

Differential Viewing Strategies towards Attractive and Unattractive Human Faces

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ABSTRACT

This paper presents a study on the different viewing strategies that males and females display when looking at attractive and unattractive human faces. We hypothesized that males will display distinctive gaze patterns when looking at attractive female faces, more specifically they will spend longer viewing times on facial features such as the nose, eyes, or mouth and will not show such patterns when looking at male faces or unattractive female faces. On the other hand we also believed that females will spend the same amount of time when looking at facial features regardless of whether or not the presented faces are attractive and whether or not they are male or female. In order to test that, we used eye tracker technology to record the eye movements of a group of 12 participants (6 males and 6 females) when presented with a stimulus in the form of attractive and unattractive human faces of both genders. Based on the analysis of our data, we were able to use key statistics such as the sum of fixation durations on AOIs, the average fixation durations on AOIs, and the number of fixations on each image to confirm our hypothesis.

Author Keywords

Gazing; attractive; unattractive; faces; eye tracking;

INTRODUCTION

Eye tracking studies have shown that humans process only a fraction of their visual environment and tend to spend longer viewing time on regions that are of particular interest. This is referred to as visual attention, and it is closely associated with cognitive tasks such as communication, perception, motivation, and even sexual desire (Hall et al., 2012). Recent studies have shown that inter-individual differences play an important role in visual attention with naturalistic stimuli (Valuch et al., 2015). This is of particular interest when we try to quantify and model the viewing patterns of humans towards figures and faces.

Previous experiments have shown that males and females exhibit different gaze patterns toward human figure images when reflecting their sexual interest, with males showing stronger visual preference towards viewing opposite-sex figures, while women display a much more even distribution in the viewing patterns between same and opposite sex figures (Lykings et. al., 2008).

Furthermore, sexual cognition was shown to influence male gaze strategies when viewing full body figures, but showed no effect on female viewing patterns when presented with the same stimuli (Hall et al., 2012). Both males and females spend significant time fixating on the upper body and the waist-hip ratio. It was shown that men tend to gaze at the waist-hip ratio when determining attractiveness and judging body fat (Conelissen et al., 2009). In addition, it was determined that these distinct gaze patterns in men were demonstrated only when viewing age-preferred female images (Hall et al., 2011). On the other hand, the viewing patterns displayed by female observers were independent of age. In this experiment, we are trying to determine if similar viewing differences and patterns exist toward attractive and unattractive human faces.

When compared to other stimulus categories, faces have an advantage in retaining attention (Bindemann et al., 2005; Langton et al., 2007). This might be due to the fact that we process faces automatically and without conscious awareness (Young et al., 1986). Research has shown that observers have longer fixations on attractive faces (Leder et al., 2012), with men spending more time on opposite-sex faces (Levy et al., 2007). However, individual fixations on facial features can differ between observers. Many evolutionary psychologists suggest that humans have evolved to associate certain features with healthy individuals and desired reproduction, thus finding them attractive (Fink and Penton-Voak, 2002). For example, several research groups have shown that blue-eyed males show stronger attraction to other blue-eyed than brown-eyed female faces (Laeng et al., 2007). Other research has focused on finding the relationship between attractiveness and the symmetry, averageness, and non-average sexually dysmorphic features (Fink and Penton-Voak, 2002).

In this study, we combine eye-tracking methodology with a ranking questionnaire to determine the different gaze patterns of individuals towards attractive and unattractive faces. According to Isaacowitz (2006), people direct their gaze towards stimuli that are consistent with their goals and capture their attention; however, individual fixations cannot be directly used to determine the cognitive perception of the individual. Since attractiveness is subjective, we use the ranking questionnaire to determine

which faces are considered attractive to the participants. Motivated by the differences in the gazing patterns between males and females, we tested the hypothesis that males will display distinctive gazing patterns when looking at female faces, while women will not display a significant bias toward images of opposite-sex faces. Furthermore, we employ the use of linear mixed effect models as described by Valuch et al., in order to study inter-individual differences in gazing patterns (2015).

METHODOLOGY

Experimental Design

The purpose of this study was to determine the different gazing strategies that males and females employ when viewing attractive and unattractive human faces. We hypothesized that males will display distinctive gaze patterns when looking at attractive female faces, more specifically they will spend longer viewing times on facial features such as the nose, eyes, or mouth and will not show such patterns when looking at male faces or unattractive female faces. On the other hand we also believed that women will not display a significant bias toward images of opposite-sex faces. We hypothesized that females will spend the same amount of time when looking at facial features regardless of whether or not the presented faces are attractive and whether or not they are male or female. Our study consisted of a $2 \times 2 \times 2$ (*Sex of Participants vs Sex of Face Stimuli vs Attractiveness of Face*) within-subjects design in which we presented male and female faces of varying degrees of attractiveness to 12 different participants.

Participants

For the study we selected twelve college students from Clemson University of varying majors between the ages of 18 and 22. Half of the participants were males, while the other half were females. Each person was selected on a voluntary basis and had normal or corrected-to-normal visual acuity. The experiment was conducted in accordance to the ethical standards and conduct of research as outlined by the Collaborative Institutional Training Initiative. Furthermore, the study was conducted with approval from the Clemson Institutional Review Board.

Face Stimuli

A total of 12 images with two sets of six images were selected from the Chicago Face Database (Ma et al., 2015). One of the sets was selected from a pool of male face images and the other set of images was selected from a pool of female faces. The Chicago Face Database has a rating for the attractiveness of each face based on the classification made by independent judges. This classification was used to order the images from most attractive to least attractive. The three images with the highest attractive rating, and the three images with the

lowest attractive rating were selected from both genders. Each selected face has a neutral expression with a closed mouth. In addition, all of the images were taken against a white background. The selected images were converted to a 1680 x 1050 resolution. To keep the experiment consistent and to allow for reproducibility in the future, the selected images are reported in Table 1.

			
F1-A	F2-A	F3-A	F4-U
			
F5-U	F6-U	M1-A	M2-A
			
M3-A	M4-U	M5-U	M6-U

Table 1: A table showing the faces selected for the experiment and the code selected to represent the images. The first letter of the name represents the gender, while the last letter of the name stands for attractive (A) or unattractive (U). Each image also shows the areas of interest selected for each of the image. The areas of interest were chosen to represent the eyes, nose, and mouth.

Apparatus

The eye movements of the twelve participants were recorded using the Gazepoint GP3 Eye Tracker. The GP3 Eye Tracker has a sampling rate of 60 Hz and a 0.5-1 degree of visual angle accuracy with a 0.1 degree spatial resolution. This eye tracker works with most glasses and contact lenses.



Figure 1: A behind the shoulder picture of the experimental set up. The Gazepoint Eye Tracker is mounted below the monitor shown in the picture. A participant is viewing an image in the Gazepoint Analysis software.

The gaze data was recorded using the Gazepoint Analysis software running on a school computer using Windows 7 (Microsoft, Inc.). Stimuli were displayed on a 22-in. Dell P2213 LED-backlit LCD monitor with a resolution of 1680 x 1050 pixels, refresh rate of 60 Hz, and color depth of 32 bits. Viewing distance was held constant at 21 inches. Prior to the experiment, the system was calibrated for each participant using a standard 5-point calibration sequence. A picture of the experimental setup can be seen in Figure 1.

Procedure

Prior to beginning the experiment, participants were informed that the purpose of the experiment was to study the differences in gaze patterns and fixations displayed when looking at attractive and unattractive human faces. The participants were given basic task instructions of how to position themselves and were informed that the study involved looking at six male and six female faces. The participants were not informed about the hypothesis of the experiment or the experimental design. Each participant was also positioned in a way that they were about 21 inches from the computer screen. Before each observer viewed the selected images, a 5-point calibration was performed on the eye tracking device in order to maintain accuracy and precision between different trial runs. The participants were also asked to fill out a questionnaire about their age and major. Before each image was shown to the participant, a central fixation (also known as a drift check) was presented by displaying a black dot on a white background for five seconds. This was used in order to ensure that each participant began viewing the images by looking at the center of the screen. This also ensure reproducibility of the results, as well as it makes comparison of the data easier. Each participant was presented with all of the selected images in random order and each images was shown for 15 seconds. After each image was shown, the participants were asked to rate the attractiveness of the face. For this part of the experiment, we used the Likert scale with 1 representing unattractiveness and 10 representing attractiveness. This was done in order to validate the ratings obtained from the Chicago Face Database, as well as for later analysis.

RESULTS

Eye movement data collected during the recorded experiments was exported from the Gazepoint Analysis software and examined for statistical significance. Various metrics were used to gather additional information from the study, including sum of fixation duration and number of fixations per area of interest (AOI). The gathered questionnaire was used to make sure that the classification obtained from the Chicago Face Database was consistent with the way the participants in the study objectively viewed the images.

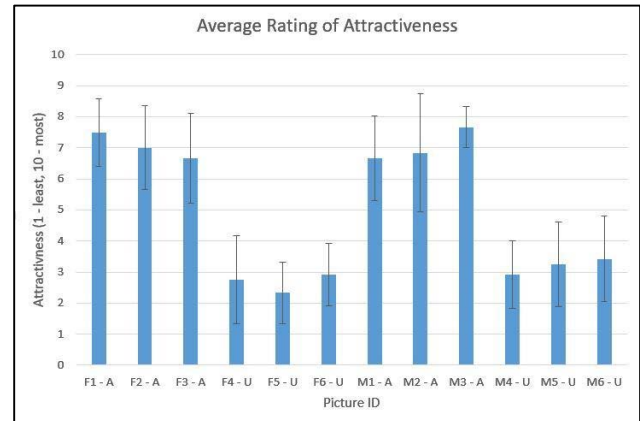


Figure 2: Average rating of attractiveness as rated by the actual participants in the experiment. Ratings are based on the Likert scale with 1 representing very unattractive and 10 representing very attractive. Error bars were calculated using standard deviation between the reported ratings.

Figure 2 shows the average rating for each of the image as rated by the participants in the study. The figure shows that the selected attractive faces were rated significantly higher in attractiveness than the selected unattractive ones. The error bars shown were calculated using the standard deviation between the responses. The variation between the responses is generally large, but attractiveness is a subjective trait and thus we would expect to see such large variations.

To analyze the difference in the viewing strategies between females and males when looking at attractive and unattractive faces, we first examined the sum of fixation duration on the selected AOIs as indicated in Table 1. The results are shown in Figure 3.

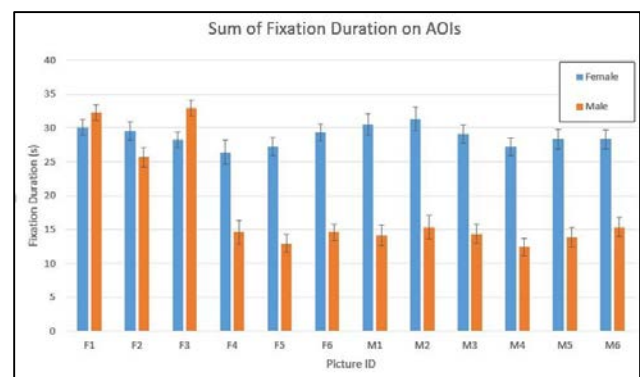


Figure 3: Sum of fixation duration on AOIs. The AOIs are considered eyes, nose, and mouth and are shown in Table 1. The blue bars represent the data obtained from female participants, while the orange bars represent the data obtained from male participants. Error bars were calculated using standard deviation between the fixations on the AOIs.

The figure shows that the male participants had significantly longer fixation durations on AOIs associated

with attractive female faces, and spent significantly less time fixating on AOIs associated with unattractive female faces or any of the presented male faces. On the other hand, female participants did not display the same gazing patterns. Females spent about the same fixation duration on all of the faces present, regardless of the gender or attractiveness associated with the image. Furthermore, it is interesting to note that the fixation duration between the male and female participants when looking at the attractive female faces are almost identical.

We also analyzed the average fixation duration on AOIs split between male and female participants. The results are shown in Table 2. An ANOVA test was also performed on the averages in order to determine if there is a significant statistical difference between the averages for the different groups. Based on the results ($F = 5.47$, $p < .05$), the average fixation duration for the male participants when looking at attractive female faces was statistically different from the mean values reported for the other groups as well as the means reported from the female participants. Furthermore, there is no statistical difference between the average fixation duration for each of the groups for the female participants ($F = 5.47$, ns).

	Average Fixation Duration for Male Participants	STD	Average Fixation Duration for Female Participants	STD
Attractive Female Faces	1.86	1.707	1.031	1.164
Unattractive Female Faces	1.074	0.999	0.729	1.117
Attractive Male Faces	0.93	1.16	0.702	1.18
Unattractive Male Faces	0.96	0.888	0.982	0.992

Table 2: Average fixation duration on AOIs for males and females participants. Each group average represents the average of the fixations based on three images. For example, the “Attractive Female Faces” average is comprised of the average fixation duration obtained from the three attractive female images.

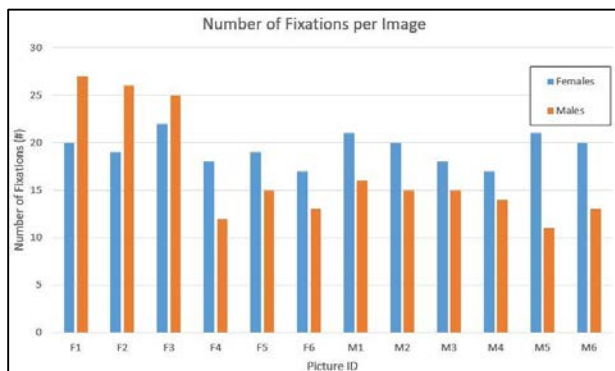


Figure 4: Number of fixations per image. The blue bars represent data obtained from female participants, while orange bars represent data obtained from male participants.

We also analyzed the number of fixations per image. The results are shown in Figure 4. Based on the results shown in the figure, the male participants had a larger number of fixations when viewing the attractive female faces when compared to viewing the unattractive female faces, or any of the male faces.

On the other hand, the female participants did not display the same gazing patterns. On average, the female participants spent same number of fixations per image regardless of whether the image was of a male or female or whether or not the presented face was rated as attractive or unattractive.

DISCUSSION

The results of our study support our hypothesis that males tend to display distinctive gazing patterns when looking at attractive female faces and thus exhibit longer fixation durations on AOIs associated with facial features. On the other hand women did not display the same viewing patterns. The women participants in our study displayed the same viewing patterns regardless of whether the presented face was male or female and regardless of how attractive they rated the presented the face. This pattern is strongly supported by all of our results; the sum of fixation duration on AOIs, the average fixation durations on AOIs, and the number of fixations on each image.

While the results did support our initial hypothesis, other aspects were more unexpected. It is interesting to note that the male participants displayed very similar gazing patterns when looking at unattractive female faces and any of the male faces. In addition, in every statistic that we looked at, the females tended to spent longer fixating on AOIs associated with facial features in all of the presented faces, except in the attractive female faces where the fixations were almost identical.

There are a few aspects to consider regarding the results of our experiment. It should be noted that our sample size was fairly small. With only 12 total participants with 6 of each gender, each participant would have a large impact on the results of the experiment. Another aspect to consider is that all group members and therefore those facilitating the experiments were all male which might have influence the results of the ratings given by the participants. More specifically this could have an impact on the participant's ability to give completely honest results, unbiased by any worry of judgment from those conducting the experiment.

CONCLUSION

Based on the results of this experiment, there is a strong indication that males aged 18 to 22 seem to display different gazing patterns when looking at attractive women when compared to the patterns displayed when looking at unattractive female or any male faces. These

males spend on average longer fixating on AOIs associated with facial features when looking at attractive women. In contrast, women aged 18 to 22 seem to not differentiate their gazing patterns between males or males, or even between attractive or unattractive human faces. Since the sample size for this experiment was fairly small, further work would need to be done to confirm the results.

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