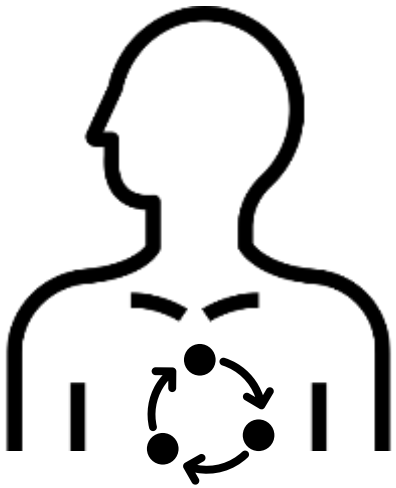
Parieto-occipital connectivity during correct and incorrect feature integration

Pablo Rodríguez-San Esteban, Ana B. Chica & Pedro M. Paz-Alonso

External information



Internal information

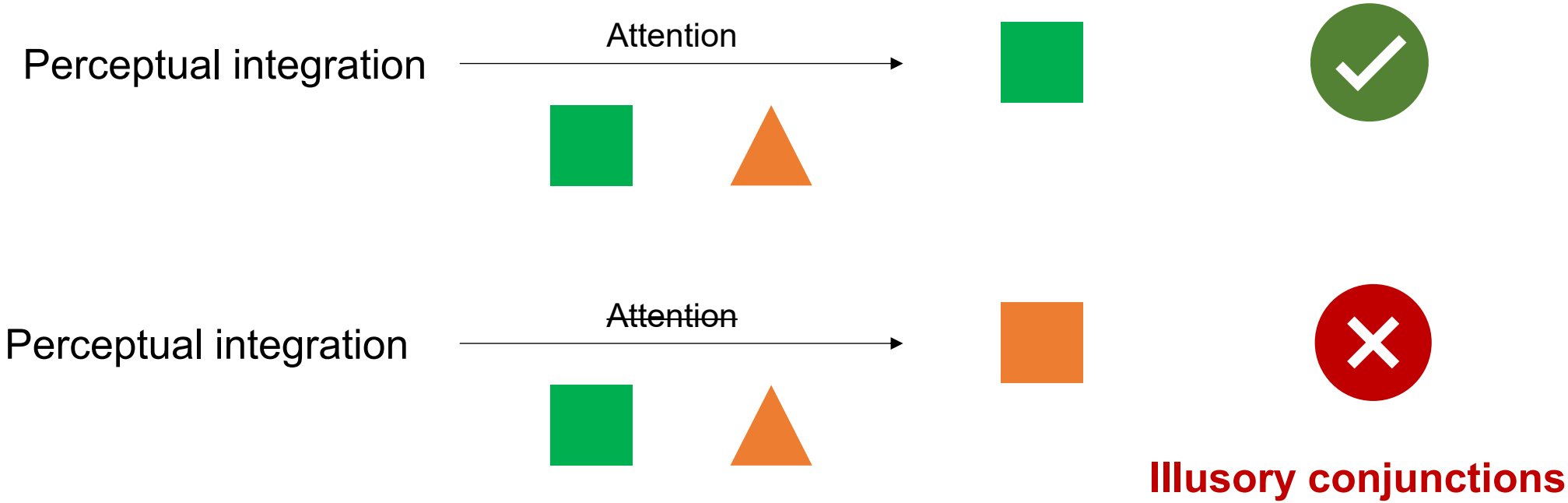
Block (1995)

- Phenomenal consciousness
- Access consciousness

Percetual integration ⟷ Phenomenal consciousness

Attention?

Feature Integration Theory
(Treisman and Gelade, 1980)

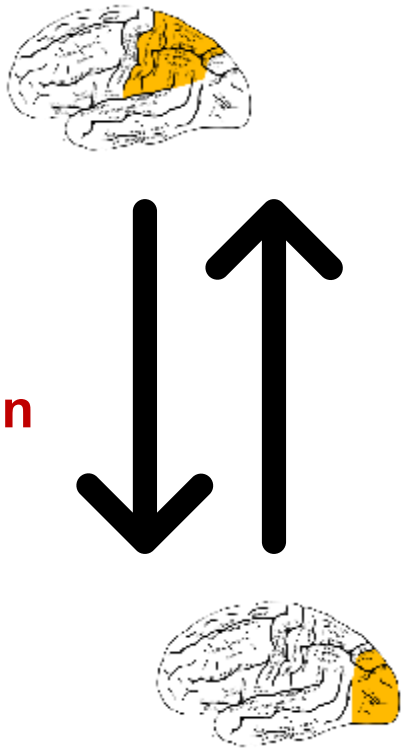


Feature Confirmation Account

(Humphreys, 2016)

- Slow attentional confirmation
- Emerges from parietal cortex

Top-down
Feature **confirmation**



Bottom-up
Feature integration

- Early coding in visual areas
- Quick but unstable representations

Background

Neuropsychological evidence:

- parietal and parieto-occipital lesions
- Increased rates of illusory conjunctions

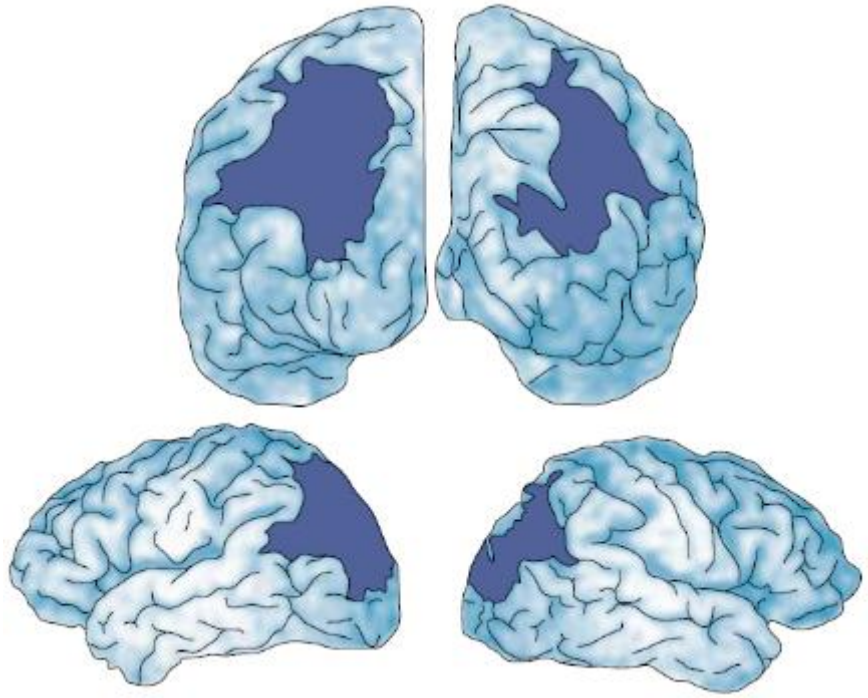
Neuroimaging studies:

- parietal and occipital lesions activations
- Increased rates of illusory conjunctions

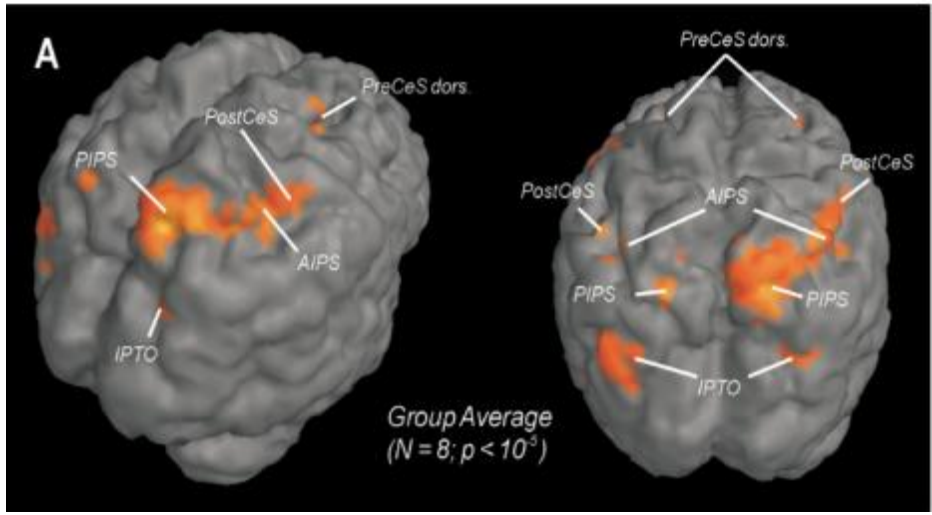
Neurostimulation studies:

- TMS over parietal cortex can increase illusory conjunction proportions

Key role for the **parietal cortex**
attention vs feature confirmation



(Robertson, 2003)



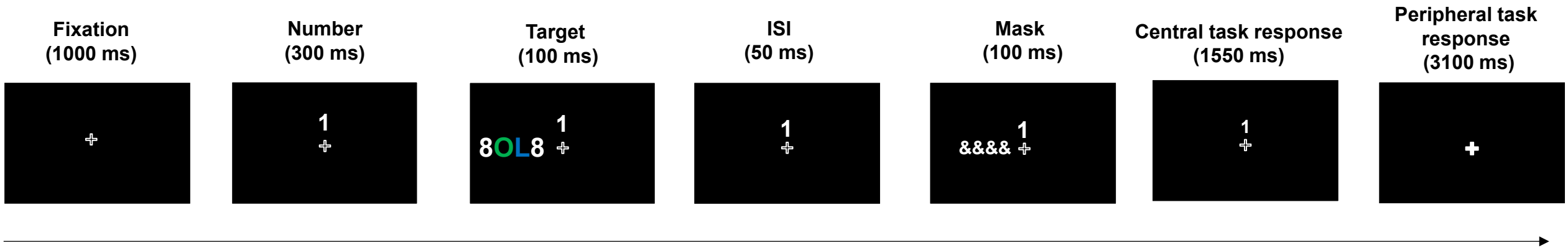
(Donner et al., 2000)

Hypotheses and aim

- Explore neural mechanisms associated with correct and incorrect feature integration
- Compare predictions of the FIT and the FCA

	FIT	FCA
More illusions in the more demanding conditions	Increased parietal and FEF activation (attentional processes)	Increased parietal activation (top-down feedback)
	Greater occipital response for hits	Larger (but unstable) response in occipital cortex for illusions

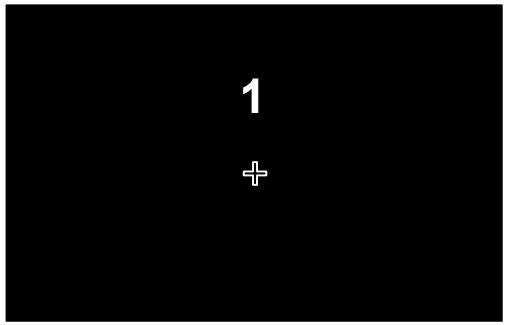
Method



→ Titration procedure: ~70% correct responses

Method

Central task



1

Far
(Easy)

4

Near
(Difficult)

Peripheral task
(Trial type)

L

Hit

L

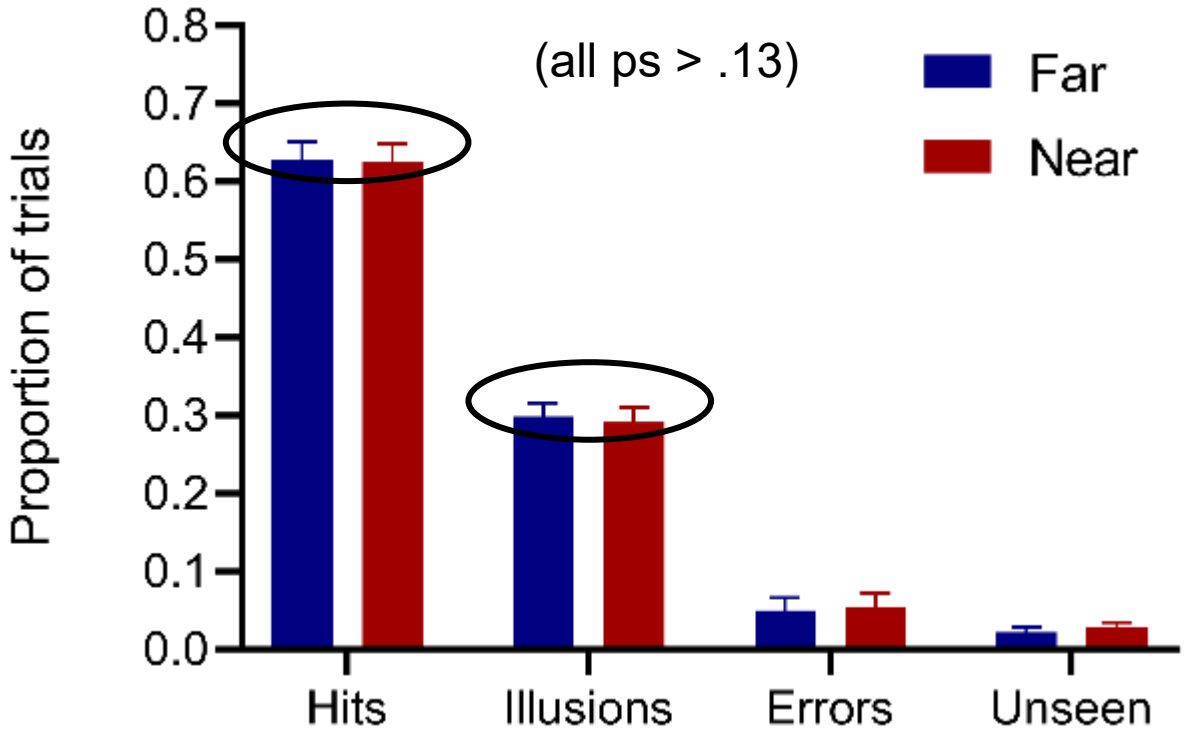
Illusion

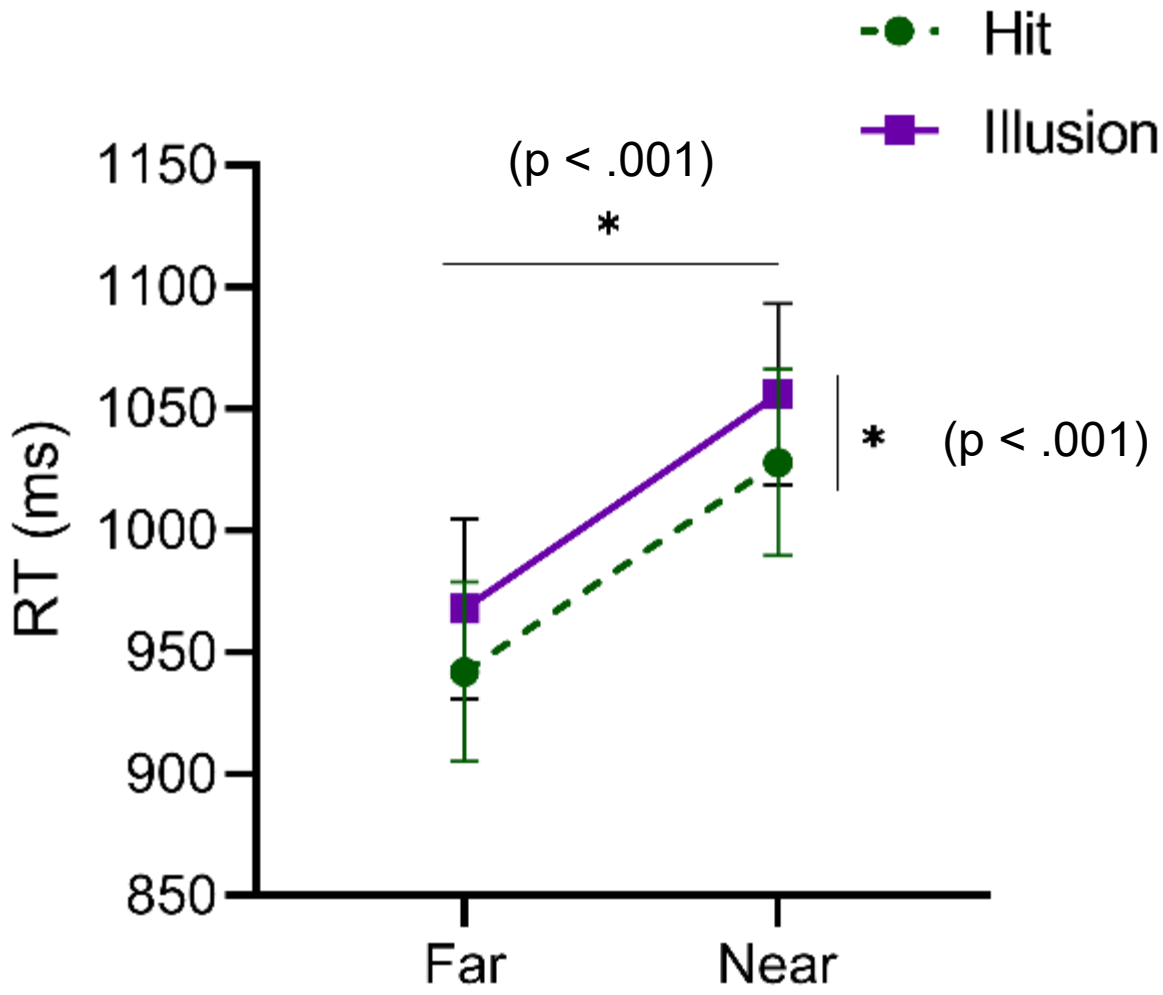
L

Error

Unseen

Behavioural results





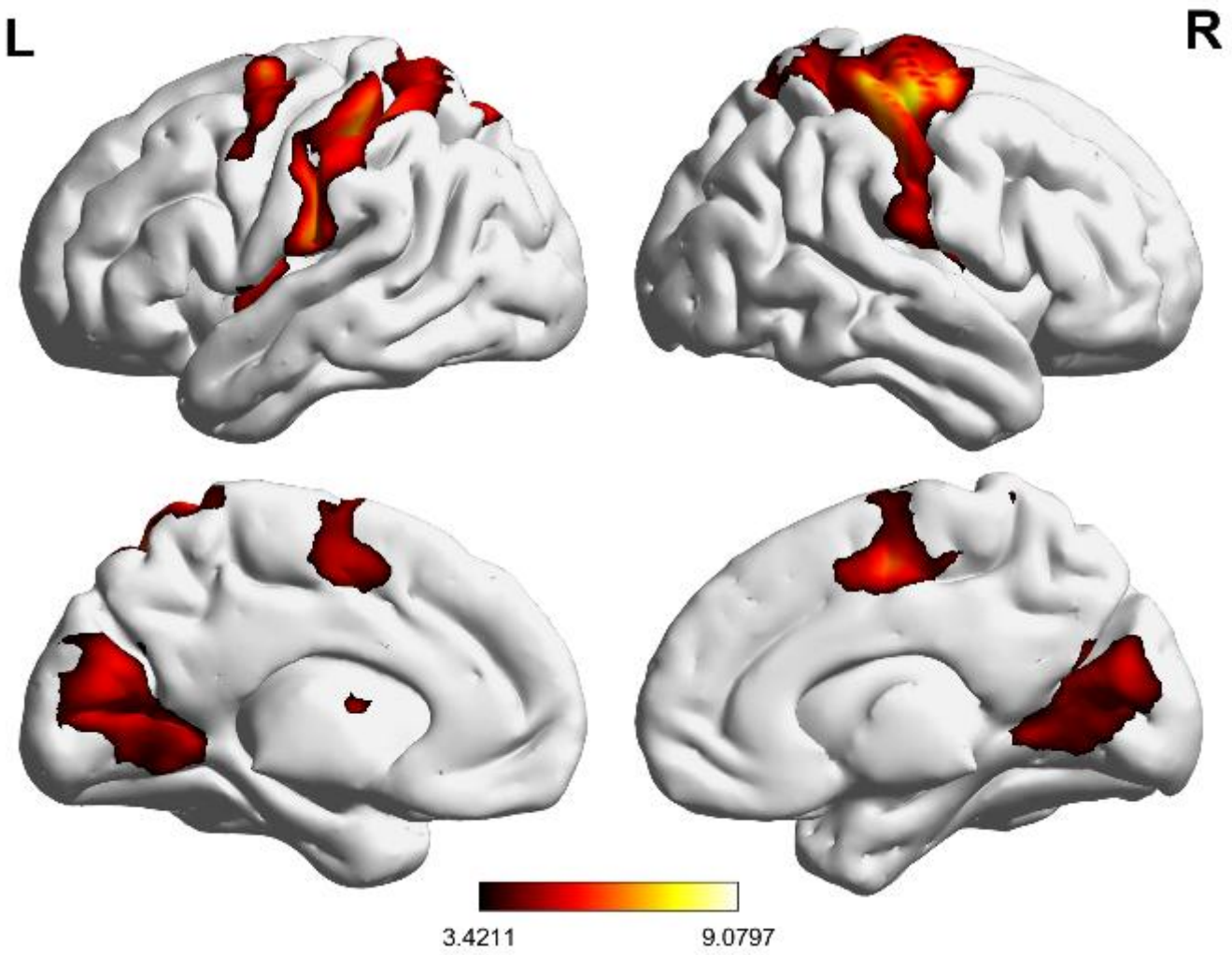
→ Successful titration

→ No differences in Central task conditions

→ Main effect Central task (far > near)

→ Main effect Trial type (hits > illusions)

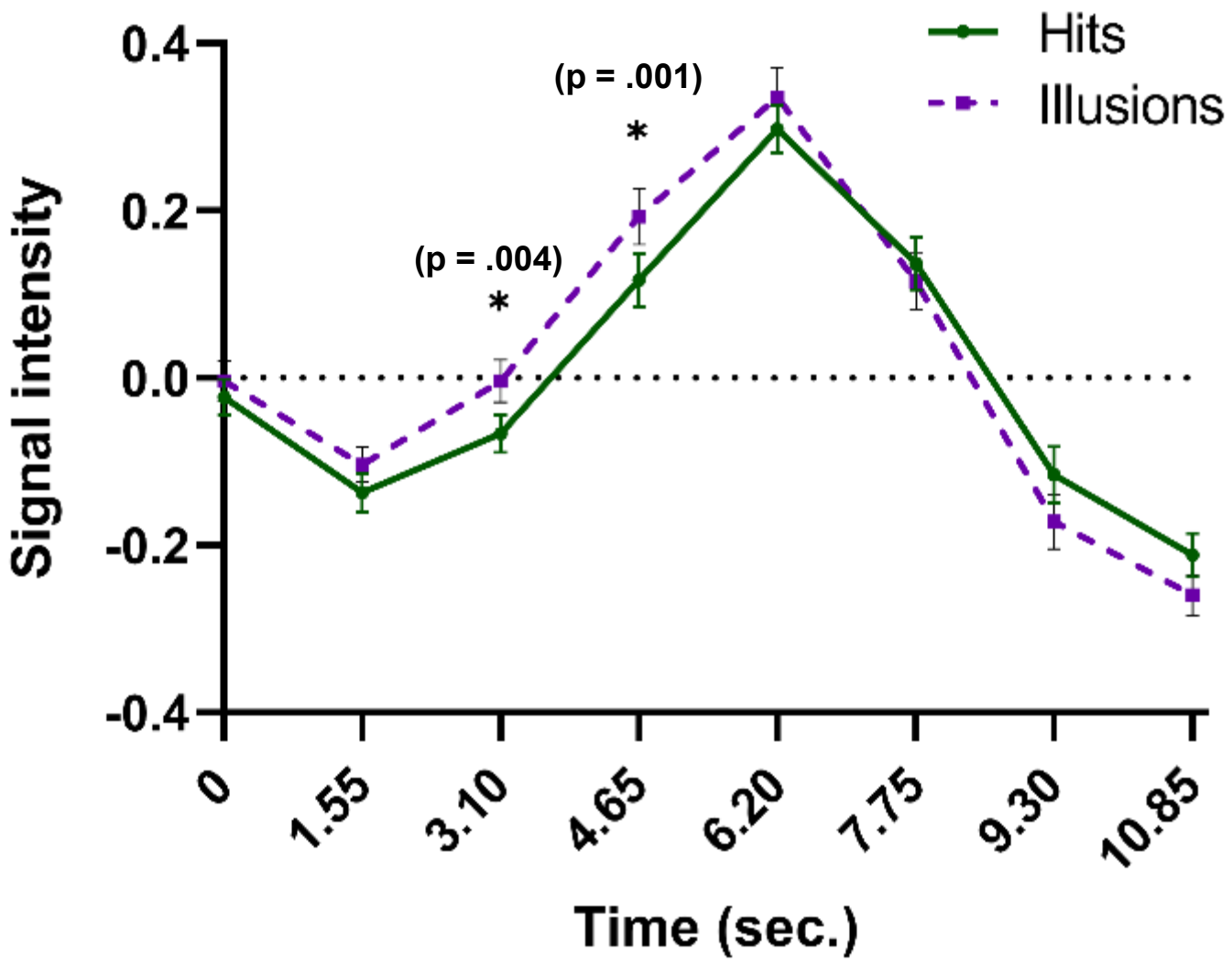
Whole-brain contrast



Hits > Ilusions (cluster FWE-corrected, p < 0.001)

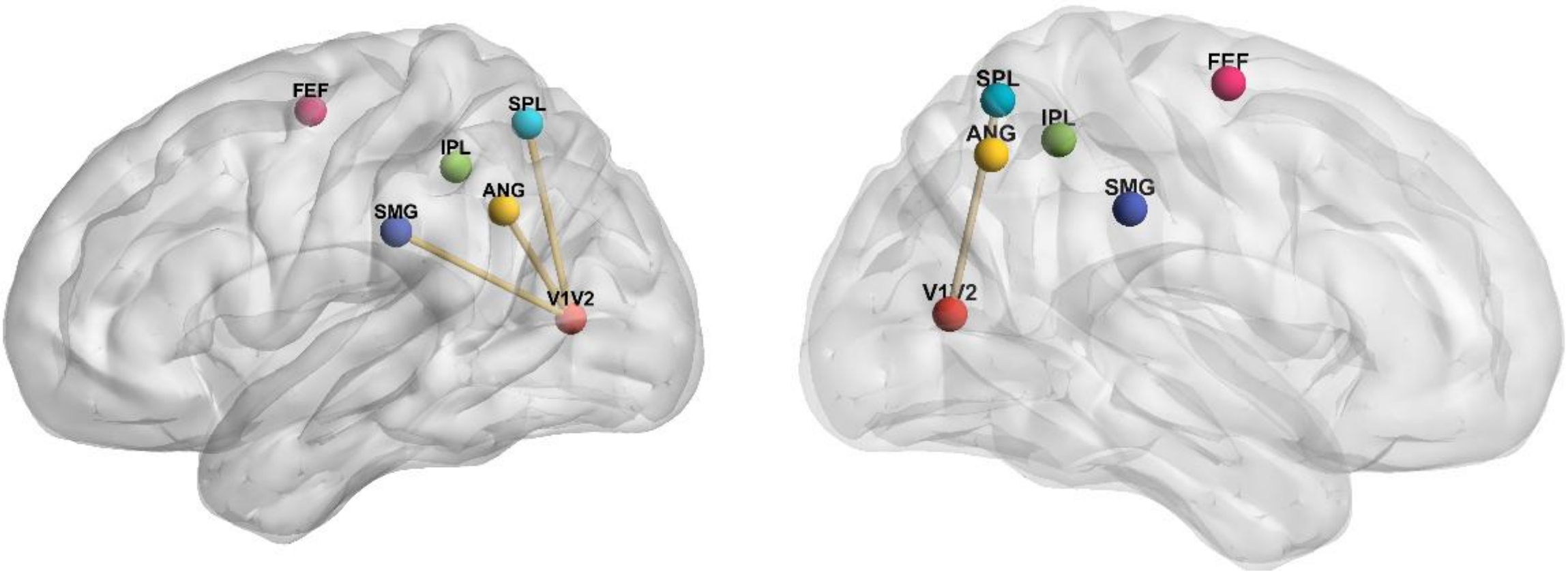
- Fronto-parieto-occipital areas involved in feature integration
- In line with previous evidence
- How are they connected?

Time courses



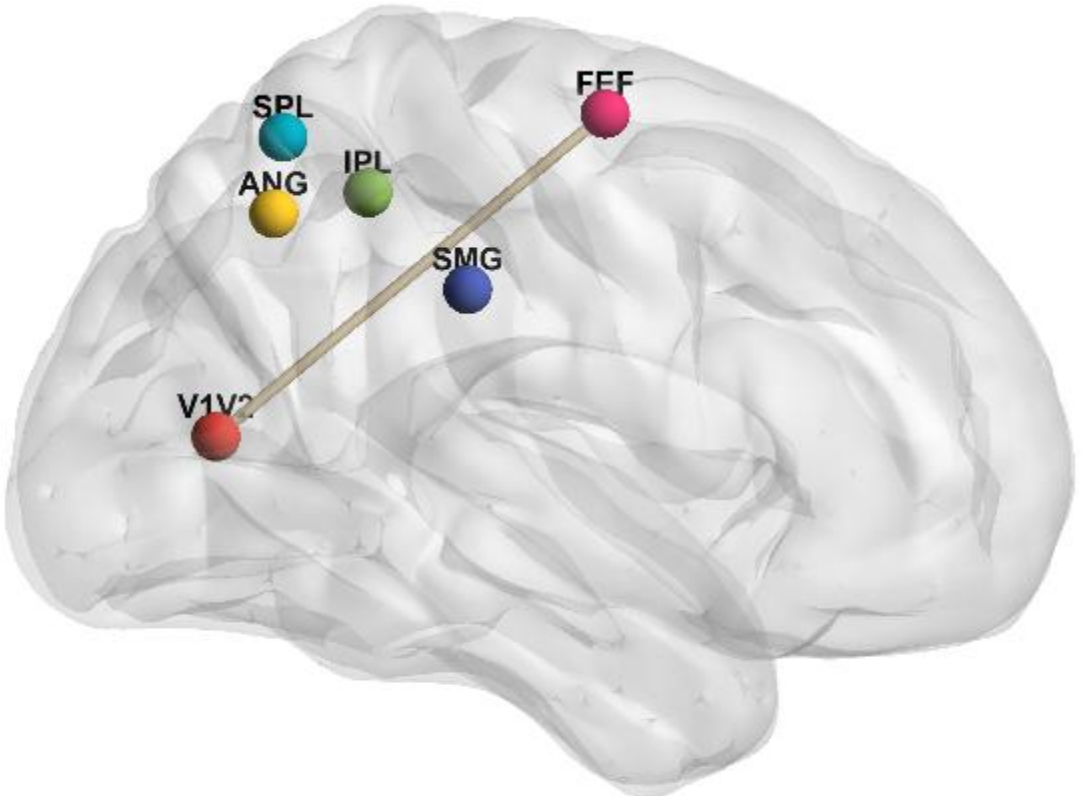
- Interaction **Trial type × Time** ($p < .001$)
- Greater intensity for **illusions** at early time points
- Only significant in **visual areas**

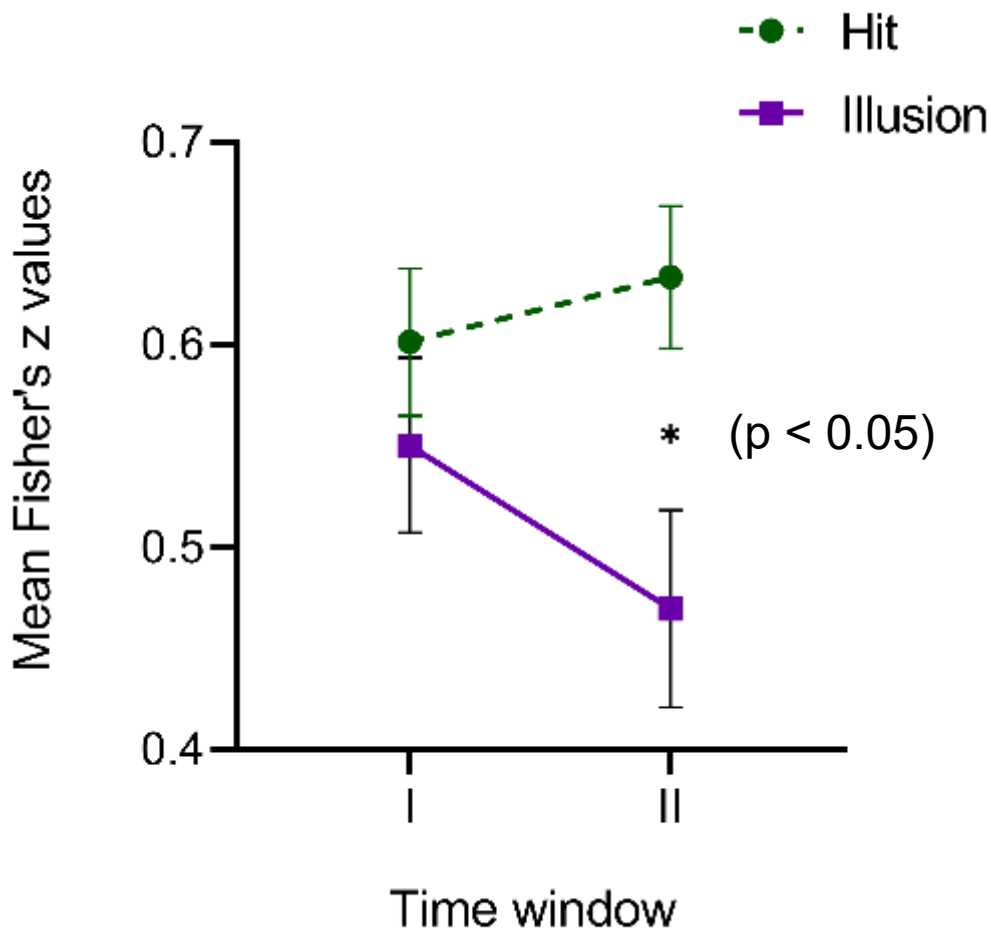
Functional connectivity: pairwise analysis



Main effect **Trial type** → stronger functional coupling for **hits** than illusions

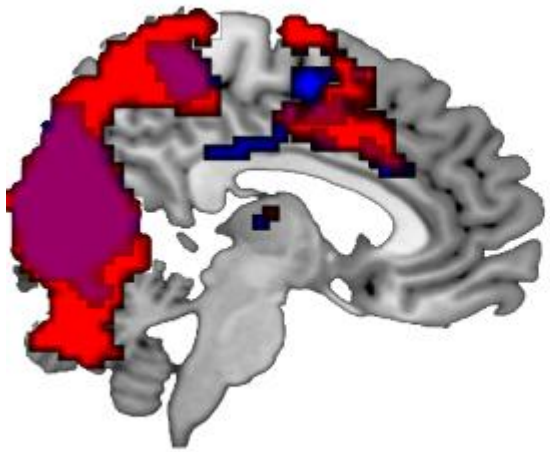
Functional connectivity: pairwise analysis



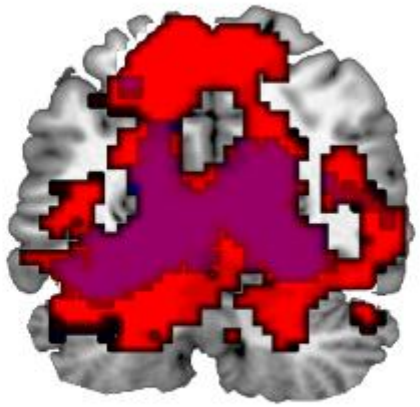


Trial type × Time window interaction → increased coupling for **hits** in the **later time window**

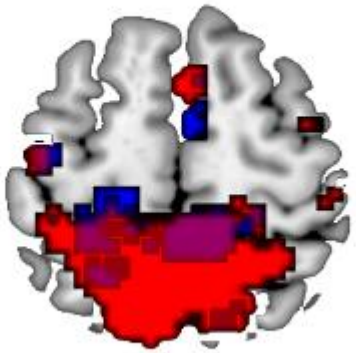
Functional connectivity: whole-brain analysis



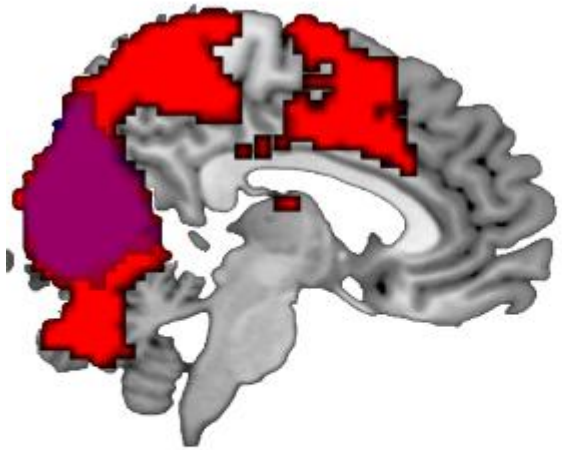
x = -5



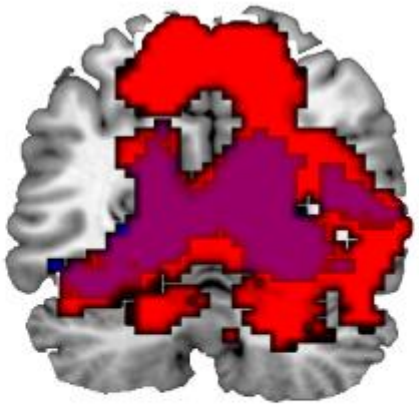
y = -61



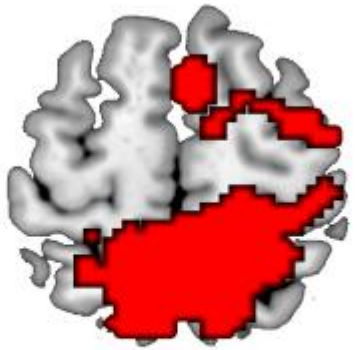
z = 59



x = 5



y = -61



z = 59

Hits > Null

Illusions > Null

Overlap

Conclusions

- Central task demands did not modulate illusory conjunctions rates
- Critical role of the parietal cortex in feature integration
- **Correct** integration (hits):
    - Overall increased activation of parieto-occipital areas and FEF
    - Stronger occipito-parietal coactivation
- **Incorrect** integration (illusions):
    - Increased activation of visual regions at early stages of processing
    - Decreased occipito-frontal coactivation at later stages
    - Lower occipital coupling with parietal cortex

Conclusions

In line with **FCA:**

→ Early coding in visual areas (bottom-up)

→ Top-down (parietal) feedback to form stable perceptual representations

→ Weak and encapsulated functional coupling for illusions

→ Importance of not only parietal cortex, but also visual regions

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