

# Eliciting early VEP components: a comparison of paradigms

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## Introduction

**Background:** Pattern onset and pattern reversal are two paradigms used extensively in perception research since they produce VEPs associated with the primary visual cortex and surrounding visual processing areas. Pattern onset VEPs have three components C1, P1 and N1. The VEP for pattern reversal also contains three components N75, P100 and N145. The similarities in peak latency between paradigms, and inversion of both early components depending on the visual field in which the stimulus is presented suggest similar neural generators are being activated. However, previous studies that have examined the relationship between the two paradigms in terms of peak latency, amplitude and neural generators are limited.

**Purpose:** We examined the VEPs of pattern onset and pattern reversal paradigms focusing specifically on peak latency and peak amplitude. We also examined the effect that stimulus duration has on VEP produced for pattern onset

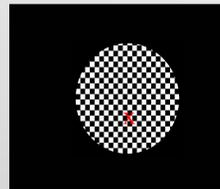
## Method

### Participants:

- 16 (8 men., 8 women) undergraduate student 19-25
- normal or corrected to normal vision

### Three Paradigms

- Pattern Onset with 50ms duration and ISI of 250 to 400 ms
- Pattern Onset with 300ms duration and ISI of 250 to 400 ms
- Pattern Reversal with 300ms duration 900 stimuli presented per paradigm



**Procedure:** To help keep alertness and fixation controlled, participants fixated on a letter (X or Y) in the central lower visual field and pressed a key when the letter changed to the other. Rest breaks of 30 s occurred after every 3.5 minutes of the task. Paradigm presentation order was counterbalanced across participants.

### Electrophysiological measurements

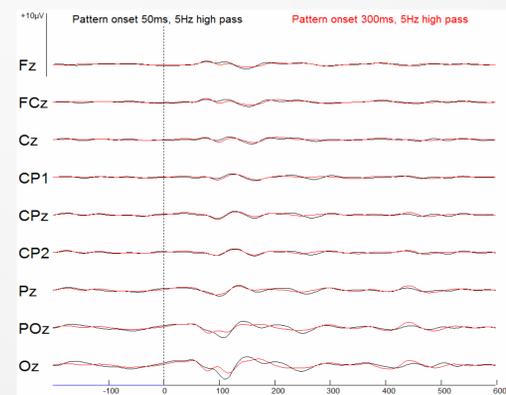
- Epochs 1000ms prior to or following fixation-letter change omitted
- 128 electrode montage was reduced to a 10-10 standard 81 electrode site layout in BESA
- Midline scalp sites scored at Fz, FCz, Cz, CPz, Pz, POz, Oz
- Amplitude and latency of the VEP components scored
- Baseline 200 to 0 ms
- Trials rejected with EEG outside -75 to +75  $\mu$ V
- Highpass filter of 5 Hz to eliminate any slow wave components (note: With a 1 Hz highpass, some correlations across paradigms were extremely high (over .9) but apparently due to slow waves not related to VEP components.)

## Results

### Pattern Onset 50ms vs. Onset 300ms

Paired samples t-tests at maximal amplitude sites for each component found no significant difference between the paradigms for the latency or amplitude of the components.

Figure 1- Pattern Onset 50ms and 300ms



Correlations for amplitude (largest *r*-value given)

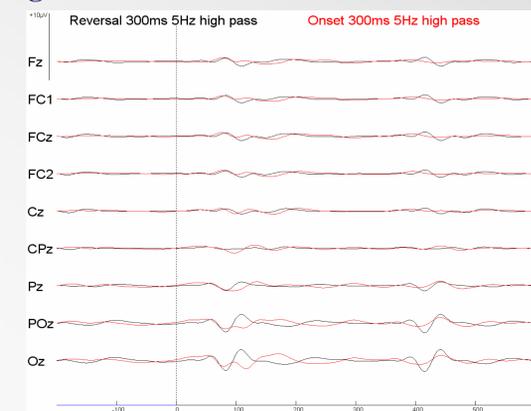
- C1 amplitude: *r* sign. at Fz, Cz, CPz ( $r=.81, p<.001$ ), Pz, Oz
- P1 amplitude: *r* significant at all midline sites,  $> .7$  at posterior sites,  $< .8$  at anterior sites.
- N1 amplitude: *r* sign at Fz ( $r=.86, p<.001$ ), FCz, Cz, CPz, Oz
- Note: Latency correlations were less stable

### Pattern Onset 300ms vs. Reversal 300ms

Paired t-tests

- C1/N75 amp and latency not different
- P1/P100 amp not different, latency was different
- N1/N145 amp different, latency not different

Figure 2- Pattern Onset and Reversal 300ms



Correlations at midline sites (largest *r*-value given)

- C1/ N75 amplitude: sign at CPz, Pz, POz, Oz ( $r=.58, p<.02$ )
- P1/P100 amplitude: sign at POz ( $r=.56, p<.03$ ), Oz
- N1/N145 amplitude: sign at Pz, POz ( $r=.72, p=.002$ ), Oz
- Note: Latency correlations were less stable

## Conclusions

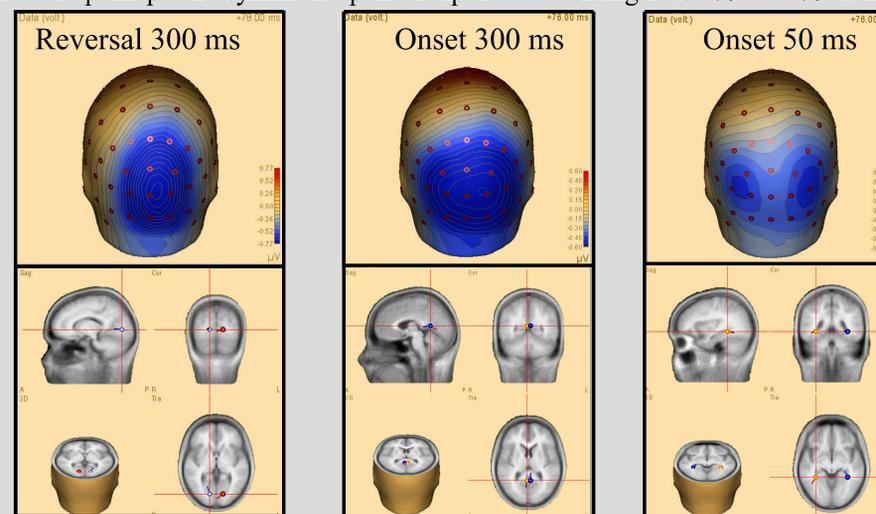
1. VEP waveform for pattern onset paradigm is independent of stimulus duration.

2. Results are compatible with C1 and N75 components having the same neural generator (dipole models differ slightly but apply across paradigms well, see Figure 3).

3. Pattern onset and pattern reversal paradigms can be used interchangeably when focusing specifically on the early component (C1 or N75) which is useful because the reversal paradigm is less tiring for participants.

4. P1 and N1 components are less comparable across onset and reversal paradigms.

Figure 3. Topomaps and symmetric pair of dipoles accounting for 95% to 98% of the variance



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Poster downloadable after the conference at <http://www.psyc.brocku.ca/people/segalowitz.htm>