GAZE LATERALIZATION BIAS DURING FREE VISUAL EXPLORATION OF FACES

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INTRODUCTION

During visual sampling of face images, a lateral gaze bias has been observed in human subjects [1]. This bias is wider for conspecific faces, probably influenced by behavioral social interaction development [1]. Face stimulus properties, e.g., spatial frequency, may also influence visual processing [2], and the engagement of central or peripheral visual pathways [3]. Low spatial frequencies (coarse information) are conveyed faster by the magnocellular pathways originating from the parasol ganglion cells, whose density increment is correlated with the foveal eccentricity [2]. This induces a functional lateralization of the visual cortex [4], which may be involved in face perception.

OBJECTIVE

Our study's goal was to assess if the face lateralization bias is maintained when basic low-level image features are removed, and only low spatial frequency information is kept in visual stimuli. To this end, we performed eye-tracking during a free visual exploration experiment.

METHODOLOGY

Human and Monkey faces were presented on a monitor. We used "dots" images with different levels of visibility set by a g parameter (higher g values, easier-to-recognize images) [5], in Ascending (low-to-high visibility) and Descending (high-to-low) order (n subj = 7, n trials = 180). Eye-tracking measurements were recorded (ASL EyeStart 6000 system, 50 Hz). The lateralization bias in gaze was quantified as the offset from the image center to the fixations' center of mass, in visual degrees, as a function of visibility.

RESULTS

The examination of heatmaps (Figure 1A) and quantification of lateralization bias show a significant right gaze bias, estimated for each stimulus category by comparing the data to chance level (0) using 2-tailed Wilcoxon Signed Rank tests ($p(x \leq Z)$). According to Shapiro-Wilk test, a normal distribution or a moderate violation of the normality assumption was found (category dependent). Therefore, parametric tests were considered robust to compare the lateralization bias per conditions. Significant differences were found between the offsets of the smallest and the largest g values, for both face conditions (p values > α) (Figure 1B). However, comparing the Human and Monkey face offsets (considering the Ascending and the Descending visibility order), no significant differences were found (p values > α) (Welch's t-tests).

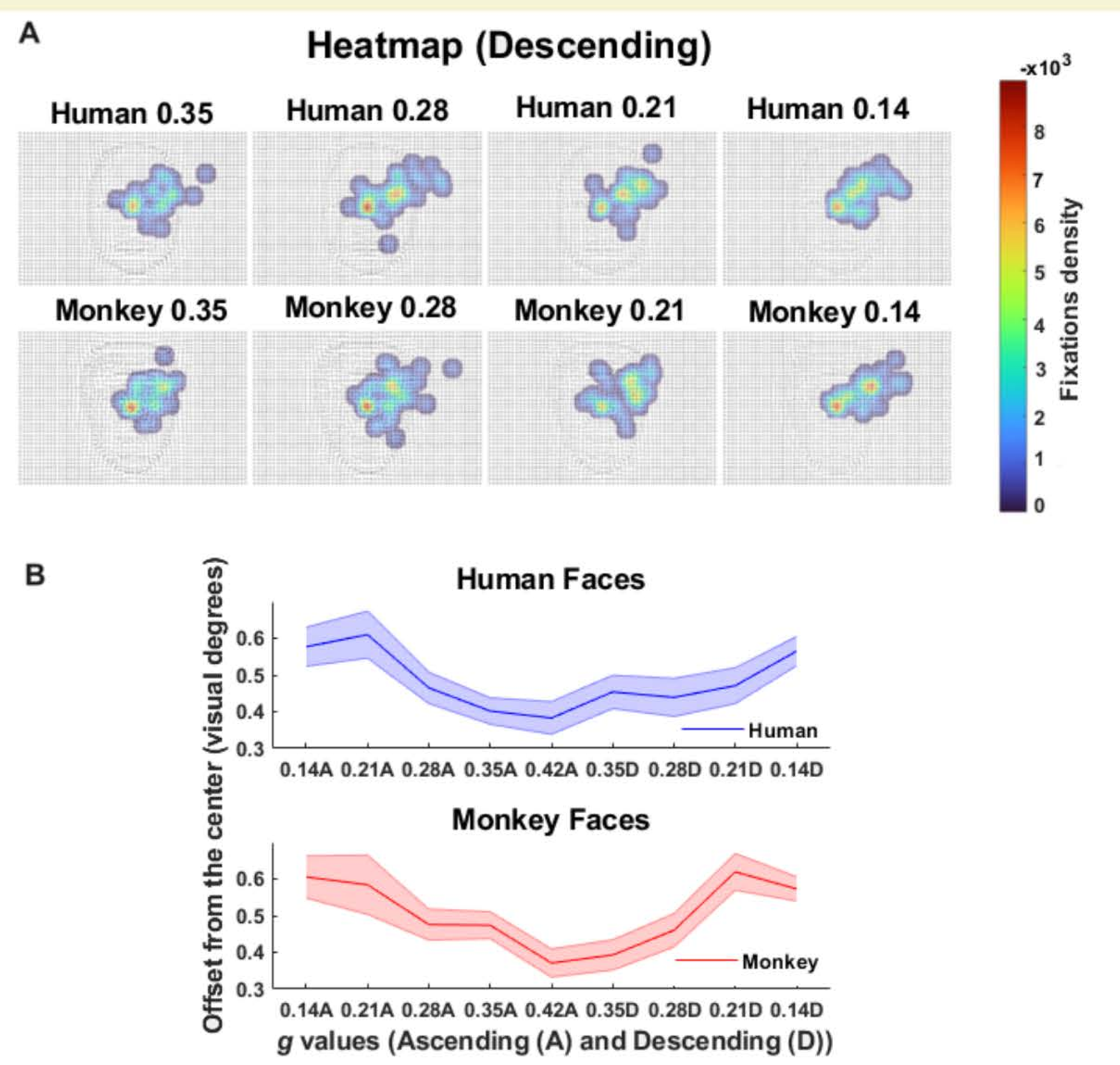

Figure 1. Right lateralization bias. (A) Heatmap (e.g., one subject; "Descending" stimulus presentation order, different visibility levels/g values) displaying a right gaze bias. (B) Lateral asymmetry quantification. Error bands represent s.e.m. The U-shaped curve emphasizes a lateralization bias influenced by the g values (higher offset values at lower visibility/smaller g values).

CONCLUSION

The levels of visibility influence the lateralization gaze bias (magnitude of the offset depends on visual difficulty), which may reflect a perceptual optimization mechanism i.e. increased reliance on peripheral vision maximizing integration of low spatial-frequency information. However, lateralization is not influenced by the face conditions (Human vs. Monkey faces), implying that the gaze conspecific bias [1] may require high spatial frequency image components.

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