Attention and Consciousness Research Group

V Jornadas de Investigación CIMCYC

Brain dynamics of feature integration

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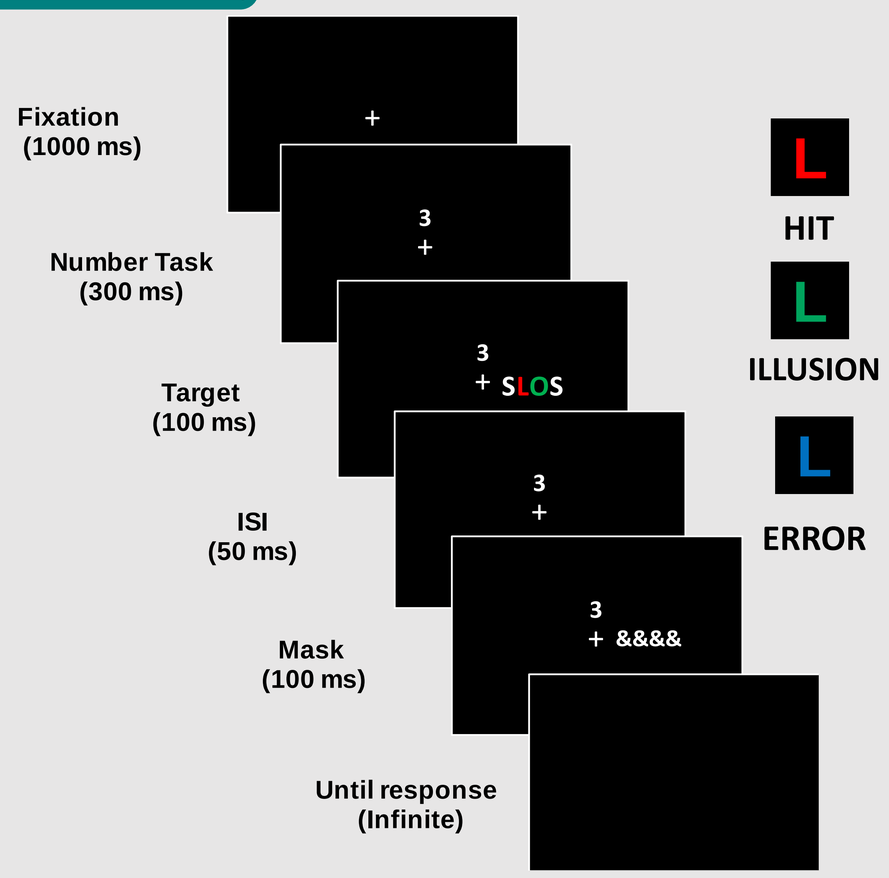
Introduction

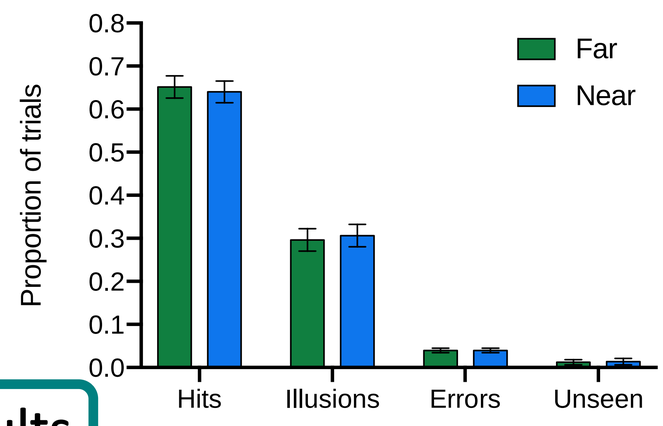
- During perception, we need to identify the different features of an object and integrate them to construct a single percept[1].
- When integration fails, erroneous combinations of features can occur, leading to "**illusory conjunctions**".
- These illusions have been proposed as a mean to study **phenomenal consciousness**: the impression of perceiving much more information than we can report[2].
- These studies aim to **explore** the brain dynamics involved in correct and incorrect feature integration.

Methods

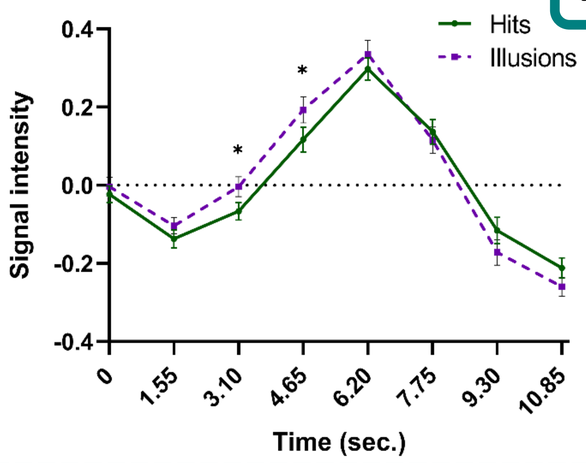
- Target size was manipulated to achieve 70% hits and 30% illusions.
- A central task was used to manipulate divided attention in two difficulty conditions (easy: Far, difficult: Near)
- Participants reported if the central number was larger or smaller than 5, and then indicated the color of the letter L.



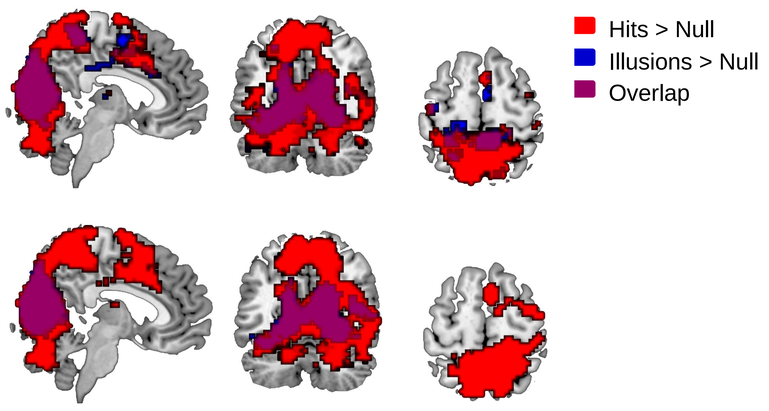
Behavioral Results

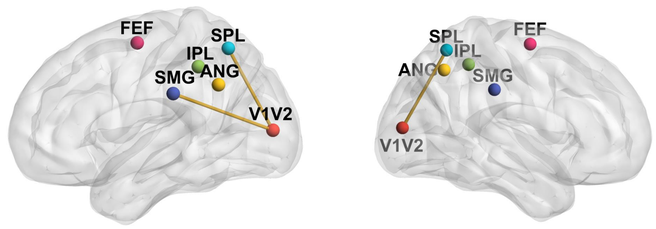


fMRI Results



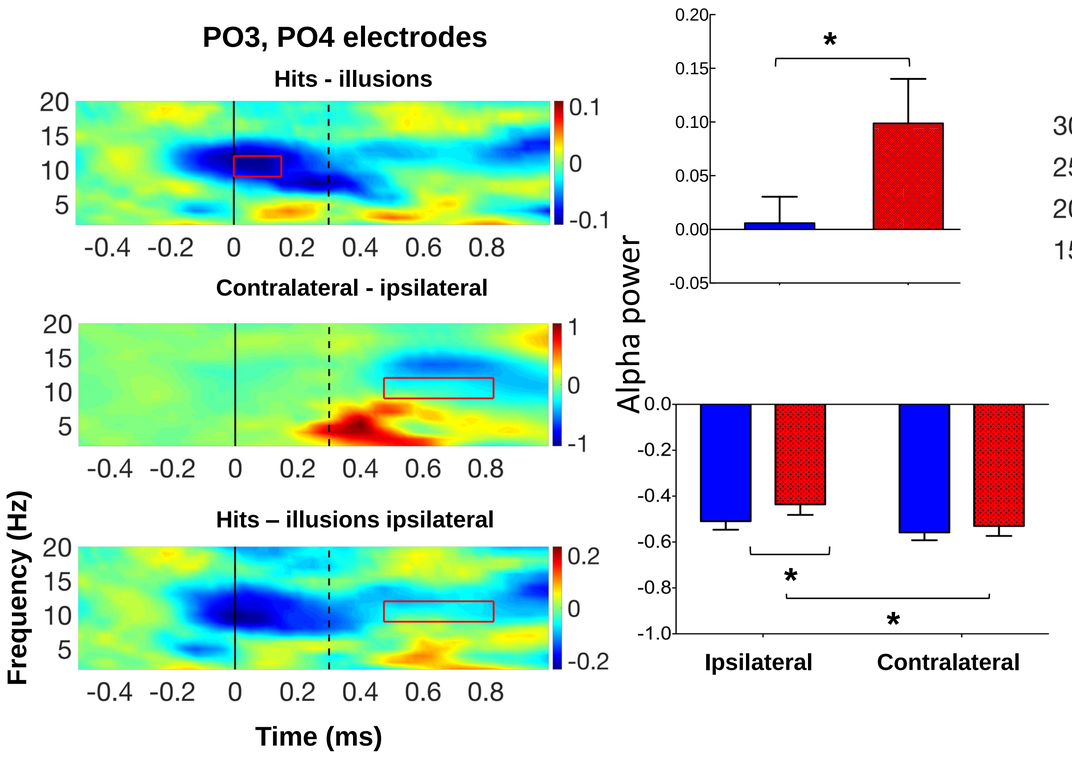
Visual regions' responses were initially larger for illusions than hits.

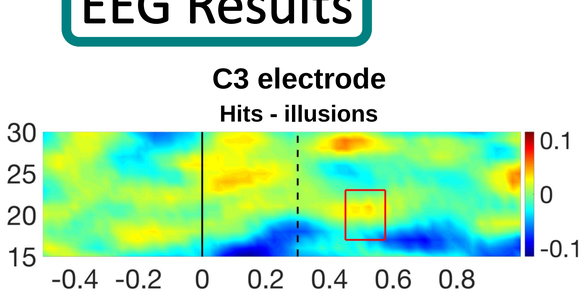


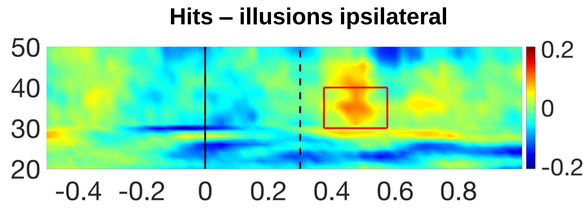


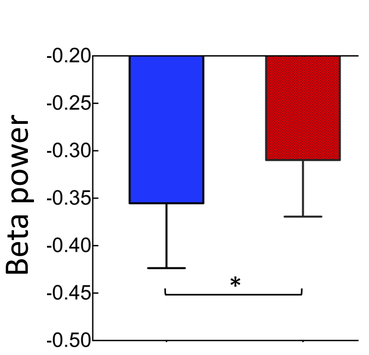
Stronger coupling of visual regions with the parietal cortex (and FEF, not shown in the pair-wise analysis) for hits as compared to illusions.

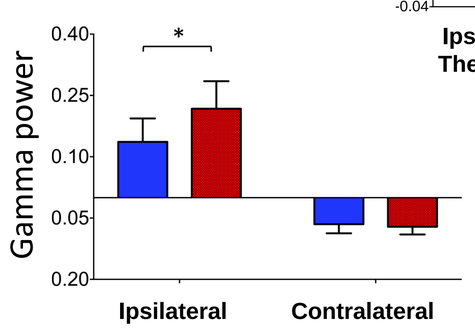
EEG Results



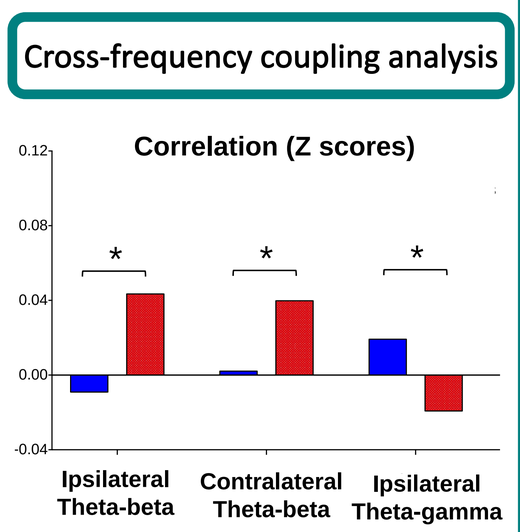








Cross-frequency coupling analysis



Discussion

- **Central task** demands (divided attention) **did not directly modulate** the production of illusory conjunctions[3].
- **fMRI**: illusions are characterized by an **early increase in occipital** activations and a weak **functional coupling** between **occipital regions and parietal and frontal regions** [4].
- **EEG**: different processes can fail during feature integration. **Pre-stimulus preparation** (early alpha), **inhibition of distractors** (lateralized alpha), **feedback from top-down regions** (beta), and **working memory** (gamma).
- Trial-by-trial amplitude correlations between the theta band and the beta and gamma band characterize correct and incorrect feature integration.
- **General conclusion**: these results highlight the importance of parieto-occipital and occipito-frontal connectivity for correct feature integration, and suggest that feature integration is a complex process that can go wrong at different stages.

[1] Block, N. *Behavioral and Brain Sciences* (1995). [2] Mudrik, L., et al., *Trends in Cognitive Sciences* (2014). [3] Cobos, M., I., & Chica, A., B,. *QJEP* (2022). [4] Rodríguez-San Esteban et al. *Cerebral Cortex* (2022).

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