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BRIEF REPORTS

Facial Attractiveness Is Appraised in a Glance

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Those who are physically attractive reap many benefits—from higher average wages to a wider variety of mate choices. Recent studies have investigated what constitutes beauty and how beauty affects explicit social judgments, but little is known about the perceptual or cognitive processing that is affected by aesthetic judgments of faces and why beauty affects our behavior. In this study, the authors show that beauty is perceived when information is minimized by masking or rapid presentation. Perceiving and processing beauty appear to require little attention and to bias subsequent cognitive processes. These facts may make beauty difficult to ignore, possibly leading to its importance in social evaluations.

Keywords: beauty, emotion, aesthetic, backward mask, face

Physical attractiveness gives rise to astounding benefits that some have dubbed the *beauty premium* (Hamermesh & Biddle, 1994). Attractive people receive more favorable treatment in hiring and promotion (Dipboye, Arvey, & Terpstra, 1977; Landy & Sigall, 1974) and are rated as smarter, more extraverted, more socially skilled (Dion, Berscheid, Walster, 1972), and as more effective classroom instructors (Ambady & Rosenthal, 1993; Hamermesh & Parker, 2003). Attractive children are punished less severely by adults (Dion, 1972), and attractive babies receive more attention than do unattractive babies (Langlois, Ritter, Casey, & Sawin, 1995; Ritter, Casey, & Langlois, 1991). A preference for attractive individuals occurs early in development: Even infants prefer to look at attractive faces compared with unattractive faces (Langlois, Ritter, Roggmann, & Vaughn, 1991). Such findings suggest that the perception of beauty may be innate (Thornhill & Gangestad, 1999) and culturally universal (Perrett, May, & Yoshikawa, 1994).

How does physical attractiveness lead to profound societal effects? Although the social consequences of attractiveness are well documented, little is known about how and when these effects arise. We began our inquiry into the cognitive consequences of viewing attractive faces by asking whether attractiveness can be perceived from minimal amounts of visual information. This idea bears upon the issue of awareness and attention: If one can perceive some attribute under highly impoverished viewing conditions, it can be taken as evidence that this attribute has some sort of special status and requires little in terms of explicit, effortful, or attentive processing.

There is very little evidence for or against the idea that attractiveness is perceived quickly and effortlessly, and what little is known could be interpreted as weighing in on either side of the question. For example, some investigators have reported that facial symmetry (Grammer & Thornhill, 1994; Rhodes, Proffitt, Grady, & Sumich, 1998) and feminization (Perrett et al., 1998) are important factors in determining beauty. It may take time and effort to assess subtle differences in feminization, arguing against the idea that beauty can be ascertained from minimal amounts of visual information. On the other hand, simple forms of symmetry can be extracted very quickly by the visual system (Wagemans, 1995) and dedicated neural hardware exists for the visual processing of faces (Kanwisher, McDermott, & Chun, 1997).

In Experiment 1 we tested the hypothesis that beauty can be assessed from a brief visual exposure. Participants were asked to rate the attractiveness of faces that were presented under viewing conditions that precluded them being aware that they had seen a face. This was accomplished by presenting the faces rapidly and by using forward and backward visual masking, a procedure that reduces or eliminates the visibility of a briefly presented stimulus. The presence or absence of a masked target stimulus can be detected with as little as 14 ms of viewing time (Keysers, Xiao, Foldiak, & Perrett, 2001) but it usually requires more time to identify specific stimulus features. For instance, a past study reported that attractiveness can be ascertained from 100 ms of viewing time (Locher, Unger, Sociedade, & Wahl, 1993). If attractiveness is extracted rapidly and with little need for visual scrutiny or elaboration, participants should be able to make attractiveness judgments even when they are unaware of the presentation of the stimuli.

Experiment 1: Masking

Method

Participants. Ten students and employees (5 women, 5 men), ranging in age from 18–35 years, from the University of Pennsylvania and Yale

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University participated in this experiment. None of the participants knew the purpose of the experiment and none had seen the pictorial stimuli prior to being tested. All participants received $8.00 for participation.

Equipment. Participants were tested individually in a darkened room with a 19-in. (48.26 cm) 75 Hz CRT monitor. They sat at an unrestricted viewing distance of approximately 57 cm, at which distance 1 cm corresponds to a 1° viewing angle. All experiments were programmed in MacProbe for Macintosh computers (Hunt, 1994).

Materials. The stimuli appeared at the center of the screen upon a uniform gray (RGB 127) background. Faces and masks were 6 × 6 cm in size. Face stimuli were in color and varied in pose, lighting, and hairstyle. Face stimuli were obtained from three different high school yearbooks and the Internet. None of the faces were famous.

Face stimuli were preselected by the experimenters and categorized as either attractive or unattractive. There were 40 faces in each attractiveness category with equal gender distributions. To ascertain the generality of our aesthetic judgments, we asked 11 participants to rate the faces for attractiveness on a 10-point scale, with 10 being *extremely attractive* and 1 being *extremely unattractive*. Faces were presented in random order at the center of the computer screen for 1000 ms, followed by a prompt to rate the face. The average rating for *attractive* faces was 7.44 (range = 6.48 to 8.67) and the average rating for *unattractive* faces was 2.45 (range = 1.33 to 3.52). This difference was significant ($p < .01$).

Faces were also preselected by the experimenters for emotional expression in order to exclude faces that exhibited negative emotions and to balance the emotional expression of faces across the attractive and unattractive face categories. To confirm the experimenters' classifications, we asked 7 different participants (undergraduate and graduate students at Yale University) to rate the faces for emotionality using a 5-point scale with 5 indicating *very positive emotions* and 1 indicating *very negative emotions*. Faces were presented in random order at the center of the screen for 1000 ms, followed by a prompt to rate the face. The two classes of stimuli did not differ by emotional expression: The average emotion rating for attractive faces was 3.10 and the average emotion rating for unattractive faces was 3.02. This difference was not significant, $t(6) = 0.076$, $p = .94$.

Two masks were used. Pilot experiments ensured that masks blocked visibility of the face stimuli; no participant in our pilot work was able to accurately determine whether or not a target face was shown under the present viewing conditions. The forward mask was a scrambled face and contained many high-frequency contours. The backward mask was a cartoon face. These masks were chosen based on extensive piloting that found these masks to be more effective than uniform color or random noise masks. The target stimulus was presented for a shorter time and the mask was presented for a longer time than that used in previous studies that reported unconscious evaluation of facial emotion (Dimberg, Thunberg, & Elmehaed, 2000), suggesting that our timing parameters yielded unconscious processing.

Design and procedure. Each trial was initiated by the participant. Trials began with a forward mask for 39 ms, followed by the target stimulus—a face—for 13 ms (the refresh rate of the computer). This was immediately followed by an interstimulus interval of 13 ms, and a backward mask for 39 ms. Finally, the backward mask was erased by a black screen that cued participants to make an unspeeded decision about the attractiveness of the face as in the face-rating task described earlier. Participants were instructed to make their best guess about whether the face was attractive or unattractive. After a participant entered a response, the screen was cleared and their computers prompted him or her to press a key to initiate the next trial. No feedback was given. There were 80 trials.

Results and Discussion

A two-tailed *t* test tested the effects of facial attractiveness (attractive or unattractive) on ratings. The average rating for attractive faces was 5.79, whereas for unattractive faces it was 4.71. This difference was significant $t(9) = 4.90$, $p < .01$, demonstrating that attractiveness can be assessed from very brief glimpses of visual information. We believe that this process was largely unconscious for two reasons: (a) Participants reported that they could not see the target faces and that they were guessing on each trial, and (b) a similar masking procedure has been shown to elicit unconscious but not conscious processing of faces (Dimberg et al., 2000).

Experiment 2

In Experiment 2, we asked whether viewing an attractive face biases subsequent cognitive processing. This question bears upon the issue of whether attractiveness exerts its influence at an explicit, reflective level of awareness, or whether it operates more implicitly. For example, one may hire a job applicant whose appearance is pleasing because one would like to spend more time looking at him or her. Although this may sometimes be the case, one may also hire a good-looking job candidate because he or she makes us feel happy following the interview, without ever knowing that the warm feeling was due to the applicant's high level of attractiveness.

To assess whether the presence of an attractive face biases subsequent cognitive processing, we used a priming task. Each trial consisted of a rapidly presented face followed by a black screen and white word. Participants were instructed to ignore the face stimulus and to attend to and classify the words as "good" or "bad" (see Figure 1). If attractive faces (a) are encoded with little effort or attention, and (b) bias subsequent processing, then response times (RTs) to *good* words preceded by attractive faces should be faster than when the same words are preceded by unattractive faces. To rule out the possibility that stimuli differed in uncontrolled low-level visual variables, we compared priming effects between upright and inverted faces. Inverted faces are ideal control stimuli because they contain the same low-level visual features as the task stimuli but different high-level (i.e., canonical face orientation) information. We hypothesized that if low-level visual differences among our stimuli account for any priming effects, there should be no difference in priming effects between the inverted and upright faces.

Figure 1. A schematic illustration of the stimuli used in Experiment 2. The shown face (published here with the permission of Christy Marshuetz) was not used in the actual experiment.

Method

Participants. Twenty-one students (15 undergraduate students: 10 men, 5 women; 6 graduate students: 2 men, 4 women) participated for payment of $8.00. One participant was excluded for failure to comply with instructions. None of the participants knew the purpose of the experiment and none had seen the pictorial stimuli prior to being tested.

Materials. The stimuli (see Figure 1) appeared at the center of the screen upon a uniform gray background. The face stimuli were the same as used in Experiment 1 except that those used in the *inverted* condition were inverted 180°. The word stimuli were white and appeared in Helvetica (24 point) font. Word stimuli were taken from a normed word list (Phelps, LaBar, & Spencer, 1997).[1]

Design and procedure. Four factors were orthogonally crossed across all experimental trials: face gender (male or female), facial attractiveness (attractive or unattractive), face orientation (upright or inverted), and word valence (positive or negative). All factors were interleaved and presented in random order. Face gender was not analyzed.

Prior to the onset of the experiment, participants were familiarized with the positive and negative word stimuli. Participants initiated each trial by a key press. Each trial was composed of this order of events: a face for 13 ms, followed by a black screen for 26 ms, followed by a positive or negative word for 260 ms, which was then erased by a black screen. The task was to ignore the face, attend to the word, and detect whether it was a positive word or a negative word as quickly as possible. The participant entered his or her response by pressing one of two predesignated keys. The words *good* and *bad* along with reminders of the appropriate response key were placed in the lower portion of the screen. Each participant completed 80 experimental trials.

Results and Discussion

A repeated-measures analysis of variance tested the effects of facial attractiveness (attractive or unattractive), facial orientation (upright or inverted), and word valence (positive or negative) on RT. Trials with RTs exceeding 3,500 ms were discarded in Experiments 2 and 3, corresponding to less than 2% of all trials. Data are shown in Figures 2a and 2b. The main effects of facial attractiveness ($F < 1$, *ns*) and facial orientation, $F(1, 19) = 1.89$, $p = 1.89$ were not significant. The main effect of word valence was significant, $F(1, 19) = 4.52$, $p < .05$, because of faster RTs to negative words. No interaction was significant (all ps $> .25$) except for the interaction of interest, Attractiveness × Orientation × Word Valence, $F(1, 19) = 5.09$, $p < .04$. Planned comparisons showed that RTs were faster to positive words when they were preceded by upright attractive faces (700 ms) as compared with when they were preceded by upright unattractive faces (753 ms), $t(19) = 2.72$, $p < .01$. However, this was not true when positive words were preceded by inverted attractive faces (716 ms) versus when they were preceded by inverted unattractive faces (705 ms), $t(19) = .55$, $p = .59$. Response times to negative words were not modulated by any of the prime types (all ps $> .50$).

Thus, attractive upright faces prime positive words and these effects cannot be explained by low-level visual differences among the stimulus groups. This implies that attractive faces either induce positive emotions or bring to mind positive labels (e.g., "good") that, in turn, speed categorization of positive words.

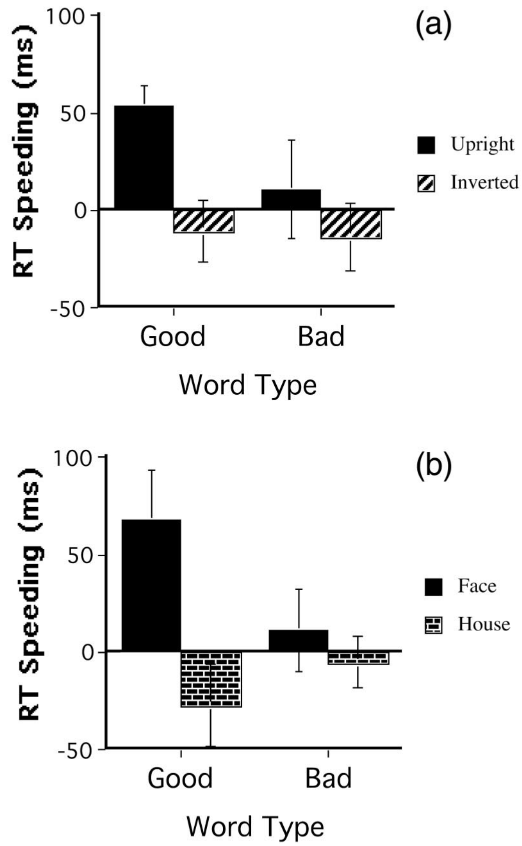

Figure 2. Data from (a) Experiment 2 and (b) Experiment 3 showing the amount that response time (RT) is speeded by having a congruent prime (e.g., positive word preceded by an attractive face or a negative word preceded by an unattractive face) as compared with an incongruent prime (e.g., positive word preceded by an unattractive face or a negative word preceded by an attractive face) for different conditions. A taller bar indicates a larger priming effect; error bars represent standard error of the mean.

Experiment 3

Were the effects reported in Experiment 2 due to the attractiveness of stimuli in general or more specifically, to the attractiveness of faces? To test this, we asked one group of participants to perform the priming task with attractive and unattractive houses as primes, and another to perform the priming task with attractive and unattractive faces as primes. Houses were chosen as a comparison category of stimuli because (a) they are nonsocial; (b) they are a homogeneous, subordinate-level class; (c) they are known to be processed in a localized part of the brain that is different than the area that processes faces; (d) they possess some of the same visual properties as faces (e.g., interior features, enclosed shape); and (e) a pilot study found high interparticipant agreement about which houses were attractive and which were unattractive.

Method

Participants. Eighteen students (12 undergraduate students: 6 men, 6 women; 6 graduate students: 2 men, 4 women) and 1 community volunteer

[1] The positive words were *joy, peace, love, wonderful, pleasure, glorious, laughter,* and *happy*. The negative words were *agony, terrible, horrible, nasty, evil, awful, failure,* and *war*.

(1 woman) participated in the face-priming task. Fifteen students (12 undergraduate students: 5 men, 7 women; 3 graduate students: 3 women) participated in the house-priming task. Ages ranged from 18–38 years. All participants received $8.00 for their participation. None of the participants knew the purpose of the experiment and none had seen the pictorial stimuli prior to being tested.

Materials. Word stimuli were the same as used in Experiment 2. House and face stimuli appeared at the center of the screen upon a uniform gray background. The face stimuli were the same upright faces as used in Experiment 2. House photographs were in color and were 4.73 to 7.06 cm high and 5.43 to 7.06 cm wide. House pictures were of the front of the house and were cropped so that only a small amount of nonhouse information was visible. House images were obtained from real estate Web sites and were preselected to be attractive or unattractive.

To ascertain the generality of our aesthetic judgments, we asked 7 participants (ages 18–22 years; 5 women, 2 men) to participate in a pilot experiment. They rated the houses for attractiveness. Each trial in the pilot experiment consisted of the following events: First, a single house appeared in the middle of the screen for 1,000 ms, then, a text prompt instructed participants to rate the house on a 1–10 scale with 10 being *extremely attractive* and 1 being *extremely unattractive*. As expected, ratings were higher for the attractive house category (M = 8.03, range = 7.3 to 8.6) as compared with the unattractive house category (M = 2.2, range = 1.6 to 2.7; $p < .01$). There was no correlation between attractiveness ratings and the height or width of house stimuli($p > .25$).

Design and procedure. Three factors were orthogonally crossed across all experimental trials: stimulus category (face or house), attractiveness (attractive or unattractive), and word valence (positive or negative). All factors were interleaved and presented in random order. Other aspects of the procedure and task were the same as for Experiment 2.

Results and Discussion

A between-subjects analysis of variance was used to test the effects of prime type (face or house), attractiveness (attractive or unattractive), and word valence on RT (see Figure 2b). The main effect of prime type was significant, $F(1, 34) = 7.05$, $p < .01$, because of overall faster responses when houses served as primes. The main effects of attractiveness and word valence were not significant (Fs < 1) suggesting that response speed was unaffected by prime attractiveness and the valence of the word targets. More important, the interaction between prime type, attractiveness, and word valence was significant, $F(1, 34) = 8.78$, $p < .01$. Planned comparisons showed that this was due to RT facilitation of positive words preceded by attractive faces (904 ms) as compared with unattractive faces (940 ms; $p < .02$), but that there were no RT differences when positive words were preceded by attractive houses (703 ms) as compared with unattractive houses (687 ms; $p = .49$). For negative words, there was a trend toward significance for unattractive faces versus attractive faces ($p = .10$) but no significance when negative words were preceded by different types of houses ($p = .28$). Although overall RT to houses was faster than RT to faces, we do not think that the faster RTs impaired the possibility of finding a priming effect for houses. RTs to faces in Experiment 2 were similar to those reported for houses in this experiment and a significant priming effect was found. Rather, we suggest that effects of facial attractiveness and unattractiveness, per se, bias subsequent cognitive processing.

Discussion

Numerous findings in the psychology literature make it clear that our society believes that attractive people possess positive qualities that unattractive people simply lack (e.g., Ambady & Rosenthal, 1993; Dion, 1972, 1973; Dipboye, Arvey, & Terpstra, 1977; Hamermesh & Parker, 2003; Landy & Sigall, 1974; Langlois et al., 1991). The purpose of this study was to investigate cognitive processes that may mediate this preference for attractive people.

We began by asking whether attractiveness can be perceived from minimal amounts of visual information. To answer this question, we asked participants to rate faces that were presented under severely impoverished viewing conditions. Although participants reported that they could not accurately see the faces, their ability to “guess” about the attractiveness level of the faces was surprisingly accurate.

In Experiment 2, we asked whether the presence of an attractive face biases subsequent cognitive processing. This was tested in a priming task in which rapidly presented face primes were followed by positive or negative word targets. We reasoned that if attractive faces are encoded with little effort or attention and bias subsequent cognitive processing, then RTs to congruent words (e.g., positive words) should be faster than when the same words are preceded by an incongruent (e.g., unattractive) face. The results were that attractive upright faces prime positive words. This finding could be interpreted as the generation of an implicit attitude (Fazio, 2001) when an attractive face is presented.

No priming effects were observed for inverted faces or unattractive faces. The lack of RT speeding when a positive word was preceded by an inverted attractive face suggests that it is attractiveness, per se, rather than some uncontrolled low-level visual attribute, that led to the performance benefit observed in Experiment 2. Why unattractive faces did not speed processing of negative words is less clear, although we speculate that unattractive faces do not induce negative emotions.

The generality of the attractiveness effect was tested in Experiment 3. This experiment replicated the priming effect of attractive faces but found no priming effect for attractive houses, suggesting that attractive faces may induce emotions, whereas other attractive stimuli may not, or at least may not in the same manner. Other types of attractive stimuli, such as abstract art (Duckworth, Bargh, Garcia, & Chaiken, 2002) or animals (Halberstadt & Rhodes, 2003), have been shown to bias cognition, but such processes may be slower, requiring more time (Duckworth et al., 2002), attention, or effort, than attractiveness judgments for face stimuli, which appear to be easy and rapid. An alternative explanation for these findings is that the attractiveness of houses is not extracted as rapidly as it is from faces. Future studies can address this issue by using houses in a masking task similar to that reported in Experiment 1.

There are a number of interesting issues not addressed in this article. For example, we did not find any significant interaction of participant gender with the gender of the stimuli (all ps $> .10$), but this finding may have resulted from low power. Another interesting issue is the question of how variables like sexual orientation might interact with facial attractiveness and gender.

The specifics of what particular feature or property of the face stimuli contribute to a positive or negative attractiveness judgment cannot be determined from this study. Other researchers have reported that facial averageness (Rhodes, Sumich, & Byatt, 1999) and facial symmetry are critical features (Grammer & Thornhill, 1994; Rhodes et al., 1998), as well as sexual dimorphism (Johnston, 2000) or feminization (Perrett et al., 1998).

In summary, we propose that facial attractiveness is assessed rapidly and from small slivers of visual information. These attentionally undemanding judgments bias other cognitive processes that may be the result of changes in affect upon viewing the "rewarding" (Aharon et al., 2001; O'Doherty, Winston, Perrett, Burt, & Dolan, 2003) attractive faces. Our findings suggest that the positive benefits that attractive people garner may be due to processes that influence decisions with little awareness or intention, and that the beauty bias may result from a host of low-level visual and emotional effects.

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