The pupillary light response reflects eye-movement preparation

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Slides (and much more) on
<http://www.cogsci.nl/smathot>

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The light response

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The active pupil

- The light response traditionally considered a reflex
- Recent studies show cognitive influences
 - Brightness illusions and pictures of the sun (Laeng et al., 2012; Naber et al., 2013; Binda et al., 2013)
 - Binocular rivalry (Naber et al., 2011; Fahle et al., 2013; Harms, 1937)
 - Mental imagery (Laeng & Sulutvedt, 2014)
 - Endogenous shifts of attention (Binda et al., 2013; Mathôt et al., 2013; Naber et al., 2014)
 - Exogenous attention and inhibition of return (Mathôt et al., in prep.)

Does your pupil constrict already
before an eye movement towards a
bright stimulus?

Paradigm

Constant

Speaker icon "Right"

Onset

Speaker icon "Right"

Swap

Speaker icon "Right"

Predictions

- Reduced light-response latency
 - If preparation is possible ...
 - the Constant condition
 - ... relative to when it is not
 - the Onset condition
- Initially (seemingly) inverse light response
 - If preparation is incongruent
 - the Swap condition

Results

Interim discussion

- We find that a pupillary light response is initiated during eye-movement preparation
- But how long before the eye movement does this start?

Modeling

Modeling results

Latency difference of ± 100 ms

Discussion

- A pupillary light response is initiated during eye-movement preparation ...
- About 100 ms before the eye movement
- This matches the time-course of the pre-saccadic shift of attention (Rolfes & Carrasco, 2012; Deubel, 2008)

Discussion

The pupil adjusts its size during eye-movement preparation as soon as attention shifts to the target of an upcoming eye movement

Thank you!

Slides, pre-print, and much more on
<http://www.cogsci.nl/smathot>

Illusion Contest!

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