Poster D225

Perceptual grouping and completion induce event-related coherence in extrastriate cortex

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Introduction

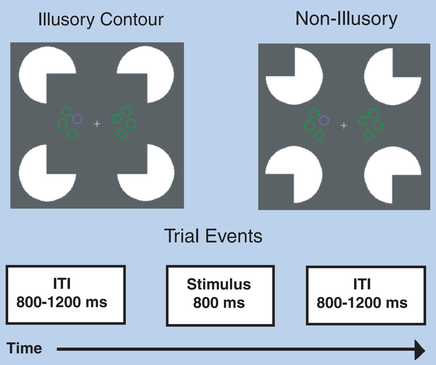
Neural Interactions, Grouping and Completion

Several researchers (von der Malsburg, Singer, et al.) have proposed that interactions between neural populations representing grouped elements is the mechanism of grouping.

We studied displays with illusory contour inducers (pacmen) in the left and right visual fields. When aligned, the edges grouped by collinearity and formed an illusory contour spanning the visual fields. In a control condition, the inducers were not aligned and no contour was formed.

We predicted that completion of the illusory contour between the visual fields would involve more interhemispheric interactions than when no contour was formed. To demonstrate this we measured interhemispheric interactions in human EEG with two measures of neural coupling (see measures appendix).

Experimental Methods



Task: One circle popped-out due to its different color. Participants discriminated the color of this target, blue or yellow. The orientation of the inducers (forming an illusory contour or not) was irrelevant to the task.

Participants: 14 neurologically normal college students.

Accuracy: d' = 4.31 (illusory), 4.36 (non-illusory)

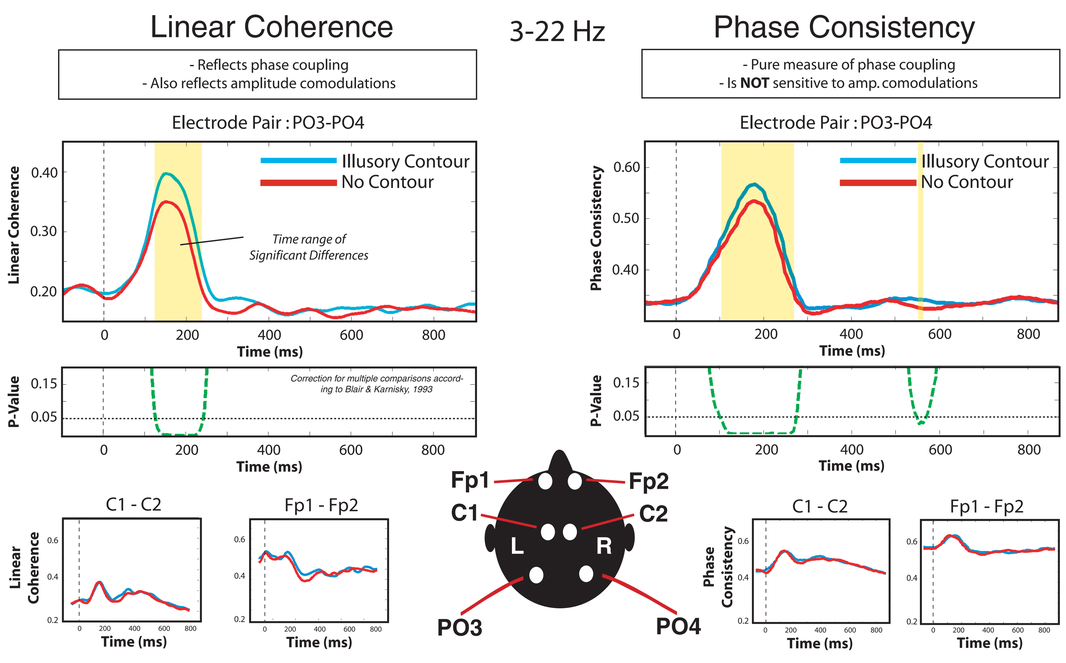
Reaction Time = 478 ms (illusory), 483 ms (non-illusory)

EEG System: 64 + 4 channel BioSemi Active 2 System

Sampled at 256 Hz, referenced to the average of all scalp electrodes. Trials with eye movements and blinks were rejected by automated inspection. 34.8% of trials were removed on average.

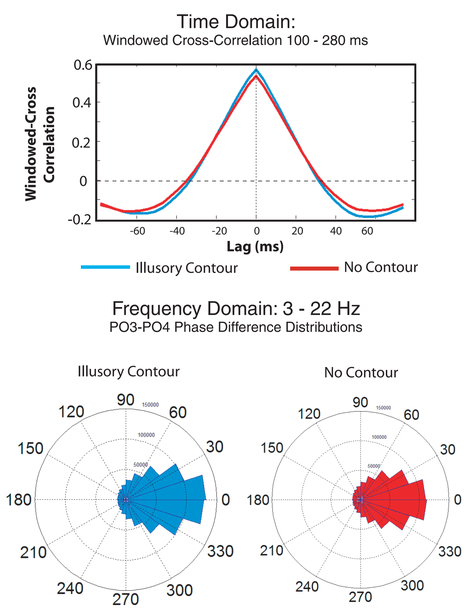
Participants completed 1280 total trials.

RESULTS

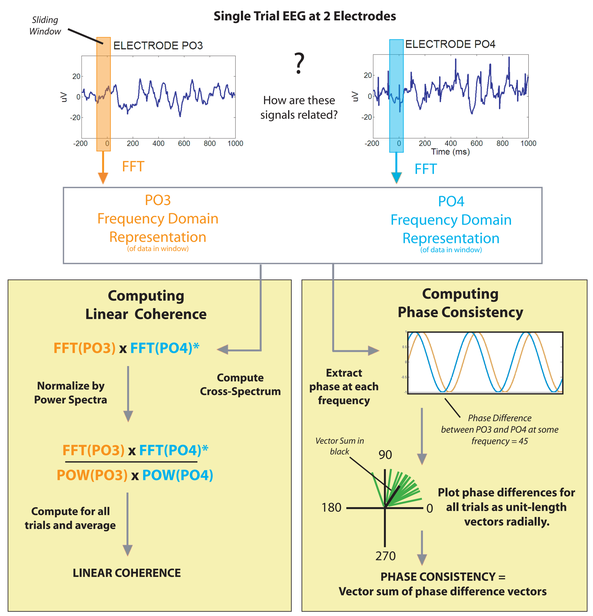


Oscillatory brain activity in left and right extrastriate cortices is more coupled when there was an illusory contour connecting the two visual fields than when there was not. This effect was limited to posterior cortex. We see similiar effects at all individual frequency bins in the 3-22 Hz range.

Lag Between Signals



Appendix : Measures of Neural Coupling



Conclusions/Discussion

Completion of a contour increased coupling between hemispheres

Linear coherence and phase consistency between left and right extrastriate cortices was greater when a contour is completed across the midline.

Phase-locking between the hemispheres

The phase consistency measure demonstrated that the linear coherence effect was at least partially due to increased phase-locking of oscillatory activity between left and right extrastriate cortices.

Coherence effect was limited to posterior cortex

There were no significant interhemispheric interactions at central and frontal electrode pairs.

Coherence effect was limited to low frequency bands when the completed contour is task irrelevant

Similar stimuli have been found to evoke gamma band responses in other studies. Why did we not see changes in the gamma band? Directed attention to the contour may bring out higher frequency effects.

No lag between coherent brain regions

This result suggests that one hemisphere was not directly driving the other. The hemispheres may have been mutually influencing one another (more so in the illusory condition than the other) OR they may have been driven by a common source. Further evidence is necessary to discriminate between these models.

References

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