

### Stimulus and task-based modulations of ERPs and gamma oscillations



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#### **Current Results Previous Results** Introduction Grand-averaged ERPs. <u>Difference Waves (Shape - Random):</u> Previous studies have identified an ERP signature of contour integration—Contour Integration Negativity Experiment #1 Time-Frequency Results: Experiment #1 Stimuli: (CIN) that is elicited regardless of attention, awareness, or task-relevance. Same Shape Diff Orient More recent experiments suggest that only the early phase of this CIN reflects contour integration while Diff Shape Same Orient subsequent phases reflect attentional and task-related processes. Diff Shape Diff Orient Previous studies showed that when the stimulus is task relevant, the CIN is followed by subsequent ERP components (SN & P3) as well as induced gamma oscillations (40 Hz; 300-400 ms). Here, by manipulating the target status of individual contour shapes, we tested whether the functional characteristics of the gamma oscillations matched those of the SN or P3. Difference Scalp Maps (Shape - Random): **Time-Frequency Results:** Same Shape Diff Orient Target-Random Difference: 30-40Hz Random Array: Squares: task relevant Methods Square Pattern Random Array Difference: 30-40Hz Random (No Shape) Same Shape Diff Orient-Random Stimuli: Experiment #2 Stimuli: **Experiment #2 Time-Frequency Results:** 200 400 600 **Vertical Ellipse Pattern** Horizontal Ellipse Pattern Time (ms) Shapes: task irrelevant Random Array Diff Shape Same Orient-Random Random Array Shape Pattern Difference: 30-40Hz Random Array Shape Pattern Diff Shape Diff Orient-Random 200 200 **Horizontal Rectangle Pattern** Vertical Rectangle Pattern Same Shape Diff Shape Diff Shape Diff Orient Same Orient Diff Orient Shapes: task relevant Gamma **Example:** Horizontal Vertical Horizontal Subject #1 Rectangle Ellipse Ellipse Rectangle Difference Maps:

## Randomized Stimulus Sequence Random Array (33%) Vertical Ellipse Pattern (16.5%) Horizontal Ellipse Pattern (16.5%) Vertical Rectangle Pattern (16.5%) Random Array 600-800 ms Random Array 600-800 ms

Same Shape

Diff Orient

**Target** 

Horizontal Rectangle Pattern (16.5%)

Random Ai
600-800 n

300 ms

ERPs
time-locked

Diff Shape

Same Orient

Diff Shape

Diff Orient

# Subject #1: 5 blocks (1500 Trials) Target Shape: Rectangle Target Orientation: Horizontal 5 blocks (1500 Trials) Target Shape: Rectangle Target Orientation: Vertical

5 blocks (1500 Trials)

Target Shape: Ellipse

**Target Orientation: Horizontal** 

Target

5 blocks (1500 Trials)

Target Shape: Ellipse

**Target Orientation: Vertical** 

During each trial, all line elements changed orientation randomly once per second to either form a horizontal ellipse shape, a vertical ellipse shape, a vertical ellipse shape, or a random arrangement.

Number of Stimuli (per block):

- Horizontal Rectangle = 50

- Horizontal Ellipse = 50

- Vertical Rectangle = 50

- Vertical Ellipse = 50

- Random = 100

Target shapes and the order of target orientation were counterbalanced across subjects.

#### Discussion

200

400

A CIN of equal amplitude was elicited by all shapes regardless of which shape was the target.

The SN component was present for all shapes but significantly (and equally) enhanced for the target shape and non-target same shape stimulus compared to the non-target stimuli of different shape.

The P3 was largest for the target, decreased in amplitude for the non-target stimulus of the same shape, and was nearly absent for the non-target stimuli differing in shape.

Gamma oscillations of equal magnitude were elicited by all shapes

These results along with those from previous experiments suggest that the CIN component indexes an automatic grouping process, while subsequent posterior gamma oscillations reflect utilization of this information for task execution. Importantly, the current study confirms that the gamma oscillations reflect a process distinct from those indexed by the SN and P3.