Investigating face and body perception in humans with naturalistic, more ecologically valid stimuli

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Introduction

- Faces are a special stimuli category in everyday life as they are holistically and easily recognizable (Farah et al., 1998).
- Classical experiments investigating face perception in humans usually involve static, controlled laboratory setups and highly manipulated/edited stimuli (e.g., Bentin et al. 1996,)
- The issue of using ecologically valid conditions to study brain functioning is still a pressing one within cognitive neuroscience (Nastase et al., 2020; Finn et al., 2022).
- Previous research on face perception has used natural scenes (Rousselet et al., 2004) and real-life free-viewing scenarios as stimuli revealing unknown EEG signatures of face processing (Gert et al., 2021).
- However, the stimuli used for the passive comparison condition involve a set of selected, portrait-like photographs.
- There is still a lack of studies investigating the implications of using naturalistic, unedited images to study face perception.
- Faces of human-like avatars or cartoons are shown to elicit similar responses to real human faces (Wheatley et al., 2011; Zell et al., 2015).

Goal:

- Investigate ERPs responses to faces and bodies compared to objects using images retrieved from previous gazes during a free-viewing exploration in a virtual city.
- Compare the passive condition responses with the free viewing exploration condition.

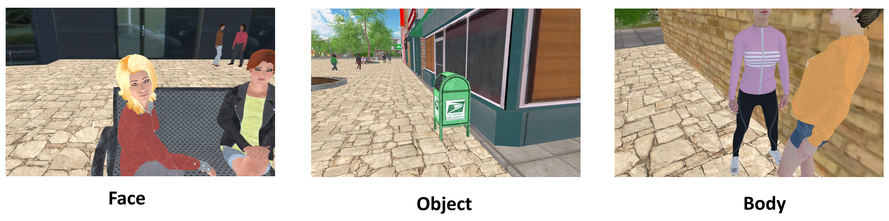
Methods

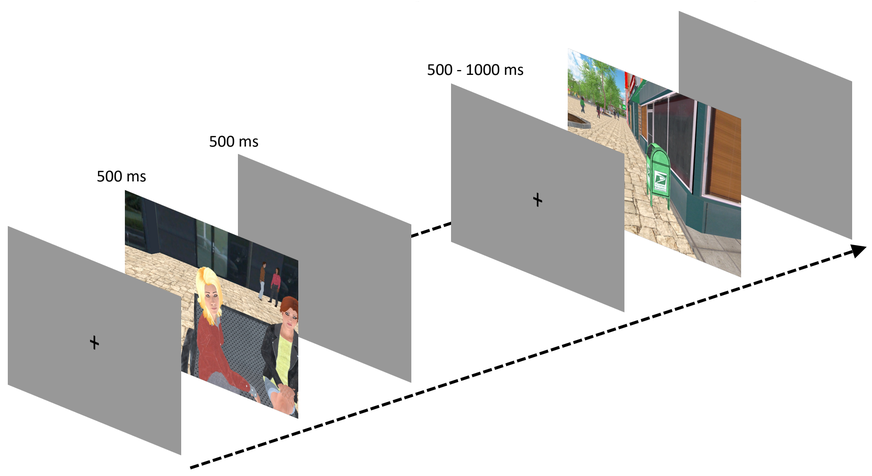
Images collection:

- Three head and eye-tracking datasets collected during the free-viewing exploration condition were used to reconstruct each player's walked path.
- Screenshots were automatically taken from the eyes camera when the player was gazing at faces, bodies, and objects in the scene.
- Additionally, Unity 3D's physics raycast was used to calculate and save the distances and rotations.

The experiment:

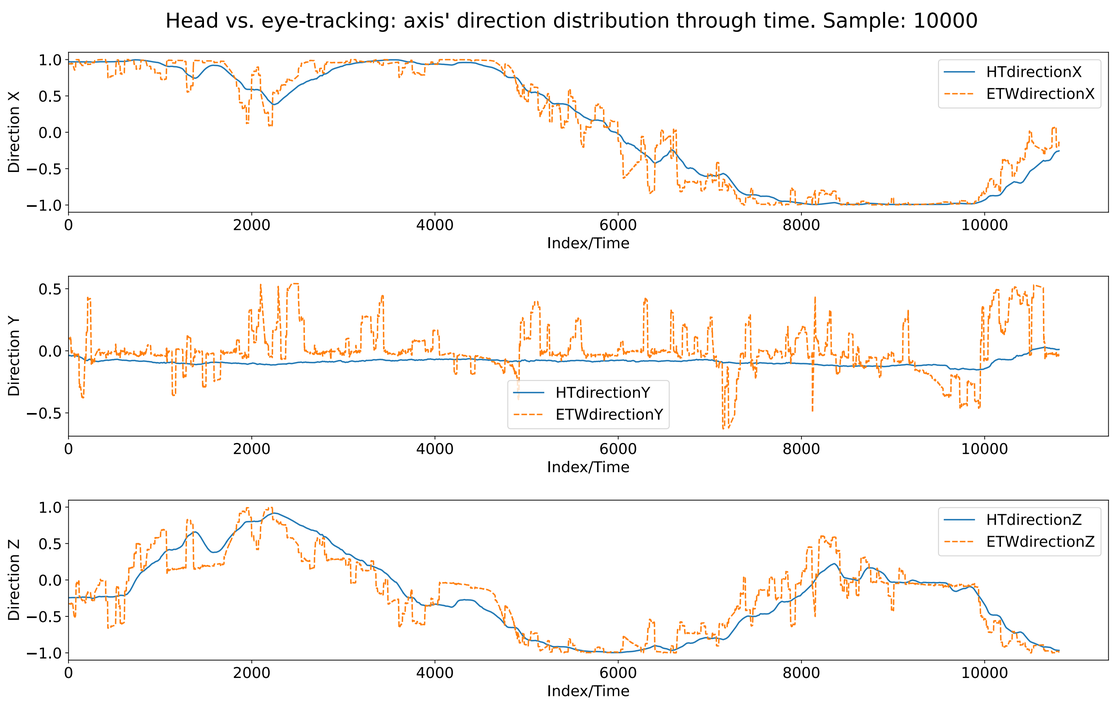
- The experiment consists of 1680 total trials divided into four blocks of about 8-10 minutes with eye-tracking calibration and validation before and in the middle of each block.
- There are 70 unique images per category (face, object, body) with randomized order of stimulus presentation.
- Each image can repeat only twice within a block and not after itself.





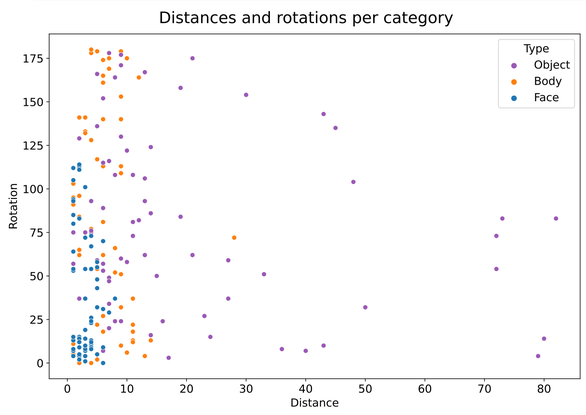
Results

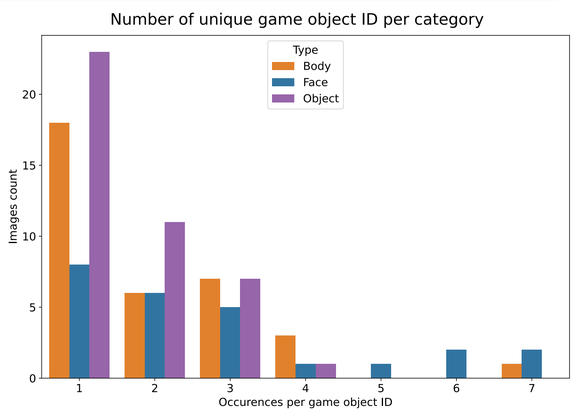
- The X, Y, and Z coordinates of the head and eyes follow each other in the direction of movement, the head axis being smoother.
- Behavioral head and eye-tracking data suggest it is possible to use head data to predict gazes.



Conclusion & Discussion

- A total of 210 images (70 per category) were selected to use during the passive condition experiment. The following properties can be observed:
- **Faces:** max rotation of ~100 degrees, max distance of ~10 (Unity scale).
- **Bodies:** max distance of ~20 and can be seen from any angle.
- **Objects:** rotations and distances are less relevant and range widely.
- Most Game Objects (body, face, object) appear at max 3 times in the dataset, only 11 occur 4 or more times.
- Faces and bodies have the less amount of unique object ID.





- The analysis of the behavioral and hit event data collected during the free-viewing exploration condition shows similar behavior for the head and the eye-tracking direction of movement during free-viewing exploration.
- Head and eye-tracking behavior seem to suggest that head data could potentially be used to predict gazes. However, further analysis investigating the accuracy with which head data predicts gazes is needed.
- It is possible to produce images of faces and bodies in natural scenes from gazes that occurred during free-viewing explorations.
- The analysis of the ERPs responses to images of faces and bodies in natural scenes compared to objects is still in progress.
- We hypothesize an ERPs response difference between the free-viewing exploration condition and the passive condition

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