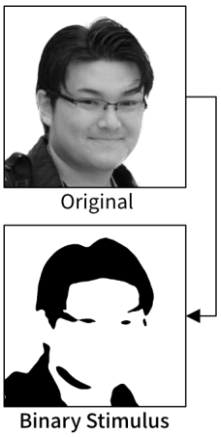
Face-likeness affects Unconscious Processing

Extent of the Facial Ambiguity and Facial Perception

Overview



Our brains possess a cognitive mechanism that allows us to quickly recognize faces even with limited visual information. Focusing on this phenomenon, Toyohashi University of Technology investigated how the brain processes ambiguous visual stimuli resembling faces under unconscious conditions. The research team from the Visual Perception and Cognition Laboratory and the Cognitive Neuroengineering Laboratory in the Department of Computer Science and Engineering investigated, utilized a technique called Continuous Flash Suppression (CFS). This method involves rapidly presenting images to one eye to suppress the visual information of the other eye, enabling the study of processing mechanisms for ambiguous images under unconscious conditions. The research revealed that even ambiguous black-and-white stimuli reach consciousness more quickly when they resemble faces. This suggests that the brain responds rapidly even when facial cues are minimal. These findings were published online in the *Journal of Vision* on September 27, 2024. https://doi.org/10.1167/jov.24.9.18

Details

In CFS, breaking time (BT) is a useful tool to investigate unconscious processing. BT indicates the duration for a suppressed stimulus to overcome suppression and become consciously perceived by the participant. Among the four types of stimuli used in the experiment, the study revealed that upright grayscale faces were recognized faster than inverted ones. This is known as the inversion effect and is a well-documented phenomenon in the field of facial recognition. However, the inversion effect was not observed in the case of binary face stimuli—images presented in black and white. This implies that regardless of whether these binary images were upright or inverted, the brain did not exhibit the same recognition bias observed for grayscale faces. Now, does this mean binarized images do not demonstrate any advantage over grayscale stimuli?

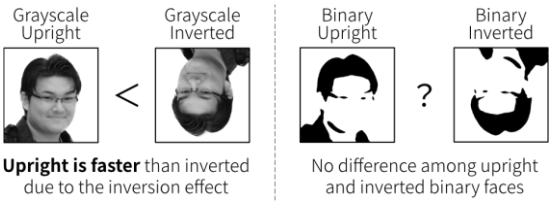


Figure: Types of stimuli used in the experiment.

Interestingly, among the binarized images, there were those with a high degree of facial likeness and those without, and an investigation into the relationship between BT and facial likeness revealed a strong correlation. In other words, images with features closer to a face were detected faster than those without. This suggests that even ambiguous stimuli containing facial features like the contours of the eyes and mouth are processed by the brain preferentially over other types of stimuli. The brain

exhibits a very high sensitivity to face-like features, emphasizing the uniqueness of facial cues in visual cognition.

Makoto Michael Martinsen, a third-year doctoral student and the first author of this study, commented on the significance: “Our findings underscore the brain's exceptional sensitivity to faces, even under challenging visual conditions. This suggests that facial recognition constitutes a highly specialized system that is pivotal in perceiving and interacting with others.” He further suggests that the results open new avenues for research exploring the influence of emotions, attention, and other factors on facial recognition.

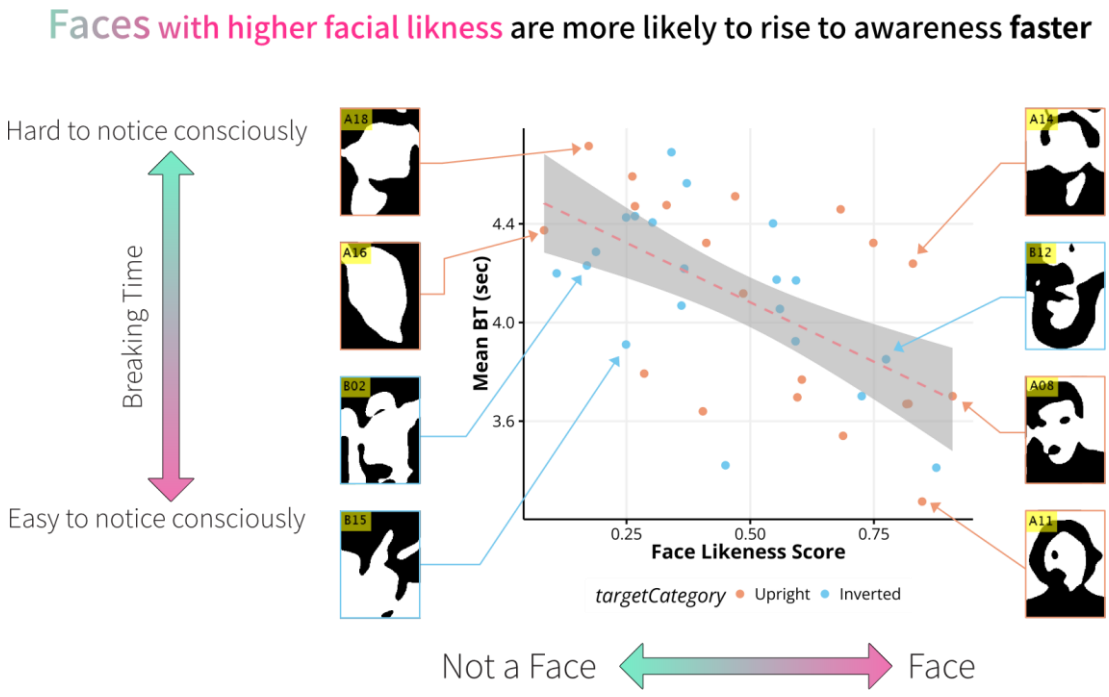


Figure: Each dot represents a stimulus used in the experiment. Higher face-likeness score is linked to shorter breaking time.

Future works

Moving forward, the research team plans to explore how emotional expressions, such as fear or happiness, might affect unconscious processing similarly to face-likeness. Additionally, incorporating techniques like eye-tracking could help identify which facial features participants focus on during unconscious processing, providing further insights into how attention is distributed across different face parts.

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Published paper

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