Covert attention in 3- to 4- month-old infants

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Purpose
Do infants’ covert attention shift to the stimuli outside their fixation.

Introduction
Covert attention
- Human can direct their attention without eye movements. (Deuel & Schneider, 1996)
  ➡ covert attention

Infant studies on visual attention
(Hood, Willen & Driver, 1998; Johnson & Tucker, 1996)
- Fixation and attention are intermixed in infant studies because of the assumption that infants look at what their attention is directed.
  ➡ Important to dissociate attention from fixation.

Infants’ covert attention using SSVEP
(Robertson et al., 2012)
- SSVEP of 3-month-olds in response to toy duck flickering at 8, 10, and 12 Hz.

Methods
Participants:
Forty 3- to 4- month-olds participated in the experiment. (Half for Orientation: m = 109.4, SD = 13.98 days; Motion: m = 109.9, SD = 12.64 days)
The target of orientation (horizontal/vertical) and motion direction (upward/downward) was counterbalanced across infants.

Stimuli:
Target
Orientation — Oriented grating patch (3.8° × 3.8°, 1 cycle/deg)
Motion — Drifting grating patch (3.8° × 3.8°, 1 cycle/deg, 5°/s)

Cue — Black circle (4° × 4°)
The distance between the central fixation and target was 5.7°.
The contrast of target was 0.5 in familiarization, 0.92 in test phase.

Procedure:
Familiarization/Novelty preference method
We began each trial when infants looked at the central fixation.
- [Familiarization phase]
  - Exogenous cue presented for 100ms.
  - Horizontal/Vertical grating patch (Orientation)
  - Upward/Downward grating patch (Motion) presented for 200ms.
  - The location of the cue was random, but fully valid for either target.

- [Test phase]
  - Horizontal/Vertical grating patch (Orientation), Upward/Downward grating patch (Motion) presented for 5000ms.
  - Two trials was conducted by changing the location of each grating.

Results
We only analyzed the data in which infants fixated at the fixation without their eye movements in each trial to extract the effect of covert attention.

Novelty preference score = \frac{\text{Looking time on novel oriented/motion}}{\text{Total looking time}}

We found significant differences against chance level (0.5) in both conditions.
(Orientation: t(19) = 4.99, p = .001, d = 1.55; Motion: t(19) = 4.92, p = .001, d = 1.39)

➡ Covert attention regardless of the stimulus feature.

Discussion
- Attentional shift to the exogenous cue independent of the eye movements in 3- to 4- month-olds.
  Covert attention already acquired at 3 months.
- Infants could identify the target regardless of the target feature (orientation/motion direction).
  Spatial attention has an effect on early visual area.

Next step
Using eye-tracking system to check infants’ eye movements strictly.
The modulation of covert attention on appearance of stimuli.

References
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