Inattentional blindness & visual awareness without report

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Reed College

NCC 2016
Inattentional Blindness

Failure to perceive unexpected objects or events because attention is focused on another task

Mack & Rock (1998); Simons & Chabris (1999)

- attentional blink
- change blindness
- backward masking
- bistable figures / binocular rivalry
- interocular suppression
Inattention paradigm adapted for EEG/ERP

Video example of stimuli:

https://www.youtube.com/watch?v=8-9NAFUn_CI
Stimuli

Square or Random

600-800ms 300ms 600-800ms

-100 +2μV -2μV

400ms

Square Pattern
Random Array
Procedure

Phase 1:
Distracter Task
(no attention, delayed report)

Phase 2:
Distracter Task
(attention, delayed report)

Phase 3:
Shape Discrimination Task
(trial-by-trial report)

Awareness Assessment

# of Stimuli per phase:
Random: 300
Square: 240
Diamond: 60
Awareness assessment

1) During the experiment, did you notice any patterns within the little white lines?

☐ Yes  ☐ No

2) If you did see any patterns, please describe (or draw) what you saw in as much detail as possible:
3) Rate how confident you are that you saw each pattern during the experiment.

Please use the following scale:

1 = very confident I *did not* see it
2 = confident I *did not* see it
3 = uncertain
4 = confident I saw it
5 = very confident I saw it

<table>
<thead>
<tr>
<th>Pattern</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diamond</td>
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<tr>
<td>Horizontal Rectangle</td>
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<tr>
<td>X Pattern</td>
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<tr>
<td>One Big Square</td>
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<td></td>
</tr>
<tr>
<td>Four Small Squares</td>
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<tr>
<td>Vertical Rectangle</td>
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</tbody>
</table>
Behavioral results (awareness reports)

Phase 1: Confidence Ratings

Phase 2: Confidence Ratings

IB

noticers

Did not report square
Reported seeing square
Phase 1:

-2μV
-100 +2μV
OZ

random array

square pattern

Phase 2:

-2μV
-100 +2μV
OZ

Phase 3:
Results Summary

- Early (~180ms) ERP difference *even when* subjects report no awareness of shapes.
  - Phases 1, 2, & 3

- Subsequent (~260ms) ERP difference *only when* subjects can report awareness of shapes.
  - Phases 2 & 3

- P3 and gamma (>300ms) *only when* subjects report awareness on a trial-by-trial basis.
  - Phase 3
Interpretations

- Early (~180ms) ERP difference *even when* subjects report no awareness of shapes.
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Interpretations

- Early (~180ms) ERP difference *even when* subjects report no awareness of shapes.
  - Phases 1, 2, & 3
  - Preconscious

- Subsequent (~260ms) ERP difference *only when* subjects can report awareness of shapes.
  - Phases 2 & 3
  - Attention...
  - but why no P3/gamma?

- P3 and gamma (>300ms) *only when* subjects report awareness on a trial-by-trial basis.
  - Phase 3
  - NCC
Why no P3 or gamma?

- Shape or color task (counterbalanced blocks)
- P3, gamma for consciously perceived, but task-irrelevant stimuli?

Pitts et al. (2014) *NeuroImage*
P3 & gamma: NCC or task-based process?

shapes task-irrelevant

shapes task-relevant

Pitts et al. (2014) NeuroImage
P3 & gamma: NCC or task-based process?
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GNW Theory

- Dehaene

Images:
- Preconscious
- Attention
- NCC
Interpretations

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GNW Theory

- Preconscious
- Attention or NCC?
- Task-based categorization
Inattentional blindness to faces

Results Summary

- No ERP differences when subjects fail to report faces.
  - Phase 1 (inattentional blindness)

- N170 and subsequent (~260ms) ERP difference only when subjects can report seeing faces.
  - Phases 2 & 3

- P3 (>300ms) only when subjects report faces trial-by-trial.
  - Phase 3
Interpretations

- No ERP differences when subjects fail to report faces.
  - Phase 1 (inattentinal blindness)

- N170 and subsequent (~260ms) ERP difference only when subjects can report seeing faces.
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Interpretations

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<td>• iconic memory</td>
</tr>
<tr>
<td>• zombie behaviors</td>
<td>• gist</td>
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<td>• basic summary stats</td>
<td>• animal detection (dual task)</td>
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<td>• partial reportability</td>
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<td><strong>Attention</strong></td>
<td><strong>Detection of unexpected stimuli</strong></td>
</tr>
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<td>• working memory</td>
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<td>• priming</td>
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<td>• adaptation</td>
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Awareness without Attention?

Recent evidence against:

- Cohen et al. (2011) *Psychological Science*
- Mack et al. (2015) *Consciousness & Cognition*
- Mack et al. (2016) *Consciousness & Cognition*
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adapted from Tsuchiya & Koch (2015)
# Attention → Awareness

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Thank you for your attention and awareness!

Collaborators:
- Steve Hillyard
- Antígona Martínez
- Juliet Shafto
- Jennifer Padwal
- Dan Fennelly
- Enriqueta Canseco-Gonzalez

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