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ORIGINAL PAPER

Effect of Facial Self-Resemblance on the Startle Response and Subjective Ratings of Erotic Stimuli in Heterosexual Men

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Abstract Cues of kinship are predicted to increase prosocial behavior due to the benefits of inclusive fitness, but to decrease approach motivation due to the potential costs of inbreeding. Previous studies have shown that facial resemblance, a putative cue of kinship, increases prosocial behavior. However, the effects of facial resemblance on mating preferences are equivocal, with some studies finding that facial resemblance decreases sexual attractiveness ratings, while other studies show that individuals choose mates partly on the basis of similarity. To further investigate this issue, a psychophysiological measure of affective processing, the startle response, was used in this study, assuming that differences in approach motivation to erotic pictures will modulate startle. Male volunteers ($n = 30$) viewed 30 pictures of erotic female nudes while startle eyeblink responses were elicited by acoustic noise probes. The female nude pictures were digitally altered so that the face either resembled the male participant or another participant, or were not altered. Non-nude neutral pictures were also included. Importantly, the digital alteration was undetected by the participants. Erotic pictures were rated as being pleasant and clearly reduced startle eyeblink magnitude as compared to neutral pictures. Participants showed greater startle inhibition to self-resembling than to other-resembling or non-manipulated female nude pictures, but subjective pleasure and arousal ratings did not differ among the three erotic picture categories. Our data suggest that visual facial resemblance of opposite-sex nudes increases approach motivation in men, and that this effect was not due to their conscious evaluation of the erotic stimuli.

Keywords Facial self-resemblance · Kin recognition · Inbreeding avoidance · Erotic stimuli · Affective startle modulation

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Introduction

Humans and many other vertebrates are able to recognize their kin. Experimental evidence shows that humans are able to recognize genetic similarity based on shared olfactory and visual cues (Oda, Matsumoto-Oda, & Kurashima, 2006; Wedekind, 2007; Weisfeld, Czilli, Phillips, Gall, & Lichtman, 2003). Kin recognition is important, because organisms can increase their fitness by recognizing their kin and responding appropriately to them. The responses to kin are said to be context dependent, because the fitness-enhancing response to kin is different in the context of prosocial behavior and mate choice: Kinship cues are predicted to increase non-sexual prosocial regard owing to the benefits of inclusive fitness (Hamilton, 1964) but to decrease sexual desirability owing to the costs of inbreeding (Bateson, 1983; Bittles & Neel, 1994). Indeed, several studies have shown that experimentally induced facial resemblance, a putative kinship cue, increases prosocial attributions like trusting behavior (DeBruine, 2002), self-reported preference for children (DeBruine, 2004b; Platek, Burch, Panyavin, Wasserman, & Gallup, 2002; Platek et al., 2003), and the attractiveness of same-sex faces (DeBruine, 2004a).

While there is considerable evidence for increased prosocial attributions for self-resembling faces, the evidence for the effects of kinship cues on mating preferences is less clear. Experimental manipulations of facial resemblance have shown that self-resembling opposite-sex faces (putative mating part-

ners) are not rated as more attractive than control faces (DeBruine, 2004a). Furthermore, DeBruine (2005) showed that self-resemblance increased attributions of trustworthiness to opposite-sex face images, but had no effect on attractiveness in the context of a long-term relationship, and decreased attractiveness in the context of a short-term (sexual) relationship. These findings support the notion that cues of kinship (facial similarity) decrease sexual desirability of potential mates.

On the other hand, observational studies have shown that human romantic partners tend to resemble each other in many traits, including facial characteristics (Bereczkei, Gyuris, Koves, & Bernath, 2002; Bereczkei, Gyuris, & Weisfeld, 2004; Griffths & Kunz, 1973; Zajonc, Adelmann, Murphy, & Niedenthal, 1987). Imprinting-like mechanisms have been suggested to account for this effect (Bereczkei et al., 2002; Daly, 1989): Cross-fostering studies with animals and adoption studies with humans have shown that animals and humans prefer sexual partners that are similar to the opposite sex-parent that reared them (Bereczkei et al., 2004; Immelmann, Pröve, Lassek, & Bischof, 1991; Oetting, Pröve, & Bischof, 1995). For example, Bereczkei et al. (2004) examined photographs of adopted daughters, their rearing families, and their husbands. Judges found a significant resemblance of the facial characteristics of the daughters' husband and the facial characteristics of the adopted father. This is believed to be due to a fixation to a set of family characteristics that later shape mate preferences during adulthood.

Thus, based on previous research, there is a lack of consensus as to whether facial similarity decreases the approach motivation to potential mating partners or increases it. While observational studies show that human romantic partners tend to resemble each other, studies on computer manipulated self-resemblance point to a decreased sexual desirability of similar mates.

One problem inherent in the previously described experimental studies is that their designs were based solely on subjective ratings of faces, which might not be the optimal method for analyzing mating preferences (e.g., approach motivation to potential mates). The validity of subjective ratings as a measure of emotional and motivational status is problematic for several reasons. First, subjective ratings require introspection, which is susceptible to error, reconstruction, and inaccuracy (Nisbett & Wilson, 1977). Second, factors such as demand characteristics and social desirability may play a role in the response tendencies. Third, there is often a considerable time gap between the affective process itself (e.g., during viewing of the picture) and the retrieving of the affective process (since the subjective ratings were usually given after picture viewing) during which the impression of the target can decay or be influenced by new input. Furthermore, the use of face stimuli alone is not optimal for analyzing mating preferences. Studies that focus on aspects of approach motivation to potential mates and states of sexual arousal typically use erotic pictures or film segments as stimulus material and, in addition to subjective ratings, use physiological measures as dependent variables.

One well-validated and widely used physiological method for assessing affective valence in the laboratory is the affective startle modulation paradigm. Numerous studies have shown that the startle reflex (elicited by a brief burst of noise) is facilitated when people view aversive pictures and inhibited when people view pleasant pictures (for a review, see Bradley, Cuthbert, & Lang, 1999). Viewing of aversive pictures leads to an activation of the defensive system and, therefore, leads to an augmentation of the congruent defensive startle reflex. Viewing of pleasant pictures, on the other hand, engages the appetitive/approach system and leads to an inhibition of the non-congruent defensive startle reflex. Thus, affective startle modulation is not a direct measure of the physiological mecha nisms underlying emotion, but rather an indirect measure of the activity of neurobiological structures involved in the processing of approach and withdrawal motivation. The inhibition of the startle reflex while viewing pleasant pictures reflects the activity of neurobiological circuits involved in approach motivation.

Affective startle modulation has been shown to generalize to a variety of foreground stimuli other than pictures that modify the emotional state of the participants (Bradley et al., 1999), and eliciting the startle response during foreground presentation of different stimuli serves as a validated measure of the affective valence of the presented stimuli. In particular, the startle modulation paradigm has been frequently used to analyze approach motivation to erotic pictures and film segments (Graham, Janssen, & Sanders, 2000; Janssen, Goodrich, Petrocelli, & Bancroft, 2009; Koukounas & McCabe, 2001; Koukounas & Over, 2000; Lass-Hennemann, Schulz, Nees, Blumenthal, & Schachinger, 2009; Prause, Janssen, & Hetrick, 2008).

The utility of startle over self-report in studying approach motivation is based on the fact that the affective startle modulation paradigm is not hampered by the same problems as subjective ratings. Affective startle modulation is largely independent of instructions and does not require an introspective focus. It is not a conscious or controlled process and there is a very short time gap between the affective process itself and the measurement of the affective process. Therefore, affective startle modulation appears to be an appropriate measure to evaluate differences in the approach motivation to, photographs of erotic female nudes who resemble the participant compared to photographs of erotic female nudes who do not resemble the participant.

Up to now, there is a lack of consensus on whether facial self-resemblance increases the approach motivation to potential mates or decreases it. In the present study, we tested two hypotheses whether facial self-resemblance to the participant would increase or decrease the perceived pleasantness (via subjective ratings) and the approach motivation (via affective startle

modulation) to erotic female nudes. Participants viewed pictures of erotic female nudes whose facial characteristics were either computer-modified to resemble themselves, or made to resemble another person, or not manipulated control nudes, as well as viewing neutral pictures. We predicted that the startle response in the presence of erotic pictures would be influenced by facial self-resemblance, indicating differences in the activity of neurobiological structures involved in approach motivation.

Method

Participants

Participants were 40 male heterosexual students at the University of Trier, Germany, who responded to notices offering 20 € for taking part in two different experiments. Participation was limited to heterosexual Caucasian students without beards, facial piercings, or facial tattoos. Furthermore, only participants with normal or corrected to normal vision and no history of hearing problems were included in the study. Eligibility was determined by a telephone screening interview. All participants signed a written informed consent and were given a small financial compensation (5 € for the photograph acquisition, 15 € for the actual experiment) for taking part in the experiment. Study procedures were approved by the local ethics committee.

Materials and Design

Experimental material consisted of 40 pictures, 30 of which showed erotic female nudes with a completely visible face (i.e., no hair covering parts of the face), a direct gaze at the observer, and a neutral facial expression. The other 10 pictures were neutral pictures selected from the International Affective Picture System[1] (household objects) (Lang, Bradley, & Cuthbert, 1999).

We used computer imaging techniques to manipulate facial resemblance between pictures of the face of each participant and the faces of the pictures of the erotic female nudes.

Figure 1 shows the steps of the morphing procedure. The pictures of the erotic female nudes formed the basis for the morphing procedure, in which the face of the participant was morphed into the face of the erotic female nude. Templates were created that specified the contours and certain landmarks on each face. The morphing routine itself comprised two processes: a shape-morph averaged the distance between the features of both faces that were specified in the template and a color morph averaged the colors of each pixel. These processes resulted in two different output images, and the color morph

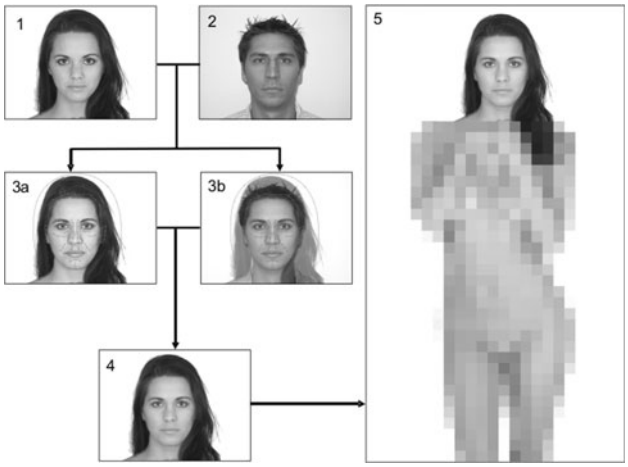

Fig. 1 Image editing procedure: The nude woman's detailed face (*1*) was morphed with the portrait picture of the participant (*2*). The morphing software produces two output images, a shape-only morph (*3a*) and a combined shape–color morph (*3b*). In a second step the shape–color morph is used as a semi-transparent layer on top of the shape-only morph. All artefacts of the morphing procedure are eliminated. The resulting image (*4*) was photo-mounted on the woman's body in a last step (*5*). The resulting image was used as a stimulus (the image was not masked in the experiment)

was used as a layer on top of the shape morph. To ensure that the resulting female nude pictures still looked attractive and feminine, transparency was added to the color morph layer to a 30% degree. That meant that the morphed picture shared 50% of the shape of the participants' face, but only 30% of the color information. By doing this, a composite face was created which was in favor of the women's features, i.e., the face was still primarily female and fitted to the body of the erotic female nude, even though it had a subtle resemblance to the participant. For further details on the underlying technology, see Tiddeman, Perrett, and Burt (2001). No participants reported detecting the nature of the experiment, suggesting that the morphing did not result in conscious recognition of their own face by any participant.

The 30 pictures of the erotic female nudes were randomly assigned to three subsets that consisted of 10 erotic female nudes each. For each participant, one of the three subsets was morphed with his own face and formed the "self-resembling" erotic female nude picture set (self resembling erotic female nudes), so that 10 pictures had a subtle resemblance to the participant. Ten other photos of erotic female nudes were morphed with the face of a different participant and formed the "other-resembling" erotic female nude picture set (other resembling erotic female nudes). The remaining 10 female nude pictures remained in their original state and were used as the "not manipulated" erotic female nude picture set (control nudes). For the assignment of the picture sets to the participants, we employed a cross-over design: Pairs of two participants were presented with the same version of the picture sets, so that the picture set that formed the self-resembling erotic female nude picture set

[1] IAPS picture numbers used in this study were 7000, 7002, 7004, 7006, 7009, 7010, 7020, 7025, 7035, and 7040.

for participant A formed the other-resembling erotic female nude picture set for participant B and vice versa. That is, every morphed picture set functioned once as the self-resembling erotic female nude picture set and once as the other-resembling erotic female nude picture set.

We included the erotic female control nude pictures as a control condition to test whether morphed erotic female nude pictures led to a comparable startle inhibition as not manipulated erotic female nude pictures. Furthermore, we included neutral pictures as a control to illustrate the effect of affective startle modulation. Pictures were displayed on an LCD computer and picture onset was virtually instantaneous.

Cover Story

To be able to morph the participants' faces into the faces of the erotic female nudes, we had to gather a standardized photograph of each participant's face. For the nature of the experiment, it was necessary that participants did not know about the true purpose of the experiment. To assure this, we used the following cover story: Participants were told that for a payment of 20 € they could participate in two unrelated studies in our lab: The experimenter told participants that the first study was to establish a new emotional face database that would be used for psychophysiological research. The second study would analyze emotional and physiological reactions to erotic pictures. Furthermore, the experimenter explained that both studies were run together for economic reasons.

Procedure

Photograph Acquisition

If the participant met the criteria in the telephone interview, he was invited to our laboratory to take the photographs of his face. After arriving at the laboratory, the experimenter asked the participant to sign an informed consent in which the participant approved the scientific usage of the photographs of his face. The experimenter instructed the participant to look into the camera with a neutral facial expression. Then, the experimenter took the portrait photographs with a digital camera from a distance of 80 cm in a fully lit room.

Startle Pretest

Directly after the photographs were taken, participants underwent a brief startle paradigm. The experimenter explained to the participants that the reaction to startle probes was the main dependent measure in the second study and that some people do not respond to these startle probes. Furthermore, he explained that only those people who showed a reliable startle reaction to the stimuli would be able to participate in the second study. The experimenter attached electrodes for electromyographic (EMG) measurement of the left musculus orbicularis oculi below the left eye of the participant with an inter-electrode distance of 1.5 cm (center to center). A third electrode taped on the forehead served as a reference. Electrode placement and skin preparation followed published guidelines (Blumenthal et al., 2005). Ten startle probes (105 db, 50 ms, instantaneous rise time) were presented to each participant and the EMG response to the startle probes were recorded.

After finishing the startle pretest, an appointment for the second part of the study was made with the participants. Ten participants showed less than 70% measurable startle responses and were therefore not invited to the second part of the study. Every participant received 5 Euros for participation and left the laboratory.

Affective Startle Modulation Paradigm

Participants arrived for the second appointment about 1 week after the pictures were taken. During this week, participants' pictures were morphed with one subset of the erotic female nude pictures.

When participants arrived at the laboratory, the experimenter asked them to sit in a comfortable chair approximately 80 cm in front of a computer screen with a visual angle of 25°. The experimenter attached electrodes for EMG measurement (as described in *Startle Pretest*). Participants were instructed via computer screen that a series of pictures would be displayed and that each picture should be viewed for its entire duration. Participants were also asked to relax, to neither move nor speak, and to avoid long periods of eye closure. Finally, they were told that brief noises would be delivered via headphones. Six startle probes presented before the experimental session served as habituation trials. Then the previously described pictures (self-resembling erotic female nudes, other resembling erotic female nudes, erotic female control nudes, and neutral pictures) were displayed on the computer screen in a randomized order for each participant. Each picture was shown for 5 s and an acoustic startle probe was presented between 2.5 and 3.5 s after picture onset in 8 (of 10) pictures per category, for a total of 40 pictures trials. A black screen was shown for 4 s in every Inter-Picture-Interval. The acoustic startle stimulus consisted of a binaurally presented burst of white noise (105 db, 50 ms, instantaneous rise time).

Pleasure and Arousal Ratings

After completing the affective startle modulation paradigm, the participants were asked to evaluate each picture for perceived pleasure and arousal using Self-Assessment-Manikin ratings ranging from 1 to 9 (1 indicates very low pleasure and arousal, and 9 very high pleasure and arousal) (Bradley & Lang, 1994).

After completing the affective startle modulation paradigm and the pleasure and arousal ratings, participants completed a

brief questionnaire about their opinion about the purpose of the experiment: They were asked if they found anything to be special about the pictures of the erotic female nudes. None of the participants correctly detected that the pictures were digitally altered. After completing the questionnaire, the participants received 15 Euros and were thanked for their participation.

Debriefing

We did not inform participants about the true purpose of the experiment until we finished the data acquisition of all participants, because we wanted to avoid participants speaking about the experiment with other potential participants. After we finished data acquisition, we contacted each participant and explained the purpose of the experiment. Participants were encouraged to contact the experimenter at any time if they had further questions.

Physiological Recordings and Data Analysis

The startle response was assessed as peak EMG activity of the left orbicularis oculi, and was recorded with a BIOPAC MP 150 system and an EMG 100C amplifier at a sampling rate of 1,000 Hz, with a notch filter of 50 Hz and a band pass filter of 28–500 Hz. The raw signal was rectified and integrated online with a time constant of 10 ms.

A semi-automated PC program was used to analyze EMG data. The algorithm identified response peaks in the time interval of 20–150 ms after stimulus onset and baseline was set to 50 ms prior to stimulus onset. EMG data of all participants were manually confirmed with respect to non-response (no visible startle response) and/or artifacts (i.e., voluntary or spontaneous eyeblinks coinciding with the startle stimulus, trials with excessive background noise, multiple peaks).

The startle response was defined as the difference between a stable baseline (50 ms before stimulus onset) and the maximum magnitude of the EMG 20–150 ms after startle stimulus onset. If responses were not visible at the typical response latency of a particular participant, response magnitude was set to zero. Zero response magnitude data were included in the averaging procedure, with startle response magnitude as the output measure. Raw data were T-scored using all blinks of each participant as the standard distribution in order to minimize between-participant variability in the absolute size of the startle response (Blumenthal, Elden, & Flaten, 2004).

A repeated measure analysis of variance (critical α level = .05) was used to analyze the effect of picture content (4 levels: self-resembling erotic female nudes, other-resembling erotic female nudes, erotic female control nudes, and neutral) on startle magnitude. Furthermore, a multivariate analyses of variance (critical α level = .05) with picture content as the within-subjects factor and pleasure and arousal ratings as dependent variables was conducted. Effect sizes are reported as partial eta-squared values.

Results

Startle Magnitude

Figure 2 shows the startle response magnitude to the different picture categories. To analyze the difference in approach motivation to the different erotic picture categories, we had to first show that affective startle modulation actually took place. As expected, startle response magnitude was affected by picture content, $F(3, 87) = 15.98$, $p < .001$, $\eta^2 = .35$. Startle probes elicited larger blink responses during foreground presentation of neutral pictures compared to self-resembling erotic female nudes, $t(29) = 6.43$, $p < .001$, other-resembling erotic female nudes, $t(29) = 3.64$, $p < .01$, and erotic female control nudes $t(29) = 4.46$, $p < .01$, showing the expected startle inhibition for appetitive pictures.

The experimental findings of central importance tested the hypothesis that the startle activity was different in the presence of pictures of self-resembling erotic female nudes compared to other-resembling erotic female nudes and erotic female control nudes. As expected, startle responses during foreground presentation of the three erotic photograph categories differed significantly from each other. Foreground presentation of pictures of self-resembling erotic female nudes led to a larger inhibition of the startle reflex compared to other-resembling erotic female nudes $t(29) = -2.59$, $p < .05$, and erotic female control nudes

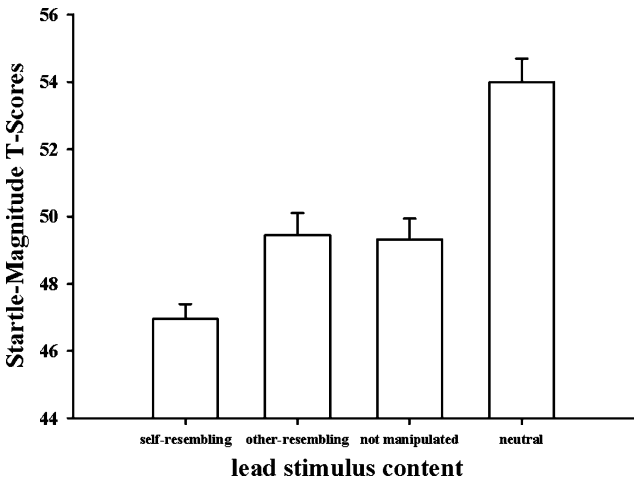

Fig. 2 Blink magnitude to startle stimuli during foreground presentation of four different picture contents: **a** photographs of erotic female nudes with manipulated facial similarity to the participant (self-resembling), **b** photographs of erotic female nudes with manipulated facial similarity to another participant (other-resembling), **c** photographs of erotic female nudes whose facial characteristics were not manipulated (control), and **d** neutral pictures (neutral). Data are reported as *T*-scores. Error bars indicate 1 SE

$t(29) = -1.97$, $p < .05$, indicating a higher approach motivation to these pictures.

Pleasure and Arousal Ratings

Table 1 shows the mean valence and arousal ratings for all picture categories. Analysis of picture valence ratings revealed a main effect of content, $F(3, 87) = 47.02$, $p < .001$, $\eta^2 = .62$. All three erotic picture categories were rated as more pleasant than the neutral pictures ($p < .001$). However, there was no significant difference in valence ratings among the three erotic categories. Analysis of arousal ratings revealed a main effect in the same direction, $F(3, 87) = 96.20$, $p < .001$, $\eta^2 = .77$. All three erotic subsets were rated as more arousing than neutral pictures ($p < .001$), but there was no significant difference in arousal ratings between self-resembling pictures of erotic female nudes and other-resembling pictures of erotic female nudes, and there was also no significant difference between ratings for self-resembling erotic pictures and erotic control pictures. These findings indicate that participants experienced all three erotic categories to be equally pleasant and arousing.

Discussion

The purpose of the present study was to investigate whether facial self-resemblance had an influence on pleasure and arousal ratings of pictures of erotic female nudes and approach motivation to these pictures. In addition to subjective ratings, we used affective startle modulation to investigate the activity of neurobiological circuits involved in approach motivation. We predicted that facial self-resemblance would influence affective startle modulation to, and subjective ratings of, pictures of erotic female nudes. We showed that startle response magnitude was smaller during foreground presentation of photographs of self-resembling female nudes compared to other-resembling female nudes and not-manipulated female nudes. This suggests the possibility that facial self-resemblance increased the activity of neurobiological structures involved in approach motivation, suggesting that similar mates led to a larger approach motivation than dissimilar mates. Although our results were based on a very basic psychophysiological measure of approach motivation, the startle response, these results were in line with the findings that humans tend to prefer similar mates over dissimilar mates. However, we have to point out that startle modulation is not a direct measure of mate choice or mating preferences; it is simply a measure of the approach motivation towards certain mates. Thus, it is a very basic indicator of approach motivation which is not necessarily reflected in true mating decisions, although it may indicate the initial steps in such a decision making process.

Another possible interpretation of our findings is that self-resembling female nudes lead to a larger startle inhibition due to a mere exposure effect of the participant's face in the self-resembling erotic female nude. The mere exposure effect describes a phenomenon by which people tend to develop a preference for things because they are familiar with them. In the self-resembling female nudes participants viewed features of their own face which is of course familiar to them. Thus, one might explain the startle inhibition to self-resembling erotic female nudes by a mere exposure preference for the self-resembling female nudes. However, an important argument speaks against this hypothesis: Several studies suggest that self-resembling faces are not generally preferred, but that the preference for self-resembling faces is sensitive to context: Factors such as menstrual cycle phase (DeBruine, Jones, & Perrett, 2005) and stress (Lass-Hennemann et al., 2010) have been shown to modulate the preference for self-resembling faces. These divergent effects of facial self-resemblance in different contexts clearly speak against the hypothesis that the preference for self-resembling faces is merely a product of repeated exposure. Thus we do not believe that the mere exposure effect can account for our findings. However, future studies should investigate this issue.

In the present study we did not find a preference for self-resembling erotic female nudes for subjective pleasure and arousal ratings, which did not differ across the three erotic female nude picture categories. Thus, there was a dissociation between our two indicators of sexual attractiveness: affective startle modulation and subjective ratings. This dissociation has been shown before (Lass-Hennemann et al., 2009; Levenston, Patrick, Bradley, & Lang, 2000) and may be explained by the different processes underlying startle modulation and subjective ratings of picture content. As described above, subjective ratings are a voluntarily controllable measure, one that may be confounded by

Table 1 Mean ratings of pleasure and arousal as a function of stimulus type

Dependent measure	Self-resembling erotica $M \pm SD$	Other-resembling erotica $M \pm SD$	Not manipulated erotica $M \pm SD$	Neutral pictures $M \pm SD$	Main effect
Pleasure ratings (1–9)	$6.57 \pm .73$[a]	$6.46 \pm .65$[a]	$6.75 \pm .93$[a]	$4.85 \pm .72$	$F(3, 87) = 47.02$, $p < .001$, $\eta^2 = .62$
Arousal ratings (1–9)	5.76 ± 1.29[a]	5.70 ± 1.25[a]	6.03 ± 1.43[a]	2.64 ± 1.31	$F(3, 87) = 96.20$, $p < .001$, $\eta^2 = .77$

[a] Difference from neutral pictures was significant

person variables such as social desirability and demand characteristics. Startle modulation, on the other hand, is not dependent on conscious intentional control. Therefore, affective startle modulation might be a more valid measure of approach motivation, especially in this specific context, since the problem of controllability of the answers that a participant gives might be even stronger in an erotic context, where factors like shame and embarrassment may play a role.

The dissociation between subjective ratings and affective startle modulation may also be explained by the opponent process theory of emotion (Solomon & Corbit, 1974). According to this theory, emotional and motivational states are modulated by opposing reactions, the a and b processes. The a process is the initial reaction to an emotion-eliciting stimulus (in our case, the pictures of the erotic female nudes). The b process is a lagging compensatory reaction that tends to return the system to equilibrium, thereby modulating the affective experience. The affective valence of the b process is opposite to that of the a process. In our paradigm, affective startle modulation took place during picture viewing, whereas the subjective ratings were assessed at the end of the session, shortly after picture viewing. Therefore, the b process might already have been dominant during picture rating, explaining the absence of a difference in subjective ratings among self-resembling, other-resembling, and control erotic pictures.

One important methodological advantage of our study is that we employed a cross-over design, using the same erotic pictures for pairs of two participants, with the other-resembling erotic pictures for one participant serving as the self-resembling pictures for the other participant. This indicates that the inhibition of startle reactions in the presence of the pictures of self-resembling erotic female nudes was based on the degree of self-resemblance with the participant, and not on some other characteristic of the pictures.

Two different processes could lead to the greater startle inhibition during pictures of self-resembling erotic female nudes compared to the other erotic picture categories. One explanation proposes an additive effect of the similar face and the attractive body. The similar face might be perceived as more attractive than the dissimilar faces and, therefore, enhances the affective valence of the erotic female nude by an additive effect of the similar, more attractive face, and the attractive body. Another explanation proposes that the similar face is more familiar to the participant and does not capture as much attention as the dissimilar faces. This could lead to a shift of attention from the face to the attractive body, leading to an enhanced startle inhibition. A replication of this study with a measure of eye-tracking would be an appropriate next step to test the hypothesis that facial similarity modulates the extent to which the face and attractive body of erotic female nude pictures are viewed. However, it must be remembered that, when we speak of perception, familiarity, and attention in these explanations, the participants did not consciously realize that the self-resembling face actually included aspects of their own features. That is, the participants were not consciously aware of the manipulation of self-resemblance.

Our results were in line with the findings that human romantic partners tend to resemble each other, indicating a larger approach motivation to similar mates (Bereczkei et al., 2002, 2004). However, our results were not compatible with the findings of DeBruine (2005), who showed that facial-self-resemblance decreased attractiveness in the context of a short-term relationship and had no effect on attractiveness in the context of a long-term relationship. However, DeBruines' study and our study differed significantly from each other in several ways. For example, DeBruine used a forced-choice paradigm in which participants viewed pairs of facial stimuli, which may have led to an artificially forced attractiveness decision which might not represent a participant's true opinion about the facial stimuli.

Another difference between our design and that of DeBruine is that we used male participants only. However, poor mating decisions may have less impact on men than they do on women, since men have a potential faster rate of reproduction and less costs of reproduction and, therefore, tend to be less choosy in their mate choices (Geary, Vigil, & Byrd-Craven, 2004). Therefore, facial self-resemblance as a potential cue for inbreeding might be more relevant to women than to men, which might be tested by replicating the present study with women as participants. Future studies might also include other physiological measures, such as skin conductance and heart rate, to allow for a more detailed assessment of emotional engagement.

Another interesting question concerns the degree to which the conscious recognition of similarity influences the startle response. None of our participants detected the computer manipulation of the erotic female nudes. However, we did not question participants about how similar they found the depicted erotic female nudes to be to themselves. In future studies, one should incorporate such a conscious similarity measure.

In spite of these limitations, our results were in line with many studies showing that romantic partners tend to resemble each other. The advantage of our study is that it is, to our knowledge, the first experimental manipulation of facial resemblance that yielded this result. Furthermore, our study was the first to use a sensitive, well-studied measure of approach motivation to erotic stimuli that was not directly under the voluntarily control of the participant. Thus, our findings not only serve to further support facial similarity as a modulator of pleasantness and approach motivation to, potential mates, but it also shows that these effects can be found in the modulation of the startle reflex, a response that may represent a very basic measure of approach motivation.

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