



The two sides of beauty: Laterality and the duality of facial attractiveness

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ABSTRACT

We hypothesized that facial attractiveness represents a dual judgment, a combination of reward-based, sexual processes, and aesthetic, cognitive processes. Herein we describe a study that demonstrates that sexual and nonsexual processes both contribute to attractiveness judgments and that these processes can be dissociated. Female participants rated the *general* attractiveness of faces presented in either their left or right visual field. In order to examine sexual and nonsexual components of these judgments, general attractiveness ratings were correlated with ratings of these same faces made by two independent groups of raters in two specific contexts, one sexual and one nonsexual. Based on an items analysis, partial correlation coefficients were computed for each individual and used as the dependent variable of interest in a 2 (laterality: right, left) by 2 (context: sexual, nonsexual) ANOVA. This analysis revealed an interaction such that faces rated in a sexual context better predicted attractiveness ratings of faces shown in the left than right visual field, whereas faces rated in a nonsexual context better predicted attractiveness of faces shown in the right than left visual field. This finding is consistent with the assertion that sexual and nonsexual preferences involve predominantly lateralized processing routes that independently contribute to what is perceived to be attractive.

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1. Introduction

The face is the most important and instantly informative social stimulus that humans perceive. Even within the many other cues contained in a face, attractiveness plays an unequivocal role in how we perceive others. Facial attractiveness is similar to other cues of a face, such as identity, emotion, gender, and race, in that it leads to consistent stereotypical attributions (Eagly, Ashmore, Makhijani, & Longo, 1991). More attractive people are seen as happier and as more socially competent than less attractive people. Even though attractiveness leads to generalized stereotypes, it is a unique construct. Unlike other facial cues, such as a person's age, identity, race, or gender, which represent stable characteristics about a person, attractiveness is by definition a subjective impression and thus cannot be considered an inherent quality of a face itself (Enquist, Ghirlanda, Lundqvist, & Wachtmeister, 2002). Nonetheless, high consensus exists in what people report finding attractive across genders, cultures, and age groups (Langlois et al., 2000). Even though different cultural groups have different ritualized forms of grooming to enhance beauty, different cultures tend to find the same faces attractive (Cunningham, Roberts, Barbee, Druen, & Wu, 1995). Additionally, infants show similar preferences for the same faces that adults find attractive (Langlois et al.,

1987). All of this suggests that there is a strong universal component to what people find attractive about others.

A number of visual cues influence attractiveness (for a review, see Rhodes (2006)). Symmetry in faces is preferred over asymmetry, (Grammer & Thornhill, 1994), especially for the midline of a face versus the lateral region of a face (Springer et al., 2007). Sexual dimorphism, especially femininity, is considered attractive (Penton-Voak et al., 1999; Perrett et al., 1998). Averageness—how close a face is to the prototypical face—is also seen as attractive. Faces that are closest to the average prototype for a specific gender are rated as highly attractive (Langlois & Roggman, 1990). Babyish features have also been linked to attractiveness, though not in all faces (Zebrowitz, Olsen, & Hoffman, 1993). Even though some of these cues may overlap, none of these cues alone are sufficient to explain attractiveness.

Despite the extensive work delineating what features are attractive, little theoretical work has examined the cognitive and neural mechanisms underlying attractiveness perceptions. The present study represents an initial step toward delineating two core components of the attractiveness judgment, differentiating between cognitive preferences for aesthetic beauty and reward-based sexual beauty in a face. Lateralized differences exist in several aspects of face processing, such as decoding emotion (e.g. Borod, 2000). However, few studies have examined lateralized differences in perceiving attractiveness. Examining potential lateralization of sexual and nonsexual preferences is one way to examine if each separately contribute to what is attractive.

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2. Cognitive and neurological underpinnings of attractiveness

Much of the research associated with attractiveness focuses on sexual aspects of face preference, such as mate selection. Facial attractiveness is associated with sexual behavior in both short and long-term relationships (Rhodes, Simmons, & Peters, 2005). Indeed, the strongest neural association with attractiveness is imaging research that links attractiveness with brain regions linked to reward processing. Perceiving an attractive face activates reward areas such as the nucleus accumbens (Aharon et al., 2001) orbito-frontal cortex (Nakamura et al., 1998; O'Doherty et al., 2003), and the amygdala (Winston, O'Doherty, Kilner, Perrett, & Dolan, 2007). These same brain regions are also involved in processing more explicitly arousing sexual stimuli (Safron et al., 2007), further supporting the assertion that attractiveness is sexual.

Sexual explanations have received the most attention in researching why and how faces are attractive. However, sexual reward is not sufficient to explain all attractiveness. Behavioral measures of how rewarding a face is and activations in reward areas are not sufficient to predict what is considered attractive (Aharon et al., 2001). This indicates that another mechanism may be at work. Face preferences and the stereotypes associated with them generalize beyond sexual reward. Different genders and age groups consistently agree on what they find attractive. This cannot be merely due to internalizing cultural stereotypes, as infants, who have not had enough time to internalize these norms, prefer the same faces as adults. All of this supports the assertion that sexual reward is not sufficient in itself to explain facial attractiveness.

Alternative cognitive processes exist that can explain why faces are attractive independent of reward. Preferences for averageness in visual stimuli generalize beyond face preferences, even to stimuli such as fish and automobiles (Halberstadt & Rhodes, 2003). Processing fluency, or how easily stimuli are processed, is one potential mechanism that can explain why averageness is considered attractive. Average stimuli are closer to the prototype, or the mental average of a category, and are thus more easily processed. This ease of processing evokes positive affect (Reber, Winkielman, & Schwarz, 1998; Winkielman, Schwarz, Fazendeiro, & Reber, 2003). Indeed, positive affect mediates the relationship between processing fluency and rated attractiveness of prototypes in dot patterns (Winkielman, Halberstadt, Fazendeiro, & Catty, 2006). Processing fluency provides a cognitive mechanism for the attractiveness of prototypes that should generalize to faces and operates independently of the sexual valence of a face.

Mere exposure is another mechanism that contributes to attractiveness judgments independent of sexual reward. Previously seen visual stimuli, including faces, are rated as more attractive than novel stimuli (Zajonc, 1968). Even though participants may not remember which faces are novel or previously seen, they still find the previously seen faces more attractive (Moreland & Beach, 1992). The mere exposure effect is not sexual, as mere exposure reduces the arousal involved with sexual stimuli (Koukounas & Over, 2001; Mann, Berkowitz, Sidman, Starr, & West, 1974) and actually increases reported negative affect to sexual stimuli (Kelley & Musialowski, 1986). Instead, mere exposure increases positive affect associated with a stimulus in a way that is similar to models of positive affect and processing fluency (Harmon-Jones & Allen, 2001; Reber et al., 1998). Both processing fluency and mere exposure represent generalized mechanisms of stimulus preference related to affect that act independently of sexual preference.

Lateralized differences exist in several aspects of face processing, such as decoding emotion (e.g. Borod, 2000). However, few studies have examined lateralized differences in perceiving attractiveness. Therefore examining potential lateralization of sexual and nonsexual preferences is one way to examine if each separately

contributes to what is considered attractive. To support a model of attractiveness judgments that entail separate mechanisms, it is necessary to demonstrate that sexual and nonsexual processes are both present in an individual's attractiveness preferences and to dissociate between the processes within that same individual. Lateralized differences in processing sexual and affective preferences would provide a unique opportunity to demonstrate separate routes.

3. Laterality, face processing, and attractiveness

Lateralized differences are present in the processing of a variety of different visual stimuli and faces are no exception. The fusiform gyrus (FG) is crucial in basic face processing. The right FG shows greater activation to faces than does the left (Haxby, Hoffman, & Gobbini, 2000; Kanwisher, McDermott, & Chun, 1997). Additionally, several different functions of face perception are lateralized. For instance, lateralized differences exist in processing emotion (e.g., Adolphs, Damasio, Tranel, & Damasio, 1996; Borod et al., 1998) as well as identity processing (e.g., Young, 1984). Despite evidence for many lateralized differences in face processing, little research has examined lateralized differences in processing attractiveness, and to our knowledge, no studies have examined dissociable differences between the left- and right-hemispheres. Despite this paucity of research on the laterality of attractiveness, hemispheric differences in visual, sexual, and emotional processing allow for the generation of hypotheses on the lateralization of sexual versus nonsexual attractiveness.

3.1. Laterality of sexual and aesthetic processes

Facial attractiveness causes activation in brain structures associated with processing many forms of reward, including sexual reward. Several studies show that processing sexual stimuli shows a right-hemisphere (RH) bias. PET and fMRI studies show considerably more brain activation in the right-hemisphere to sexual versus nonsexual stimuli (e.g., Arnow et al., 2002; Redoute et al., 2000). Additionally, EEG studies also show a RH bias for processing sexual stimuli (e.g. Cohen, Rosen, & Goldstein, 1985; Waismann, Fenwick, Wilson, Hewett, & Lumsden, 2003). These all suggest that the right-hemisphere would be biased to decode the proposed process underlying sexual attractiveness.

In contrast to the right-lateralized processing of reflexive stimuli, some more complex visual functions show a left-hemisphere (LH) bias. For instance, some studies have shown the RH is biased toward processing basic emotions while the LH is biased to social emotions (e.g. Ross, Homan, & Buck, 1994, but see Tamietto, Adenzato, Geminiani, & de Gelder, 2007). The left-hemisphere is more specialized to process higher-order cognitive tasks as well (Gazzaniga, 2000), and may be specialized to regulate the right-hemisphere's contribution to sexual arousal (Waismann et al., 2003). Additionally, the affect judgments due to mere exposure effects are higher when stimuli are presented to the right visual field (i.e., LH) than the left visual field (i.e., RH), which gives evidence that the affective mechanism for the preference of the mere exposure effect is left-lateralized (Seamon, Brody, & Kauff, 1983). This complements evidence indicating that the right-hemisphere is specialized to process basic, reflexive processes, and suggests that the left-hemisphere is predisposed to judging higher-level nonsexual preferences.

3.2. Present experiment

The primary aim of this experiment is to show if lateralized presentation of faces can decouple the processing between sexual and

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