

# Retinal Image Motion Abolishes Pattern-Reversal but not Pattern-Onset Visual Evoked Potentials (VEPs)

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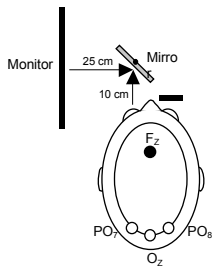
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## Introduction

- **Pattern-reversal (PR)** VEPs are strongly reduced in nystagmus patients, but **pattern-onset (PO)** VEPs can still be obtained [1].
- The underlying mechanisms are at present not understood: We quantitatively assessed the differential effect of simulated nystagmus [2] on PR and PO VEPs in normal subjects to determine the influence of retinal image motion.

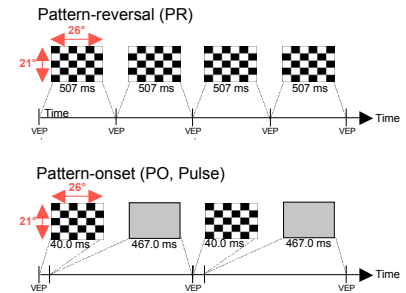
## Methods

### Setup:



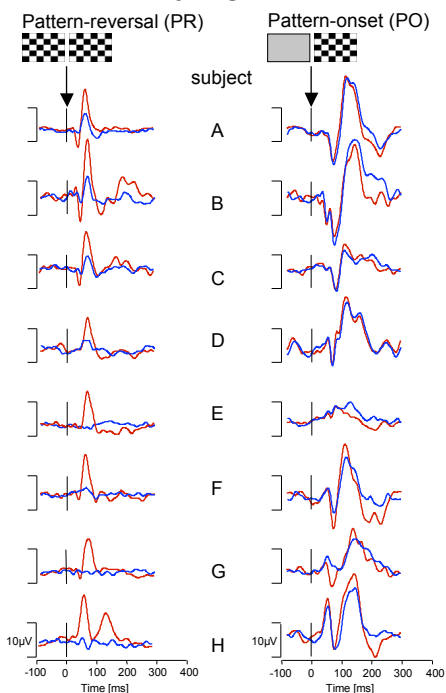
- **8 subjects** aged 18 to 35 with normal visual acuity (>1.0) without congenital nystagmus
- **Stimulation:**  
Stimulus: Checkerboard of 1° checksize  
Monocular stimulation (left eye)
- **8 different stimulus conditions:**
  - 2 Stimulation modes: Pattern-reversal (PR), Pattern-onset (PO, Pulse)
  - 4 mirror amplitudes: 0°, 1°, 2°, 3° at 4 Hz sawtooth function → nystagmus-like retinal image motion
- **Recordings** at 3 occipital derivations (O<sub>Z</sub>, PO<sub>7</sub>, PO<sub>8</sub> vs F<sub>Z</sub>)
- **EOG:** Recording of eye movements to monitor fixation

### Stimulus time course (cyclic design):

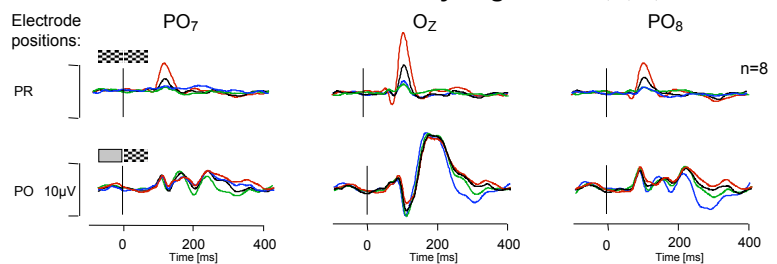


## Results

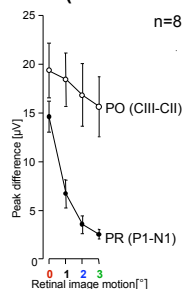
### Individual VEPs (O<sub>Z</sub>) for simulated nystagmus of 0° & 2°



### Grand mean VEPs for simulated nystagmus of 0, 1, 2, and 3°

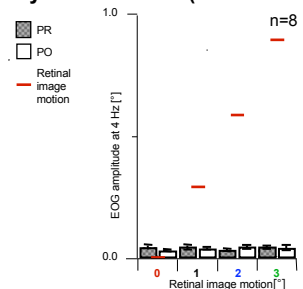


### VEP amplitudes (mean ± SEM)



- Simulated nystagmus reduces PR-VEPs by 70% (ANOVA:  $P < 0.0001$ ).
- No significant effect of simulated nystagmus on PO-VEPs.

### Eye movements (mean ± SEM)



- Image motion does not induce ocular instabilities.

## Discussion

- PR VEPs are selectively reduced by simulated nystagmus, which is in accordance with previous observations in nystagmus patients [1].
  - Retinal image motion is sufficient to reduce PR responses
- **Why does retinal image motion effect PR- while PO-VEPs are unaffected?**
  1. PR stimulus is partly extinguished by image motion, while PO is unaffected:



However: This effect is small (retinal image motion/frame only 1/25 checkwidth)

2. Different degree of motion adaptation induced by PR and PO:
  - PR stimulus high potential to drive adaptation (pattern present for 100% of stimulation time)
  - PO stimulus low potential to drive adaptation (8%)

## Conclusion

- Nystagmus can be simulated in normal subjects by induction of retinal image motion.
  - We propose that the different potential of PR and PO stimuli to drive motion adaptation is sufficient to explain the differential effect of nystagmus on PR and PO VEPs.

## References

- [1] Saunders, K.J., Brown, G., & McCulloch, D.L. (1998) Pattern-onset visual evoked potentials: More useful than reversal for patients with nystagmus. Documenta Ophthalmologica, 94(3), 265-274
- [2] Chung, S.T., & Bedell, H.E. (1997) Congenital nystagmus image motion: Influence on visual acuity at different luminances. Optometry & Vision Science, 74(5), 266-272