

## Observing ERP components in Visual Search using Implicit Novel Pattern (#32126)

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### Author(s)

Seung Min Moon (University of California, Riverside) - smoon041@ucr.edu

Rachel Wu (University of California, Riverside) - rachelw@ucr.edu

### 1) Have any data been collected for this study already?

It's complicated. We have already collected some data but explain in Question 8 why readers may consider this a valid pre-registration nevertheless.

### 2) What's the main question being asked or hypothesis being tested in this study?

Statistical regularities receive attentional priority over non-regularities (e.g., Zhao et al., 2013). Learning regularities is important for adapting to new situations that require more than observing the physical salience of stimuli and events or relying solely on prior knowledge. This manner of learning can be observed in visual search paradigms that includes task-irrelevant stimuli presented in structured sequences. The present study aims to replicate Zhao et al. (2013) with more complex real-world images. We also hypothesize that this facilitation will be reflected in the N2pc, an ERP component that is a marker of target selection).

In addition, the present study tests whether use of knowledge or regularities are modulated by self-perception of participants' cognitive skills (i.e., growth mindset vs. fixed mindset).

### 3) Describe the key dependent variable(s) specifying how they will be measured.

EEG will be used concurrently with a visual search task. We will measure the N2pc component during target present and foil trials.

Reaction time and accuracy also will be measured during target present and target absent visual search trials.

A meta-cognitive assessment will be administered to determine whether structured sequences are recognized. Subjects will be shown sets of structured and unstructured stimuli (presented in the visual search task). Responses include judgment of which set is structured and the confidence rating of the response.

A quantitative self-assessment survey will be administered to determine whether subjects follow either a growth or fixed mindset. Answer choices will be along a Likert scale, which will then be summed to get an overall score.

### 4) How many and which conditions will participants be assigned to?

All participants will be included in one condition.

### 5) Specify exactly which analyses you will conduct to examine the main question/hypothesis.

We will use a repeated measures ANOVAs to determine whether N2pc amplitude, reaction time, or accuracy differs across trial types (target present vs. target absent and whether regularities were present). Signal Detection Theory analysis of type 2 data will be used to obtain  $d'$  (sensitivity index for performance) and meta- $d'$  (sensitivity index for confidence rating) for the meta-cognitive assessment.

### 6) Describe exactly how outliers will be defined and handled, and your precise rule(s) for excluding observations.

We will exclude behavioral data points that are more than 2.5 standard deviations away from the overall mean in reaction time.

### 7) How many observations will be collected or what will determine sample size? No need to justify decision, but be precise about exactly how the number will be determined.

Twenty undergraduates will be recruited from University of California, Riverside for adequate power in typical N2pc studies.

### 8) Anything else you would like to pre-register? (e.g., secondary analyses, variables collected for exploratory purposes, unusual analyses planned?)

We will be collecting demographic information and academic records from the undergraduates for exploratory purposes. We will ask participants if they noticed the regularities after the end of the experimental session and whether they developed any strategies for the visual search task.

Half of the final sample has already been collected for this study. No changes have been made to the paradigm, and data has not been analyzed yet.