Brain-Computer Interfaces for Optimal Human-Machine Collaboration

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Aim

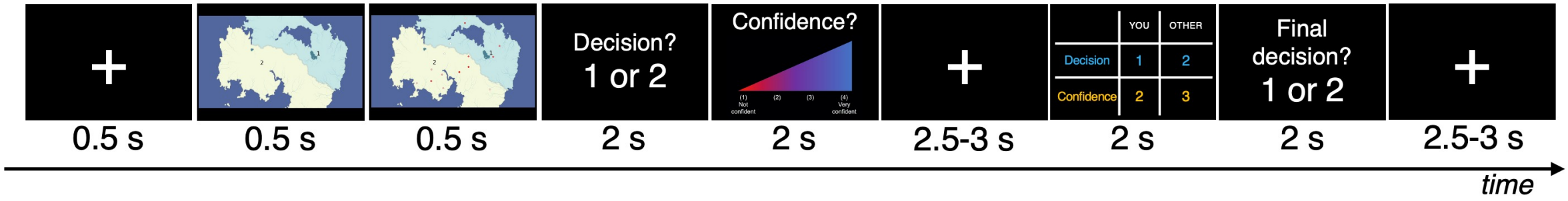
- Brain-Computer Interfaces (BCIs) can be used to **improve group decision-making** in human and human-machine teams [1-3]
- **Receiving advice** from others could be **beneficial** [4] **or detrimental** [1] to decision-making performance

Can we develop BCIs to understand if a person is willing to take advice from brain signals?

[1] Valeriani, D., Cinel, C., & Poli, R. (2017). Group augmentation in realistic visual-search decisions via a hybrid brain-computer interface. Scientific reports, 7(1), 1-12.
[2] Valeriani, D., Poli, R., & Cinel, C. (2016). Enhancement of group perception via a collaborative brain–computer interface. IEEE Transactions on Biomedical Engineering, 64(6), 1238-1248.
[3] Valeriani, D., & Poli, R. (2019). Cyborg groups enhance face recognition in crowded environments. PloS one, 14(3), e0212935.
[4] Desender, K., Boldt, A., & Yeung, N. (2018). Subjective confidence predicts information seeking in decision making. Psychological science, 29(5), 761-778.

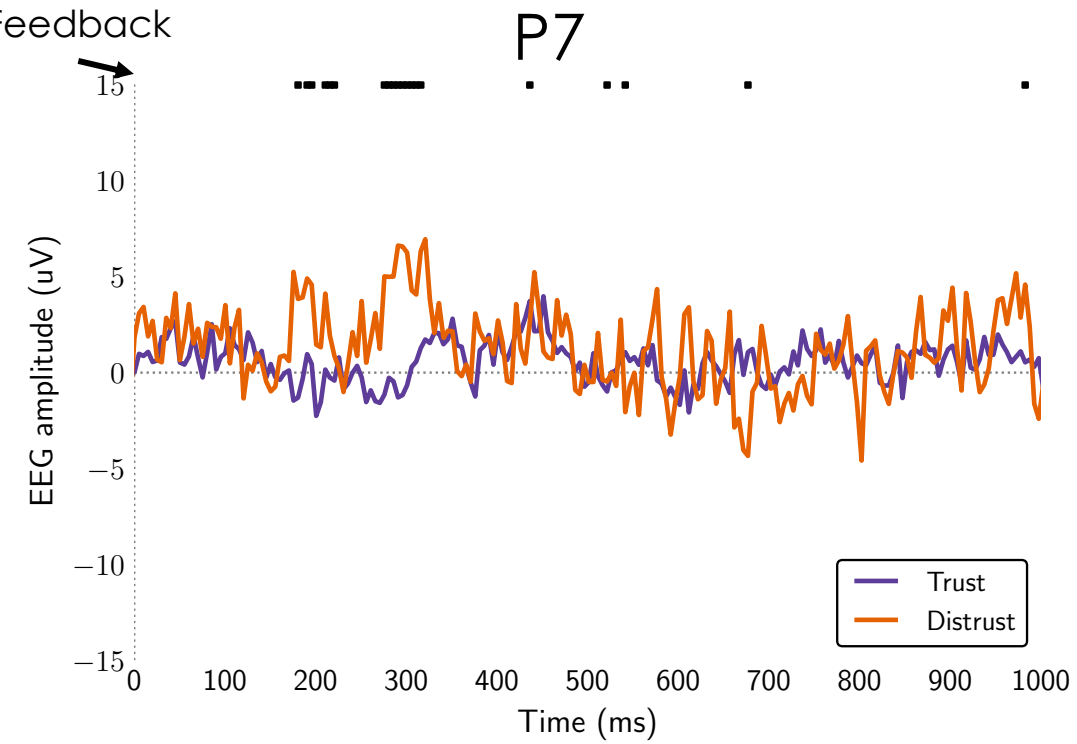
Methods – Pandemic decision-making

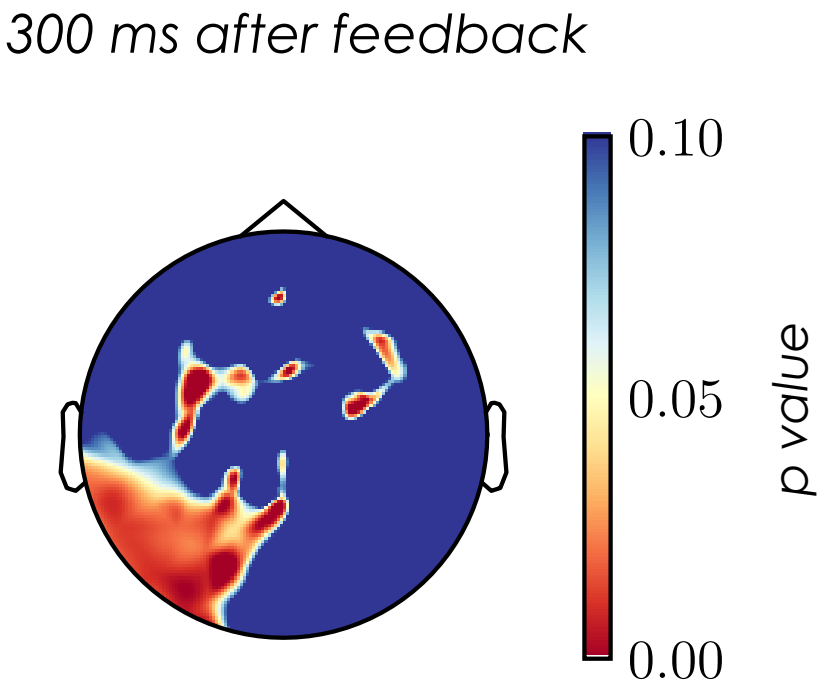
- **Task**: decide what geographic region was most in danger during a pandemic (6 blocks of 30 trials)
- **Feedback** from an artificial agent after each decision
- Neural data from 128 EEG electrodes, 14 participants
- **Openness to advice** = change of mind (trust) or not (distrust)



Results

Neural correlates of openness to advice peaking **between 150 and 350 ms** after receiving feedback in **left parietal and occipital electrodes** (P3, P7, O1)





Conclusions

- Neural correlates of openness to advice (feedback) are localized to the **left parietal and occipital regions**
- These results could inform whether receiving advice would be beneficial in decision making, and **enable the development of brain-computer interfaces for optimally-collaborating machines**

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