The Quarterly Journal of Experimental Psychology

Publication details, including instructions for authors and subscription information:
http://www.tandfonline.com/loi/pqje20

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Available online: 06 Apr 2010

To cite this article: Helmut Leder, Pablo P. L. Tinio, Isabella M. Fuchs & Isabel Bohrn (2010): When attractiveness demands longer looks: The effects of situation and gender, The Quarterly Journal of Experimental Psychology, 63:9, 1858-1871

To link to this article: http://dx.doi.org/10.1080/17470211003605142

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When attractiveness demands longer looks: The effects of situation and gender

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We investigated how aesthetics guides our exploration of the environment. We embedded attractive and nonattractive faces into complex, real-world scenes and measured eye movements during scene viewing. We examined whether attractive faces would elicit longer looks, which would suggest that the aesthetic response orients people toward the rewarding and pleasing aspects of the environment. Experiment 1 showed that mean fixation, mean first fixation, and total fixation durations were longer to attractive faces, and fixations were longest to female faces and by female perceivers. In Experiment 2, we examined whether these effects of attractiveness are sensitive to situational factors. When perceivers were subjected to a threat or social approach manipulation prior to viewing the scenes, we confirmed specific hypotheses concerning the two manipulations. In accordance with the hypothesis that males have higher aggression potential than females, there were no differences in fixation durations between attractive and nonattractive male faces in the threat condition. On the other hand, in the social approach condition, both female and male attractive faces received longer looks. These results suggest that the aesthetic response orients people not only to the pleasing aspects of their environment, but also to those features that are adaptively relevant.

Keywords: Attractiveness; Aesthetics; Threat; Social approach; Eye movements.

Attractiveness and nonattractiveness lie at each end of a dimension that is at the heart of aesthetic evaluations of objects in our environment (Darwin, 1874). It is apparent that people in most situations are able to judge whether something is beautiful or not, and which of two objects they prefer aesthetically. Such evaluations are a product of the human aesthetic response, which has been previously conceptualized as an adaptive behaviour with survival value for dealing with various aspects of the environment (Dissanayake, 2007). In this paper, we report on research that examined specific behavioural manifestations associated with the aesthetic response,

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We thank Laurent Itti and Andy Gartus for their support and Loni Leder for her valuable comments. Moreover, we thank Ulrike Schmid for her help in setting up and running Experiment 2 as part of her diploma work. Finally, we would like to thank three anonymous reviewers for their comments on an earlier version of the manuscript. This research was funded in part by Fonds zur Förderung der wissenschaftlichen Forschung P18910 to the first author.

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http://www.psypress.com/qjep

DOI:10.1080/17470211003605142
especially with regard to approach and avoidance responses. We employed a novel approach in which we measured gaze behaviour to ecologically relevant stimuli consisting of attractive and non-attractive faces embedded within complex scenes. We also assessed whether the aesthetic sense is adaptively sensitive to situational demands such as the presence of threat. This approach is consistent with current models of situated cognition wherein behaviour is contextualized within the actual situation in which they occur (e.g., Schwarz, 2007; Smith & Semin, 2004).

What are the possible functions of the aesthetic response? Consistent with the Darwinian perspective, aesthetic appreciation has been considered as “an adaptive behaviour that promotes selective attention and positive emotional response to components of the environment that lead to ‘good’ (adaptive) decisions and problem solving” (Dissanayake, 2007, p. 4). In this sense, aesthetic appreciation may function to orient people towards positive aspects of their surroundings—an approach response—and that being drawn to such things is rewarding and pleasing and has adaptive value. For example, the aesthetic sense may be sensitive to attractive people because attractiveness signals reproductive fitness (Etoff, 1999; Grammer & Thornhill, 1994; Symons, 1979; Thornhill & Gangestad, 1999). As such, attention is directed towards attractive people because this could lead to adaptive mating decisions. Furthermore, looking at attractive people may also lead to rewarding and pleasing experiences (Dissanayake, 2007; Hayden, Parikh, Deaner, & Platt, 2007). Aesthetic appreciation might also function in an adaptive way to draw people to aspects of their environment depending on the situation that they are in. For instance, being in a threatened state could lead to sensitivity to certain types of people presumably because they pose as a threat (Anderson, Christoff, Panitz, De Rosa, & Gabrieli, 2003). In the present study, we operationalized the consequences of the aesthetic response by measuring gaze behaviour. Gaze behaviour can be considered as overt manifestations of visual and cognitive processes (Henderson, 2003). In Experiment 1, participants viewed real-world scenes with attractive and non-attractive faces within a neutral context. In Experiment 2, participants viewed the same scenes and faces following a threat or social approach manipulation.

We used face stimuli that were either “attractive” or “nonattractive”. The concept of attractiveness as a biologically determined feature and an evaluative category is well established in psychological literature. It is also associated less with ambiguities and philosophical issues than are other terms in aesthetics (e.g., beauty). For faces, there are clear-cut differences in levels of attractiveness.

Faces are particularly suited for such an examination because they are associated with a biologically determined sense of beauty. There is abundant evidence that faces somehow capture visual attention. For example, Fletcher-Watson, Findlay, Leekam, and Benson (2008) found that participants tended to look at scenes with people, and that they were inclined to attend to the face region within those scenes. Once faces have captured attention, they also seem to bind it, as was shown by Bindemann, Burton, Hooge, Jenkins, and de Haan (2005). They found an attention retention bias for faces as compared to nonface objects. There is also evidence that faces are processed in a special manner (Leder & Bruce, 2000; Ro, Russell, & Lavie, 2001), in that the brain recruits a special region for face processing (e.g., Kanwisher, McDermott, & Chun, 1997), and facial attractiveness, in particular, elicits a specific neural response pattern (Chatterjee, Thomas, Smith, & Aguirre, 2009; O’Doherty et al., 2003; Winston, O’Doherty, Kilner, Perrett, & Dolan, 2007). Finally, the distinction between an attractive and a nonattractive face is often clear-cut (Etoff, 1999), so simultaneously presenting two faces that clearly differ in attractiveness should allow for a direct assessment of the aesthetic response to attractiveness.

Thus, a careful selection of faces as stimuli allows the examination of the behavioural consequences of the aesthetic response. Differences in facial attractiveness may be due to variation on features such as symmetry (e.g., Perrett et al., 1999;
Rhodes, Proffitt, Grady, & Sumich, 1998) and averageness (e.g., Langlois & Roggman, 1990). Although these features are subjects of debates (Fink & Penton-Voak, 2002), their effects on attractiveness judgements are reliably found (Etcoff, 1999). Nevertheless, individual differences with regard to aesthetic evaluations have also been shown (Hönekopp, 2006). In this sense, aesthetic responses are a result of a combination of object features and characteristics of the perceivers such as gender. Such aesthetic responses should be stable across various contexts. Consistent with this are previous studies that have shown differential aesthetic responses to female and male faces (e.g., Aharon et al., 2001) and that faces are processed differently by male and female perceivers (Levy et al., 2008; McBain, Norton, & Chen, 2009). Therefore, we included two additional variables in our design: gender of perceived face and gender of perceiver. Inclusion of these gender variables also allowed the examination of additional hypotheses in Experiment 2, which were concerned with the moderating influence of gender and situational demands.

For the purpose of our study, it was important to systematically vary the presence and location of attractiveness in complex scenes. We wanted to ascertain how attractiveness influences visual exploratory behaviour as indicated by eye movements. Thus, we digitally embedded attractive and nonattractive female and male faces into everyday scenes (Figure 1a) and measured participants’ eye movements. The embedding procedure, which was undetected to the participants, enabled the use of complex, realistic urban scenes while also allowing the control of important stimulus variables such as the location and orientation of faces in the scenes.

Previous studies that have examined the relationship between judgements of attractiveness and gaze have presented faces in isolation (e.g., Shimojo, Simion, Shimojo, & Scheier, 2003). Such an approach has made it difficult to conceptualize results in terms of how attractiveness influences natural gaze behaviour or how it affects passive viewing of real-world scenes. Here, we assumed the perspective of situated cognition wherein behaviour is considered in its natural context, one rich in physical artefacts and situational cues (see Smith & Semin, 2004). The processing of objects is known to be enhanced by the presentation of associated situational information (Chaigneau, Barsalou, & Zamani, 2009). To our knowledge, there has been no study that has...
looked at the relationship between attractiveness and gaze in the context of complex real-world scenes. Here, we used scenes consisting of various urban street environments photographed from a normal pedestrian perspective. To further examine gaze behaviour as it naturally occurs in everyday situations, participants freely viewed the scenes without having to perform a specific task.

In Experiment 1, we analysed eye movements to explore whether attractive faces would receive longer fixations because doing so is adaptive (e.g., informative to mating decisions), and pleasing and rewarding (Dissanayake, 2007; Hayden et al., 2007). This is consistent with Santayana’s (1896) claim that, “There must therefore be in our nature a very radical and wide-spread tendency to observe beauty, and to value it” (p. 1). Alternatively, nonattractive faces could receive longer fixations because they may be adaptively more informative, thus demanding more attention and longer looks, as Rhodes, Geddes, Jeffery, Dziurawiec, and Clark (2002) found with young children. Accordingly, once a face is deemed beautiful, it allows the release of perceptual resources to other aspects of the environment. This would be a negative version of the beautiful-is-good heuristic, according to which beauty is associated with positive personal characteristics (Dion, Berscheid, & Walster, 1972; Eagly, Makhijani, Ashmore, & Longo, 1991).

The function of aesthetics may be deeper and more fundamental than is typically considered. It could serve to integrate and account for the dynamic aspects and changing situational demands of the environment. If this is the case, then manipulating the context by emphasizing threat or social approach should lead to changes in the behavioural consequences of looking at attractiveness. This should particularly be evident with regard to gender. There is evidence that aggression potential is higher in males than females in humans and other species (Wrangham & Peterson, 1996). This difference may have evolutionary origins. Pinker (2002) has claimed that aggression developed as a strategy used during competitive contexts that often involved males. As a result, males are generally more aggressive than females. Consistent with this is the higher rate of violent behaviour such as rape perpetrated by males (see Thornhill & Palmer, 2000). According to the Supplementary Homicide Reports of the Bureau of Justice Statistics of the United States Department of Justice (n.d.), males are eight times more likely to commit murder than females. The Law Library states that:

Gender is the single best predictor of criminal behaviour: men commit more crime, and women commit less. This distinction holds throughout history, for all societies, for all groups, and for nearly every crime category. The universality of this fact is really quite remarkable, even though many tend to take it for granted. (Steffensmeier & Allan, n.d.)

There may also be different effects with regard to gender in contexts in which social approach and partnership are emphasized. Attractiveness is more important to males than females (Buss, 1995; Feingold, 1990). Thus, under conditions in which social partnership is stressed, the effects of attractiveness should be more apparent in male than female perceivers.

In Experiment 2, participants viewed the same scenes and faces in a similar manner as in Experiment 1. However, prior to viewing, participants were subjected to either a threat or a social approach manipulation. If attending to attractive faces is a positive and rewarding experience, and if it is related to adaptive mating decisions, then participants in the social approach condition should look longer at the attractive faces, and this might be more elaborated for male perceivers. In contrast, under conditions of threat, situation-specific behaviour may take precedence over the effects of attractiveness, particularly for male faces.

**EXPERIMENT 1**

Experiment 1 examined two competing hypotheses: People will look longer at attractive than non-attractive male and female faces because doing so is adaptively beneficial; alternatively, people could look longer at nonattractive faces because attractive faces release perceptual resources to other, potentially more informative, aspects of the environment.
Method

Participants
A total of 44 undergraduate students (half female; mean age, 21.8 years) from the University of Vienna participated for course credit. Prior to data collection, the nature of the procedures was explained to, and informed consent was obtained from, each participant. All participants had normal or corrected-to-normal vision.

Materials
The stimuli consisted of the following two types of street scenes: 18 test scenes with embedded, pretrained attractive and nonattractive neutral expression faces; and 18 filler scenes (Figure 1b), which were similar to the test scenes, although without people. These scenes were included as distractor stimuli. Their inclusion also aided in establishing an experimental scenario that resembled a realistic sequence of street scenes. Each test scene depicted two people of the same gender resulting in nine male and nine female pairs. The left–right face positions were fully counterbalanced across participants. The embedded faces were taken from our in-house face database and various Internet websites, and were all in frontal view.

Categorization into attractive and nonattractive was based on a prestudy \((n = 10)\) in which a set of 88 faces was rated for attractiveness. This rating step ensured that the attractive and nonattractive faces were clearly on the opposite ends of the attractiveness scale. The selected faces were digitally embedded into the scenes, completely replacing the original faces. The scenes were subsequently equalized in luminance and contrast, converted to greyscale, and sized to 800 × 600 pixels.

To examine the potential influence of the embedding manipulation on low-level image features, specifically in the areas around the faces, all test scenes were analysed with an automatic saliency detection system, which is based on low-level visual features analyses (Itti, Koch, & Niebur, 1998). This system simulated the first five fixations for each scene. Figure 1c depicts an example of an output of the analysis. Thus, there were a total of 180 possible fixations \((18 \text{ scenes} \times 2 \text{ versions} \times 5 \text{ fixations})\). We expected an unbiased distribution of fixations across the images. Of the 180 fixations, only 5 fixations \((2.8\%)\) landed on the faces, and of these, 3 \((1.7\%)\) were on attractive, and 2 \((1.1\%)\) were on nonattractive faces. Thus, the images and the faces within them did not systematically differ in low-level visual features.

Apparatus
Eye movements were recorded (left eye) with an iView X Hi-Speed video-based eye tracker (SensoMotoric Instruments) at 240-Hz frequency. Participants sat at a distance of 59 cm from the monitor, and their positions were stabilized with head and chin rests. The experiment was controlled by Presentation software (Neurobehavioural Systems, 2007, Presentation (11.0); available from http://www.neurobs.com).

Procedure
The experiment consisted of a viewing and a rating phase. At the beginning of the viewing phase, the signal was verified with a 5-point calibration. This was followed by the instructions. Each trial began with a “Blink Now” message allowing the participant to blink. A fixation cross followed and remained on the screen until the participant fixated on it. Each scene was presented (screen size: 8.33 × 11.11 inches) for 10 s while eye movements were recorded. Participants were not given a specific task, but were merely told to freely view the scenes. The scenes were presented in random order.

After all of the scenes were presented in the viewing phase, new instructions were provided for the rating phase. The same scenes were subsequently shown for 3 seconds. For each scene, participants provided three 7-point Likert-type scale ratings: attractiveness ratings, one for each of the two faces; and an interestingness rating of the actual scene. This latter question was included as a distractor and was used for both types of scene. Data associated with the distractors were not analysed.

Eye movement data analysis
Raw eye movement output files were filtered using Matlab (Version 7.1) to derive the fixations. Blinks
and saccades were not included in the analyses. Two areas of interest (AOIs) consisting of the areas of the two faces were defined for each scene. The sizes of the AOIs were equal for all faces and across all scenes. Fixations within the AOIs were analysed along the main factors (i.e., attractiveness, gender of face, and gender of perceiver) for the following dependent variables: mean fixation duration (MF), mean first-fixation duration (MFF), and total fixation duration (TF; see Duchowski, 2007, for a discussion of these traditional objective eye tracking metrics). MFs within AOIs were sampled across participants for each face category. MFFs consisted of the average initial fixations sampled across participants for each face category. Finally, TFs were the average total (sum) fixation durations sampled across participants for each face category.

Results

The MFs, MFFs, and TFs were sampled across participants for the attractive and nonattractive faces. Repeated measures analyses of variance (ANOVAs) of gaze data (Figure 2), with attractiveness and gender of face as within-subject factors and gender of perceiver as between-subjects factor, showed that the MFFs were longer for the attractive than for the nonattractive faces, $F(1, 42) = 15.40, \ p < .01, \ \eta^2_p = .27$, with durations being generally longer for female faces, $F(1, 42) = 5.62, \ p = .02, \ \eta^2_p = .12$. MFs showed a similar pattern with durations longer for attractive faces than for nonattractive faces, $F(1, 42) = 18.99, \ p < .01, \ \eta^2_p = .31$, and durations longer for female faces, $F(1, 42) = 10.08, \ p < .01, \ \eta^2_p = .19$. Moreover, there was a significant interaction for MFs between gender of perceiver and gender of face, $F(1, 42) = 6.70, \ p < .01, \ \eta^2_p = .14$. This indicates that female perceivers looked longer at female ($p = .07$), but not male faces ($p = .93$). Analysis of TFs indicated longer TFs for attractive than nonattractive faces, $F(1, 42) = 14.20, \ p < .01, \ \eta^2_p = .25$, and for female than male faces, $F(1, 42) = 18.70, \ p < .01, \ \eta^2_p = .30$. Finally, there was a significant interaction
between attractiveness and gender of face, $F(1, 42) = 6.13, p < .05, \eta_p^2 = .13$, indicating that the difference between attractive and nonattractive faces was larger for female ($p < .01$) than for male faces ($p = .13$). There were no other significant results.

Results of the behavioural data were analysed in a repeated measures ANOVA with attractiveness and gender of face as within-subject factors and gender of perceiver as between-subjects factor. The analysis revealed that the attractive faces were indeed rated as more attractive (means: 4.31 vs. 2.85), $F(1, 42) = 172.43, p < .01, \eta_p^2 = .80$, validating the initial classification of the faces according to attractiveness. Furthermore, female faces were rated more attractive than male faces (means: 3.86 vs. 3.30), $F(1, 42) = 37.07, p < .01, \eta_p^2 = .47$. There was a significant interaction between attractiveness and gender of face, $F(1, 42) = 12.55, p < .01, \eta_p^2 = .23$, with the difference in ratings between attractive and nonattractive faces larger for female (mean difference: 1.67) than for male faces (mean difference: 1.24). Moreover, there was a significant interaction between attractiveness and gender of perceiver, $F(1, 42) = 4.12, p < .05, \eta_p^2 = .09$, indicating that female perceivers provided higher ratings than male perceivers to attractive ($p = .05$) but not nonattractive ($p = .53$) faces. There were no other significant results. Overall, this pattern of results was similar to the gaze data. These analyses reveal that the differences in attractiveness were highly salient, but that female faces were more attractive, and that the gender of the perceiver is marginally influential. For the present analyses, the first finding is crucial as it allows an interpretation in terms of exploratory behaviour to faces differing in attractiveness.

Results of postexperiment interviews indicated that participants were unaware of the manipulations made on the images. Finally, although the faces within the scenes may have been fixated before other elements of the scenes because the faces were near central fixation and because faces generally tend to attract gaze (Fletcher-Watson et al., 2008), the direction of first fixations were equally likely (no differences) to attractive and nonattractive faces, for both male ($p = .50$) and female ($p = .63$) faces. This suggests that the response to facial attractiveness is determined by higher level cognitive functions and is consistent with the results of the visual saliency detection analysis. In Experiment 2, we tested whether the advantages of attractive faces in terms of fixation durations could be moderated by the situational context.

**EXPERIMENT 2**

In Experiment 2, we examined participants’ gaze behaviour under threat and social approach conditions. We explored the possibility that the aesthetic sense may bias the perceptual and cognitive systems in order to take account of the demands of specific contexts. In threatening situations, the advantages of attractiveness in terms of attracting gaze might disappear because of the presence of other situational demands.

**Method**

**Participants**

A total of 40 undergraduate students (half female; mean age, 21.9 years) from the University of Vienna participated for course credit. The nature of the procedures was explained to, and informed consent was obtained from, each participant prior to the experiment. All participants had normal or corrected-to-normal vision, and none had participated in Experiment 1.

**Materials**

The stimuli consisted of the same 18 test scenes with embedded faces and 18 filler scenes.

**Apparatus**

The same iView X Hi-Speed video-based eye tracker system and software as in Experiment 1 were used.

**Procedure**

The viewing and rating phases comprising the main experiment were conducted in the same
manner as in Experiment 1. However, prior to the main eye tracking experiment, participants were randomly assigned to one of two conditions (each with 10 male and 10 female participants): threat or social approach manipulation. They were then told that they would complete three different tasks. In the first task, they had to complete six matrices within 2 minutes. This task was included as a distractor task. The second task was presented as a memory task, although it actually involved the threat or social approach manipulation, depending on which condition a participant was assigned. Participants were instructed that they should carefully read a short text for 1 minute and that they would be asked to reproduce the text after reading it. The threat manipulation text described the city of Vienna with emphasis on crime rates and other crime-related information. The social approach manipulation text described Vienna with focus on being a single person and the positive elements of urban life as related to partnerships. The texts were approximately the same length and were written in a similar style. After reading the text, all participants performed the same task; they were instructed to summarize the text in a few sentences and were asked to characterize the content of the text using three keywords. To verify the effectiveness of the manipulations, three independent judges individually rated each text summary on a 5-point Likert-type scale for correspondence to a positive or negative valence (depending on the condition), with 1 indicating low correspondence and 5 high correspondence. The ratings showed that the manipulations were effective with an average rating of 4.65 (range: 3.67–5.00).

The ratings indicated high persistence due to the manipulation, with an average rating of 4.60 (range: 4.00–5.00).

Data analysis

Data analyses for both attractiveness ratings and eye movements were performed in the same manner as in Experiment 1. For the eye movement data, fixations within the AOIs were analysed along the main factors (i.e., attractiveness, gender of face, and gender of perceiver) for mean fixation, mean first fixation, and total fixation durations.

Results

MFs, MFFs, and TFs were sampled over participants for the attractive and nonattractive faces. Repeated measures ANOVAs of gaze data, with attractiveness and gender of face as within-subject factors, gender of perceiver and condition (threat and social approach) as between-subjects factors, and MFs as dependent variable revealed longer fixation durations for attractive faces, $F(1, 36) = 25.37, p < .01, \eta_p^2 = .41$, with durations generally longer for female faces, $F(1, 36) = 14.62, p < .01, \eta_p^2 = .29$. The difference in fixation durations between attractive and nonattractive faces was larger for female than for male faces, $F(1, 36) = 6.93, p < .05, \eta_p^2 = .16$. Importantly, there was a significant interaction among attractiveness, gender of face, and condition, $F(1, 36) = 7.69, p < .01, \eta_p^2 = .18$. This effect was based on longer fixation durations for attractive female faces in the threat ($p < .01$) and social approach conditions ($p < .05$) and longer durations for attractive male faces in the social approach condition ($p < .01$). However, there was no difference in MFs for attractive and nonattractive male faces in the threat condition ($p = .49$).

The pattern of effects was similar for the MFF data. MFFs were longer for attractive than for nonattractive faces, $F(1, 36) = 25.42, p < .01, \eta_p^2 = .41$, and longer for female than male faces, $F(1, 36) = 6.25, p < .05, \eta_p^2 = .15$. The difference in MFFs between attractive and
nonattractive faces was larger for female than for male faces, $F(1, 36) = 9.24, p < .01, \eta_p^2 = .20$. There was also a significant interaction among attractiveness, gender of face, and condition, $F(1, 36) = 11.90, p < .01, \eta_p^2 = .25$. This interaction reflected longer MFFs for attractive male faces in the social approach condition ($p < .05$) and attractive female faces in the threat condition ($p < .01$). There was no difference in MFFs between attractive and nonattractive male faces in the threat condition ($p = .60$) and between attractive and nonattractive female faces in the social approach condition ($p = .16$).

Analyses of TFs showed similar findings, with longer TFs for attractive than for nonattractive faces, $F(1, 36) = 19.98, p < .01, \eta_p^2 = .36$, and longer TFs for female than for male faces, $F(1, 36) = 16.92, p < .01, \eta_p^2 = .32$. The difference in TFs between attractive and nonattractive faces was larger for female than for male faces, $F(1, 36) = 27.11, p < .01, \eta_p^2 = .43$. The interaction among attractiveness, gender of face, and condition was significant, $F(1, 36) = 5.76, p < .05, \eta_p^2 = .14$. TFs were longer for attractive than for nonattractive female faces in both the threat ($p < .01$) and social approach ($p < .05$) conditions. There were no differences in TFs between attractive and nonattractive male faces in the threat ($p = .79$) and social approach ($p = .11$) conditions. There were no other significant results.

Participants’ behavioural ratings of the faces were analysed in a repeated measures ANOVA with attractiveness and gender of face as within-subject factors and gender of perceiver and condition as between-subjects factors. As with Experiment 1, the analysis revealed that the attractive faces were indeed rated as more beautiful (means: 4.04 vs. 2.55), $F(1, 36) = 274.06, p < .01, \eta_p^2 = .88$, and female faces were rated more beautiful than male faces (means: 3.60 vs. 2.55), $F(1, 36) = 50.78, p < .01, \eta_p^2 = .59$. There was a significant interaction between attractiveness and gender of face, $F(1, 36) = 11.48, p < .01, \eta_p^2 = .24$, which was based on greater differences in ratings between attractive and nonattractive faces for female (mean difference: 1.69) than for male (mean difference: 1.29) faces. There were no other significant effects. Finally, results of post-experiment interviews indicated that participants were unaware of the manipulations made on the images.

Separate analyses (see Figures 3 and 4) were performed on the eye movement data for the threat and social approach conditions to more directly address the effects of situational demands on fixation durations to attractive and nonattractive faces. Within each condition, emphasis was placed on exploring the effects in terms of the gender of the perceiver.

**Threat condition**

Attractive faces were looked at longer than nonattractive faces overall, as indicated by MFFs, $F(1, 18) = 11.49, p < .01, \eta_p^2 = .39$, MFFs, $F(1, 18) = 18.02, p < .01, \eta_p^2 = .50$, and TFs, $F(1, 18) = 12.88, p < .01, \eta_p^2 = .42$. In addition, female faces were looked at longer than male faces, as revealed by TFs, $F(1, 18) = 8.32, p < .05, \eta_p^2 = .32$, and MFFs, $F(1, 18) = 4.84, p < .05, \eta_p^2 = .21$; this effect approached significance for TFs, $F(1, 18) = 4.37, p = .05, \eta_p^2 = .20$. There were significant interactions between attractiveness and gender of face for MFFs, $F(1, 18) = 17.15, p < .01, \eta_p^2 = .49$, MFFs, $F(1, 18) = 24.19, p < .01, \eta_p^2 = .57$, and TFs, $F(1, 18) = 36.79, p < .01, \eta_p^2 = .67$. This interaction is based on significant differences between attractive and nonattractive faces for female (all $p s < .01$), but not male faces (all $p s > .49$). In other words, under threat, the attractiveness advantage remains for female faces but disappears for male faces. This is consistent with the idea that males have a higher aggression potential than females. There were no other significant results.

**Social approach condition**

Attractive faces in the social approach condition were looked at longer than nonattractive faces for MFFs, $F(1, 18) = 16.76, p < .01, \eta_p^2 = .48$, MFFs, $F(1, 18) = 7.49, p < .05, \eta_p^2 = .29$, and TFs, $F(1, 18) = 7.48, p < .05, \eta_p^2 = .29$. Female faces were looked at longer than male faces for MFFs, $F(1, 18) = 6.50, p < .05, \eta_p^2 = .27$, and TFs, $F(1, 18) = 15.39, p < .01, \eta_p^2 = .46$. This
Figure 3. Experiment 2: threat condition. Mean fixation, mean first fixation, and total fixation durations ± SE plotted separately for male and female perceivers.

Figure 4. Experiment 2: social approach condition. Mean fixation, mean first fixation, and total fixation durations ± SE plotted separately for male and female perceivers.
effect was not found in MFFs ($p = .18$). There was a significant interaction between attractiveness and gender of perceiver in MFs, $F(1, 18) = 7.68, p < .05, \eta^2_p = .30$, which reflects a difference between attractive and nonattractive faces for male ($p < .01$) but not for female ($p = .35$) perceivers. Although this finding is consistent with Buss (1995) and Feingold (1990), the effects of gender of perceiver were marginal. There were no other significant interactions.

**GENERAL DISCUSSION**

In this study, we investigated the function of aesthetics in human experience. Aesthetics could be examined using various measures. Traditionally, it has been examined using behavioural judgements such as preference or ratings of attractiveness. However, visual exploratory behaviours are more direct indicators of approach and avoidance behaviours (Henderson, 2003). We therefore looked at eye movements to examine the function of aesthetics.

There are different positions concerning its possible functions. It could function to signal a positive feature of an object. For example, when beauty and attractiveness signal general health, reproductive fitness, and overall mating value (e.g., Grammer & Thornhill, 1994), then attractiveness would attract visual behaviour. If such effects are a feature of the objects, then they would be stable and independent of transient situational variations. This would be consistent with studies that have shown agreement in judging facial attractiveness (Etoff, 1999) and in preferences for natural scenes (Kaplan, 1992). However, some studies have also shown inconsistencies that are attributed to individual differences with regard to taste (Hönekopp, 2006). According to such a position, aesthetics reflect the outcome of evaluations based on both object features and the perceiver’s characteristics. Consequently, although not everyone will evaluate the same objects as attractive, behavioural consequences in terms of exploratory visual behaviour will remain stable and would be reflected in longer looks at the attractive objects. Shimojo et al.’s (2003) finding that attractive faces received longer looks support this position. Thus, aesthetic responses could be based on both object features and individual differences, and are stable across different contexts in terms of behavioural consequences. However, aesthetics may have a deeper, more fundamental function that goes beyond stable responses. Aesthetics could be an adaptive mechanism that integrates and takes into account the dynamic aspects of situations. This enables a flexible response to the richness of human experience. Behavioural consequences in this sense would change depending on situational demands.

In order to distinguish among these different positions, we assessed the consequences of attractiveness by directly comparing visual exploratory behaviour to attractive and nonattractive faces in real-world scenes. In Experiment 1, all measures indicated that attractive faces were judged as more attractive and were looked at longer than nonattractive faces. This is clearly in accordance with the first position. While these data suggest a direct relationship between attractiveness and behavioural consequences, results of Experiment 2 clearly showed a more differentiated picture.

When perceivers in Experiment 2 were subjected to either a threat or social approach manipulation, then exploratory behaviour differed predictably depending on the situation. In the social approach condition, male perceivers had longer mean fixation durations at attractive than nonattractive faces while female perceivers did not. Moreover, under the threat condition, attractive male faces no longer received longer looks, which was expected given the higher aggression potential associated with males. Taken together, the two experiments clearly showed that the behavioural consequences of attractiveness systematically varied with regard to the situation. Thus, aesthetics adaptively guides visual exploration in response to the changing demands of the environment.

In the present studies, we employed a new approach in which we compared eye movements to attractive and nonattractive faces in complex scenes. The studies revealed the effects of the situation in terms of visual exploratory behaviour, but
not in terms of the attractiveness ratings. These findings attest to our approach of measuring eye movement behaviour. Future research could reveal more regarding the processes that moderate these effects.

Attractive faces may be looked at longer because they are rewarding, and they produce positive emotions (Hayden et al., 2007). However, as was shown in Experiment 2, the situation of threat extinguished the longer fixations to attractive male faces. Threat seemed to have overridden the pleasing and attention-binding aspects of attractiveness. On the other hand, in the social approach condition, the effects of attractiveness appeared to have been strengthened.

Concerning a more general framework of aesthetics, it remains to be seen whether using the approach used in the present study will result in similar findings with other stimuli such as artworks. There is a long history of using artworks in aesthetics research. However, artworks are not as biologically related as are faces. Thus, the aesthetic response to artworks may not depend so much on attractiveness and a sense of beauty. This is particularly the case for modern and contemporary art in which beauty has been deemphasized. Aesthetic responses to such artworks seem to rely more on the perceivers’ past experiences and art expertise than on the attractiveness of beauty of the artworks (Augustin & Leder, 2006). Recent approaches to modern or contemporary art (Leder, Belke, Oeberst, & Augustin, 2004) stress the rewarding and positive emotional consequences of aesthetic experiences of art. In this regard, future research could expand on the present findings.

While we found predicted situations in which attractive faces were not looked at longer, attractive faces demanded longer looks in the majority of experimental conditions. It appears that unless a specific situational demand is present, attractiveness is most influential in shaping the way we perceive the world. The context dependency of the aesthetic response may also be reflected in the special environments in which aesthetic experiences usually take place. Examples of these include opera houses and the “white cube” as a prototype for the art museum. The specific effects of these environments on the aesthetic response are fascinating topics for future research.

To conclude, the present studies have revealed important aspects of aesthetics much in the sense of Baumgarten (1779/1969), who first proposed the concept of aesthetics. He believed that aesthetics is a nonanalytical and integrative way to access the world around us. Our results are consistent with such a holistic approach as we have shown that object features, individual factors, and situational demands determine our aesthetic response.

Original manuscript received 23 April 2009
Accepted revision received 27 November 2009
First published online 6 April 2010

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