2.1.1. Participants and design.* Eighty-two female participants (46 romantically involved, 36 uninvolved, mean age = 21.5, SD = 2.72; age did not significantly differ between involved and uninvolved participants,  $F < 1$ ), who received 2 Euros for participation, were randomly assigned to the attractive or unattractive condition. The design thus consisted of a 2 (Relationship Status: involved versus uninvolved) x 2 (Attractiveness: attractive versus unattractive) between-participants design.

*2.1.2. Procedure.* Participants were welcomed to the lab and seated behind a computer in individual cubicles. First, participants were shown for one minute a picture of the face of either an attractive or an unattractive male on the computer screen (see Figure 1a). The pictures were taken from an internet face-database ([www.beautycheck.de](http://www.beautycheck.de)), consisting of faces that were rated by a

representative sample (presumably of both partnered and unpartnered participants; mean age = 33.3 years). Participants in our study were simply asked to have a good look at the person in this picture, who ostensibly was another student, as they would be asked some questions about this student later in the study.

Second, after a 10-minute neutral filler task, participants completed a reverse-correlation image classification task (for further details, see Dotsch et al., 2008) to capture participants' memory of the male student's face. In 640 trials, from two stimulus faces that appeared simultaneously on the computer-screen, participants were instructed to choose the face they thought best resembled the face of the previously seen male student. All stimuli consisted of the same base face (which was actually a morph of the attractive and unattractive males; Figure 1a) with random noise superimposed. Within a single trial, one stimulus consisted of the base face with a random-noise pattern added, and the other stimulus consisted of the base face with the same pattern subtracted (Figure 1a). By averaging, across trials, all stimulus faces a participant chose as better resembling the male student, we obtained a personal classification image for that participant. This classification image was a function of the participant's memory of the face of the previously seen male student, the base face, and error. Finally, to reduce error and classification image noisiness, we calculated an aggregated classification image for each condition, representing the average remembered image of the male student in each of the four conditions defined by the Attractiveness by Relationship status design (see Figure 1b).

Third, in the image-rating phase, independent participants, all female ( $N = 62$ ), rated the four average classification images on attractiveness on a scale



ranging from 1 = *unattractive*, to 7 = *attractive*. The order of the images was counterbalanced.

### 3. Results

An analysis of variance revealed a main effect of attractiveness condition,  $F(1, 61) = 54.52, p < .001, \eta^2 = .47$ . Providing strong support for the validity of the reverse-correlation technique, across all participants the classification image of the attractive male was rated as more attractive,  $M = 3.74, SD = 1.38$ , than the image of the unattractive male,  $M = 3.01, SD = 1.24$ . No main effect of relationship status was found,  $F(1, 61) = 0.33, ns$ .

An interaction effect between relationship status and attractiveness condition was obtained,  $F(1, 61) = 14.06, p < .001, \eta^2 = .19$  (Figure 1b). In support of the derogation effect, the image of the attractive male was less attractive among romantically involved participants ( $M = 3.56, SD = 1.46$ ) than the same image among uninvolved participants ( $M = 3.92, SD = 1.42$ ),  $F(1, 61) = 12.47, p < .001, \eta^2 = .17$ . Interestingly, although the effect was weaker, the image of the unattractive male of the uninvolved participants,  $M = 2.87, SD = 1.32$ , was rated less attractive than the same image of romantically involved participants,  $M = 3.15, SD = 1.33, F(1, 61) = 5.43, p < .03, \eta^2 = .08$ .

Looking at the data differently, the classification images of the attractive versus unattractive male differed less strongly in attractiveness among romantically involved,  $F(1, 61) = 11.65, p < .001, \eta^2 = .16$ , than uninvolved participants,  $F(1, 61) = 58.67, p < .001, \eta^2 = .49$ .

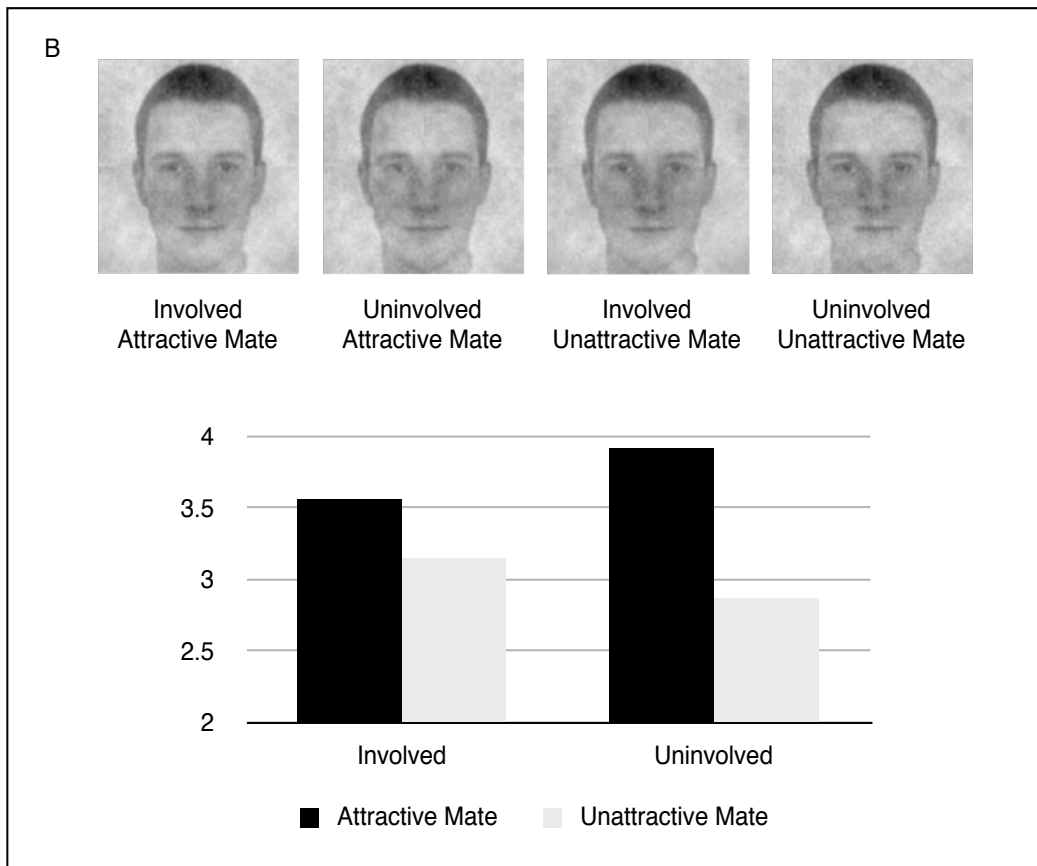
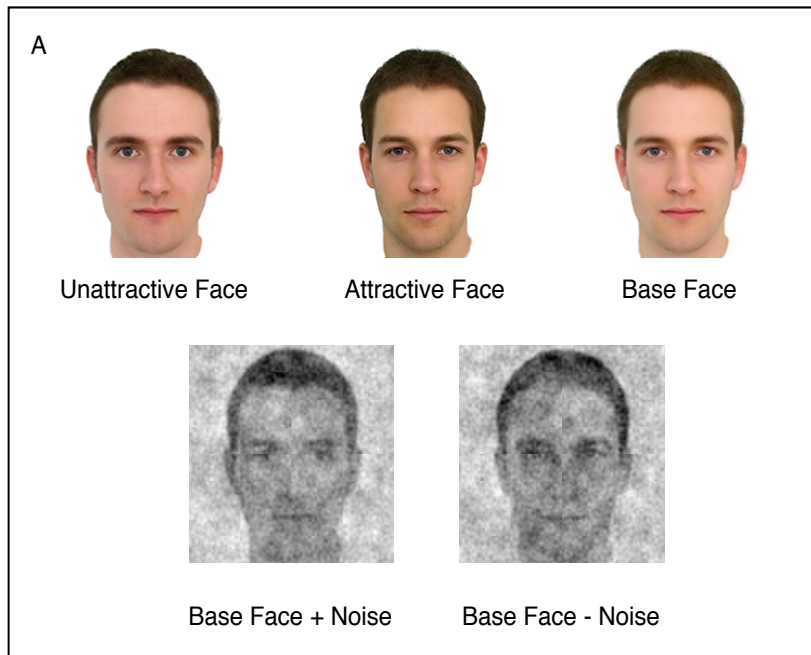


Figure 1a and 1b: The study stimuli (a) and results (b). In (a), the unattractive and attractive stimulus faces, the base face, and an example trial with the base face with random noise added and random noise subtracted are depicted. In (b), the four classification images of the Attractiveness x Relationship Involvement design are depicted, plus the mean attractiveness ratings for each of the images

#### 4. Discussion

Romantically involved females' memory of the faces of opposite-sex others differed significantly in terms of attractiveness as compared to uninvolved participants. Specifically, the remembered face of an attractive mate of romantically involved participants was found to be significantly less attractive. This finding importantly extends previous studies, demonstrating that the derogation effect is not restricted to merely lowered self-reported attractiveness ratings: romantically involved individuals actually seem to remember the face of a potential alternative mate as less attractive, a potentially important mechanism that may help involved individuals to protect their relationship from attractive alternatives. Incidentally, this finding also addresses a potential concern of previous derogation findings, namely that social desirability may have guided romantically involved participants' explicit attractiveness ratings of alternative mates.

Importantly, romantically involved participants also had a more attractive memory of the face of an unattractive mate, as compared to singles. This finding leaves open the interesting possibility that romantically involved individuals are simply less sensitive to attractiveness cues in opposite-sex others as compared to their single counterparts. They generally have a weaker mating selection goal as compared to singles, and may therefore discriminate opposite-sex others less along the attractiveness dimension. Similarly, romantically involved individuals may simply pay less attention to opposite-sex others (Maner, Gailliot, & Miller, 2009; Maner, Rouby, & Gonzaga, 2008), resulting in a less specified memory of opposite-sex others that regresses towards the mean value of attractiveness. This possible relative indifference for attractiveness of romantically involved

individuals provides an interesting avenue for future research. Although this possible mechanism is not incompatible with the derogation effect (both effects may exist), both in the current and previous studies on the derogation effect, relative indifference to attractiveness may – at least partly – have accounted for lower attractiveness ratings displayed by involved participants.

The present findings contribute to the broader literature on how people protect their relationship from the lure of attractive alternatives. As noted, several mechanisms have been documented, such as inattentiveness to attractive alternatives (Miller, 1997), and the derogation effect. Moreover, it has also been shown that, when in interaction with an attractive opposite-sex other, romantically involved individuals tend to show less behavioral interest in their interaction partner as compared to uninvolved individuals (Karremans & Verwijmeren, 2008). Finally, recent research has demonstrated that, in addition to devaluating attractive opposite-sex others, romantically involved individuals may ‘upgrade’ their own romantic partner in terms of attractiveness (e.g., Swami, Waters, & Furnham, 2010; Penton-Voak, Rowe, & Williams, 2007). As with the devaluation of attractive alternatives, an interesting and related question for future research is whether committed individuals actually hold a more attractive image of their partner in memory, or whether they simply report higher attractiveness ratings. More generally, the current research also contributes to recent literature on accentuation effects in face memory (e.g., Corneille et al., 2004; Huart, Corneille & Becquart, 2005) by highlighting a new dimension of accentuation (i.e., attractiveness) and by stressing the role of motivational factors in these effects.

We should acknowledge some limitations of the study. Previous research suggests that the derogation effect depends – at least partially – on self-regulatory resources (Ritter et al., 2010; Meyer et al., 2011). Specifically, this research has shown that romantically involved individuals only devalue attractive others when they have the self-regulatory capacity to do so. Others have demonstrated that related relationship protection mechanisms, such as inattention to attractive alternatives, tend to occur automatically (Maner et al., 2009; Maner et al., 2008). Based on the present study, it is difficult to tell whether biased face memory also relies on a self-regulatory process, or whether such biases occur automatically. Related, future research needs to clarify whether the effect obtained here resulted from differences in face encoding, face recollection, or both. Finally, we focused on female participants in the present research. As reproductive benefits of maintaining a long-term relationship may be higher for females than males (Buss & Schmitt, 1993), one might expect that relationship protection against attractive alternatives might be most pronounced among women. Hence, an interesting question for future research is to examine whether the present findings generalize to males, or whether males do not show the effect.

Offering a unique possibility to get inside participants' head, the current research is one of the first studies using the reverse-correlation technique to examine biased face memory. Using this technique, previous research demonstrated that internal representations of stigmatized outgroup faces are biased by the level of prejudice of a perceiver (Dotsch et al., 2008). Here we have demonstrated that relationship status biases face memory of a specific other person, namely an attractive opposite-sex other. The technique is a promising

and powerful tool to examine face memory biases in related and other domains. For example, an interesting question that could be addressed is whether romantic involvement might enhance sensitivity to the attractiveness of same-sex rivals. In a somewhat different domain, it would for example be interesting to examine the role of a perceiver's social power on biased memory (e.g., in terms of attractiveness, trustworthiness, or other features) of interaction partners, given the important role of social power on social perception and behavior (see for example Keltner, Gruenfeld, & Anderson, 2003). Any such questions could be examined without having to instruct participants explicitly to make judgments on the characteristic of interest.

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