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

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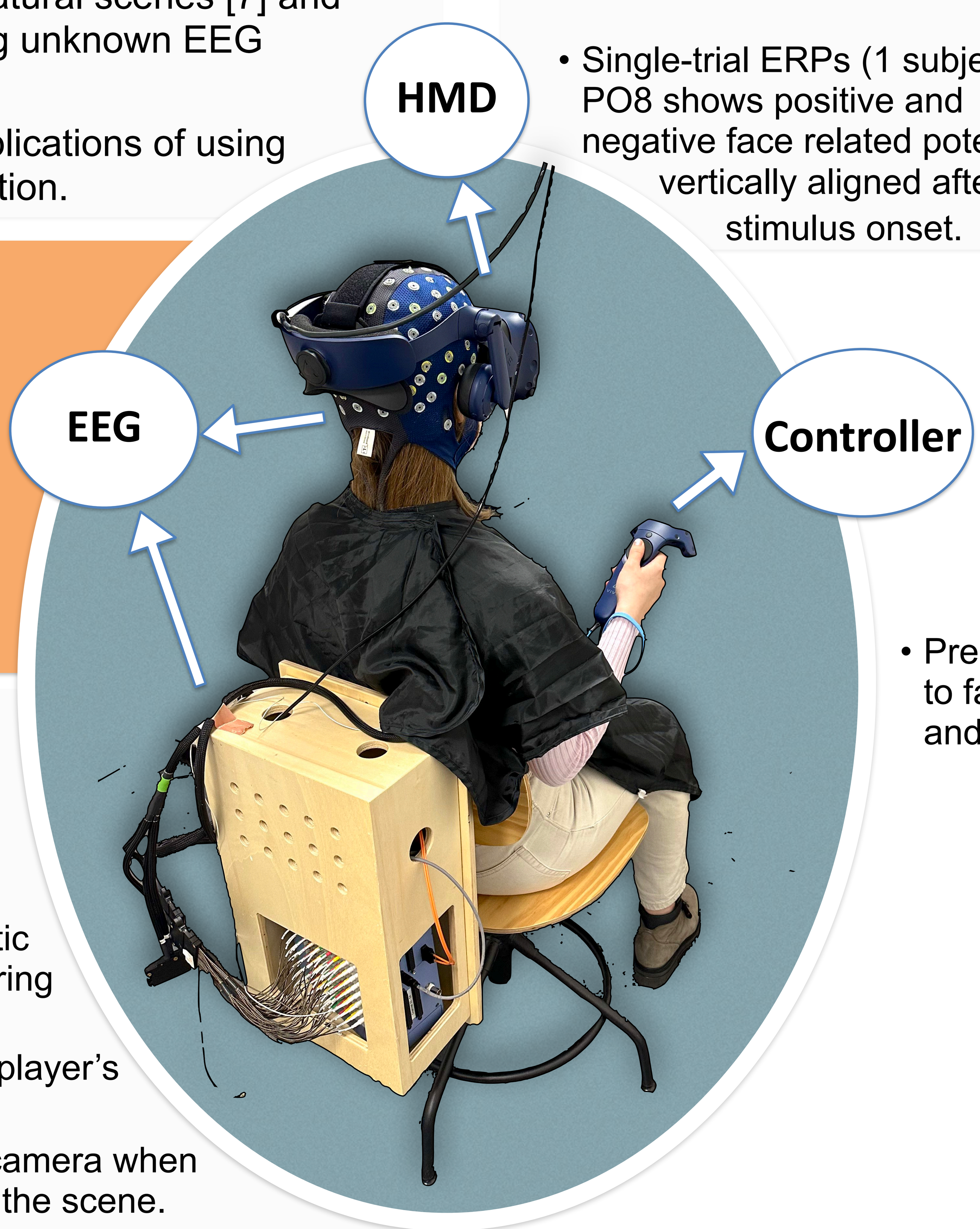
Introduction

- Translating classical laboratory-based setups into the real world (the wild) represents a major challenge in neuroscience.
- Using ecologically valid conditions to study brain functioning is still a pressing issue within cognitive neuroscience [1]–[3]
- Neuroscience in the wild involves many significant changes in how we design, conduct, and analyze ecologically valid experiments [4]
- Faces are often perceived in natural scenes
- Classical experiments investigating face perception in humans usually involve static, controlled laboratory setups and highly manipulated/edited stimuli [5][6]
- Previous research on face perception has used natural scenes [7] and real-life free-viewing scenarios as stimuli revealing unknown EEG signatures of face processing [8]
- There is still a lack of studies investigating the implications of using naturalistic, unedited images to study face perception.

Goal:

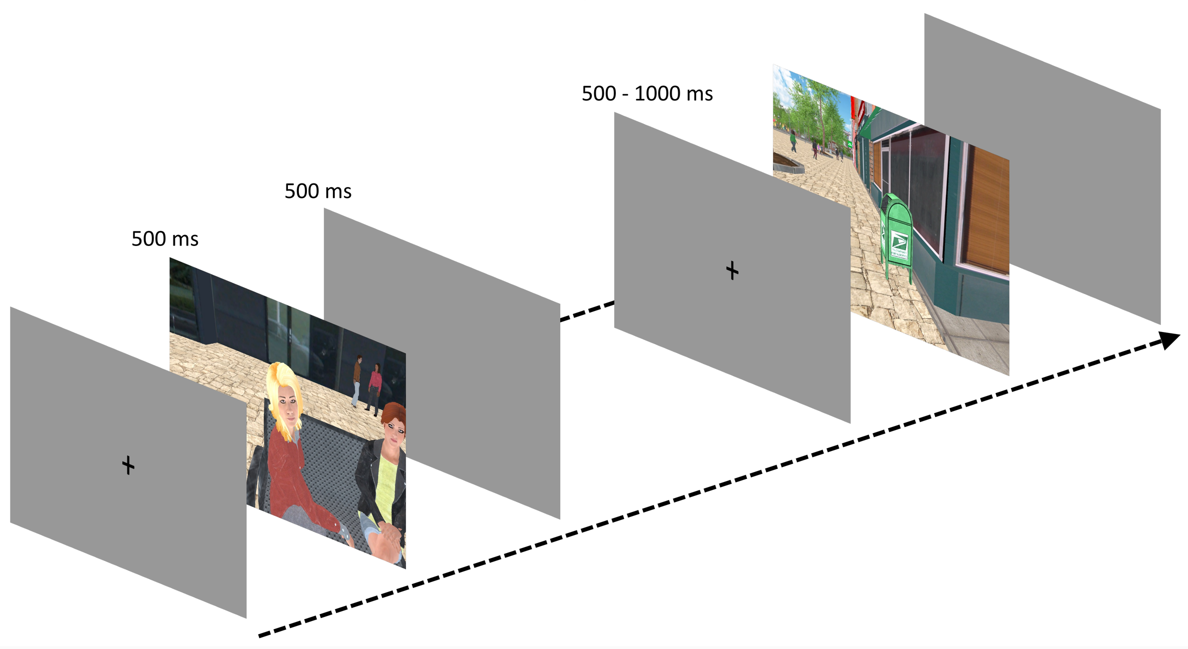
- **Translate a classical experimental paradigm into the wild.**
- **Create an intermediate set up that combines EEG and VR.**
- **Investigate ERPs responses to faces and bodies compared to objects using images retrieved from previous gazes during a walk in a virtual city.**



Methods

Images collection:

- We combined EEG and VR to investigate ERPs' responses to faces and bodies (N170) using naturalistic images retrieved from participants' previous gazes during a free-viewing exploration in a virtual city.
- Head and eye-tracking data were used to reconstruct 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.
- We aligned the EEG and VR streams timestamps to identify stimulus onset

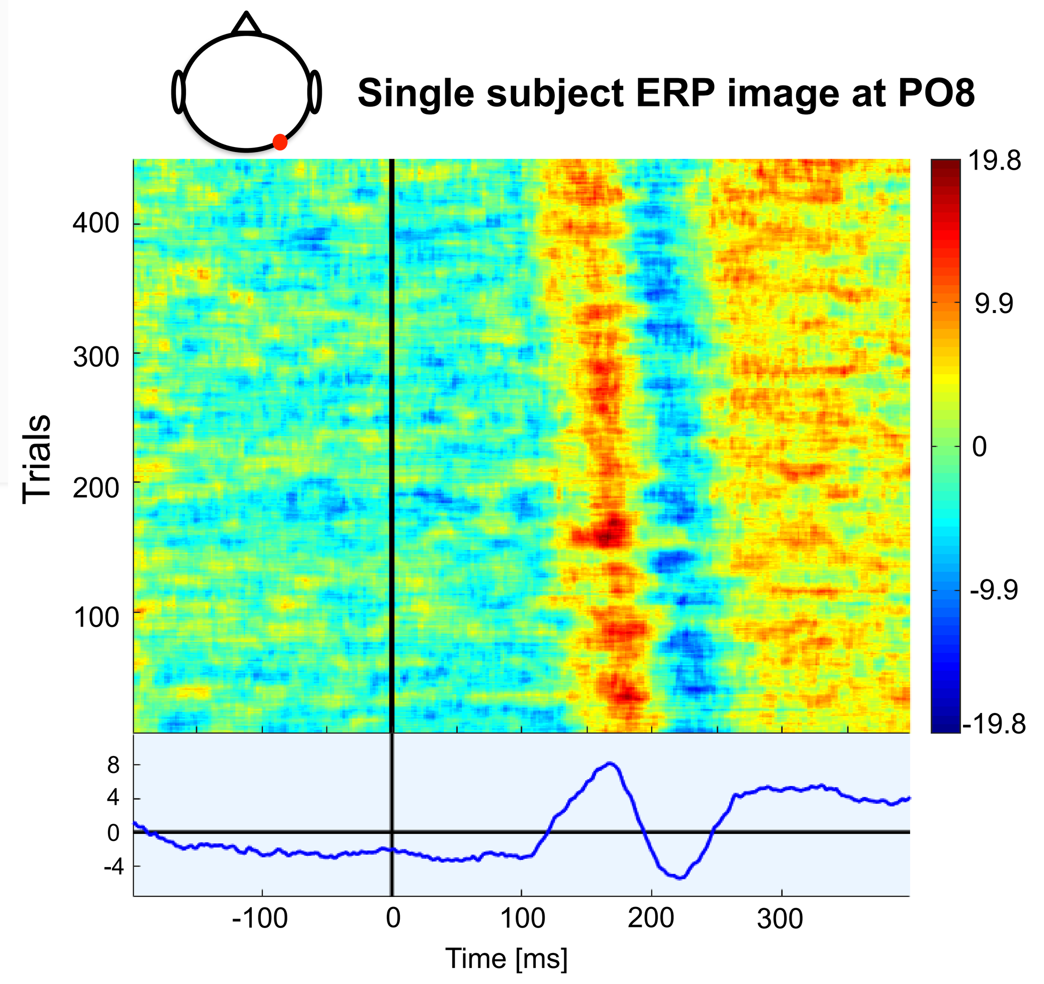


The experiment:

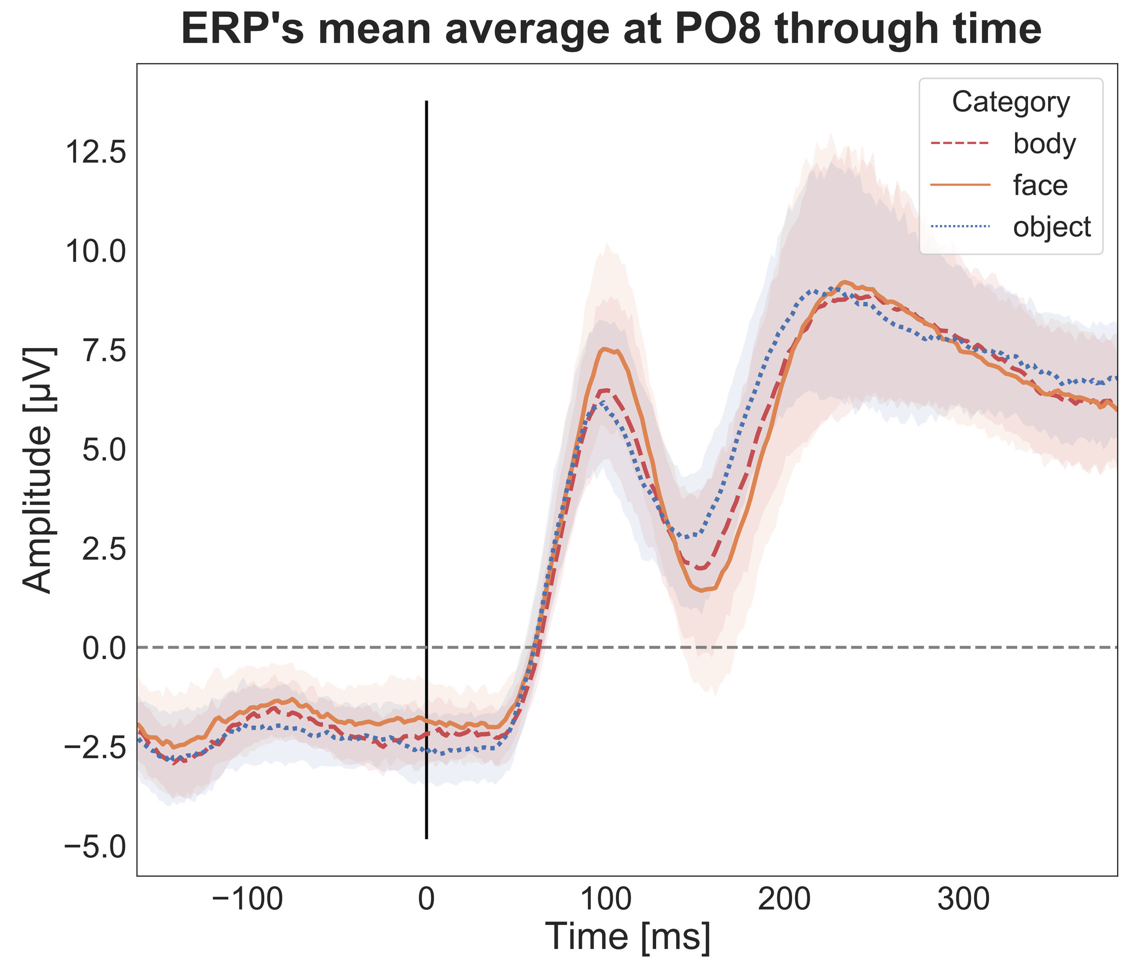
- The experiment consists of 1680 total trials divided into four blocks of about 8-10 minutes with eye-tracking calibration and validation before and in the middle of each block.
- Dataset consisted of 70 unique images per category (face, object, body) with randomized order of stimulus presentation.
- Each image can repeat only twice within a block and never after itself.

Results

- Single-trial ERPs (1 subject) at PO8 shows positive and negative face related potentials vertically aligned after stimulus onset.

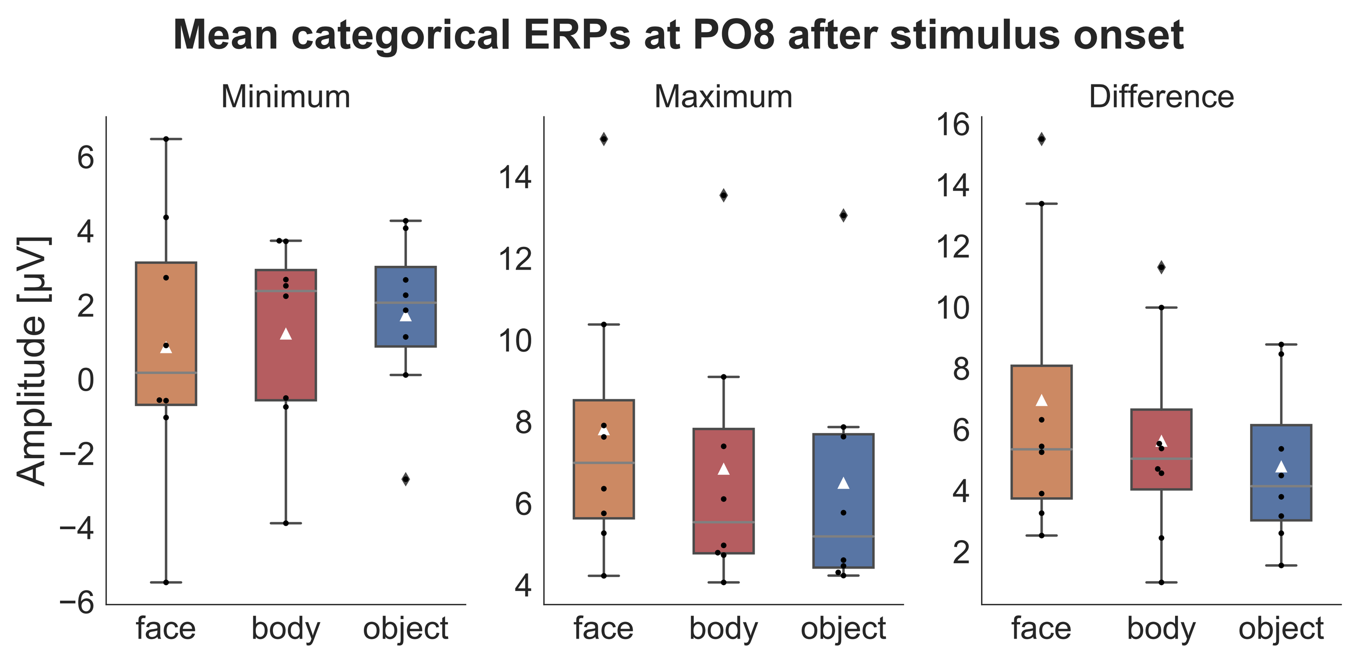


- Preliminary results (8 subjects) show a robust mean ERP to faces at PO8 with positivity of 7.8 microvolts at 100 ms and a drop in activity to 0.8 microvolts at 167 ms (N170).



- Comparing faces to objects, the positivity was changed after about six microvolts, and the drop in activity differed by about one microvolt.

- Average ERPs to faces have the strongest maximum and minimum activity with a larger difference in amplitude.
- ERPs to bodies are stronger compared to objects, but weaker than faces.



Conclusion & Discussion

- We successfully translated a classical experimental paradigm into a more practical setup combining EEG and VR that can inform and inspire subsequent fully wild investigations.
- We reproduced previous findings associated with a negative ERP component sensitive to faces from a different experimental design perspective.
- This methodological approach sets the stage for wilder, more dynamic investigations.

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