

Inattention blindness & visual awareness without report

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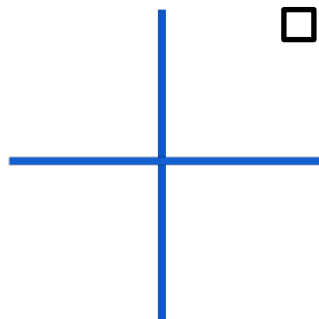


NCC 2016

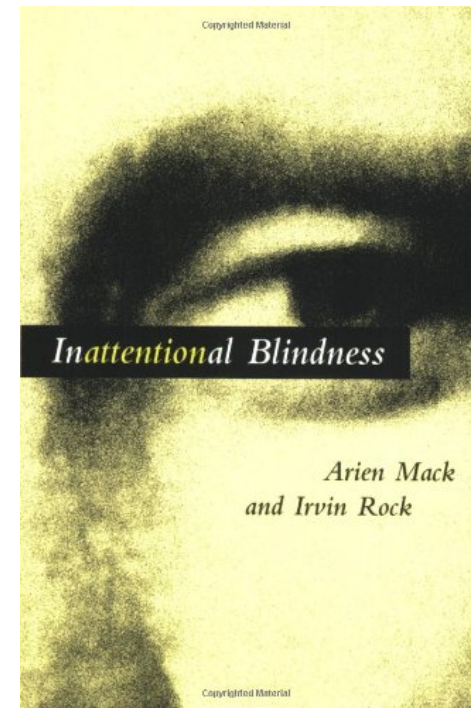
Inattentional Blindness

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



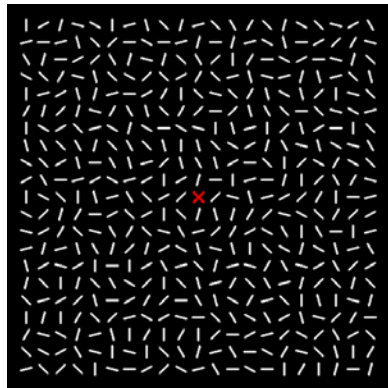
Inattention paradigm adapted for EEG/ERP

Video example of stimuli:

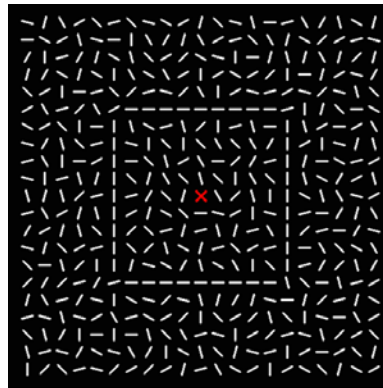
https://www.youtube.com/watch?v=8-9NAFUn_CI

Stimuli

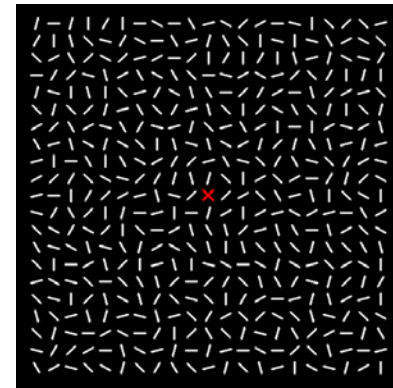
Square or Random



600-800ms

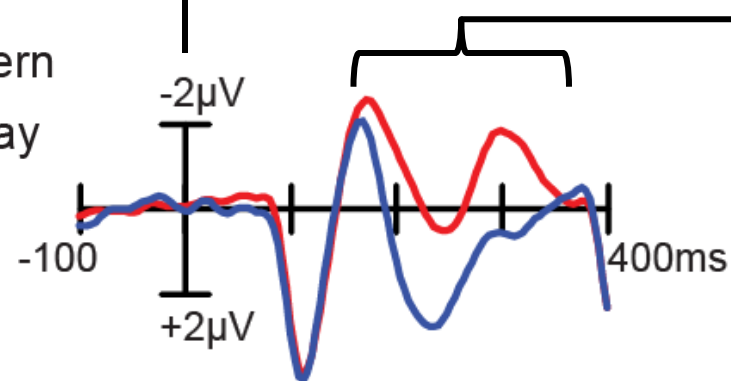


300ms

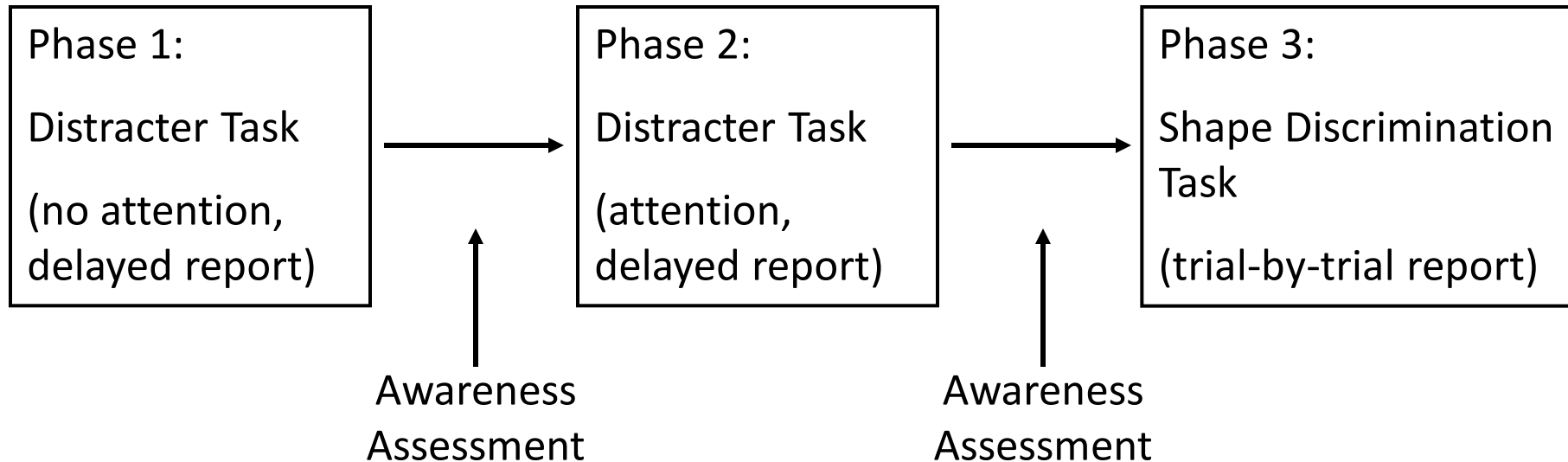


600-800ms

— Square Pattern
— Random Array



Procedure



of Stimuli per phase:

Random: 300

Square: 240

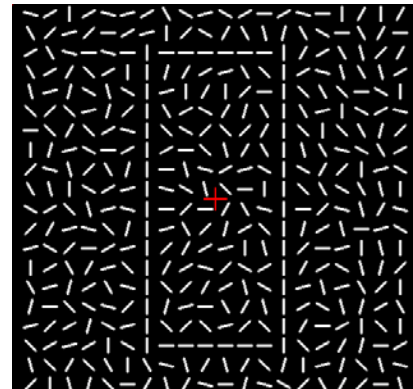
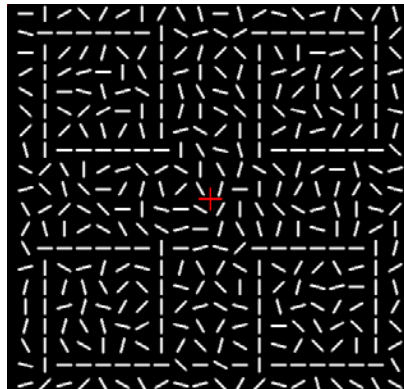
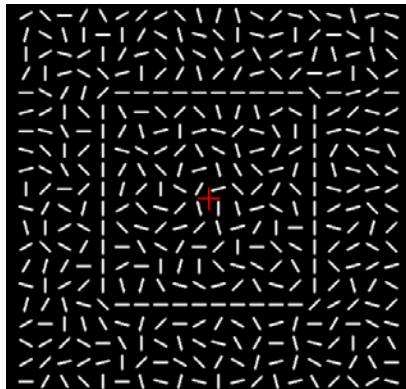
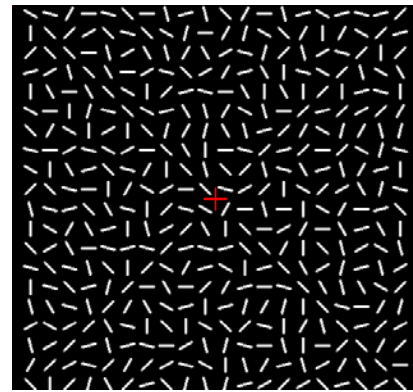
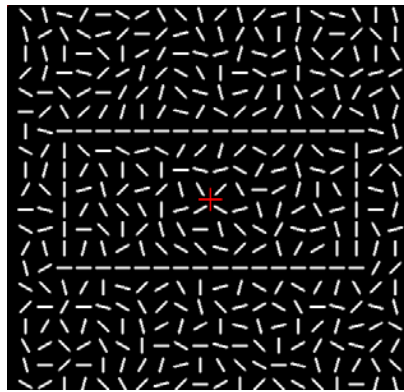
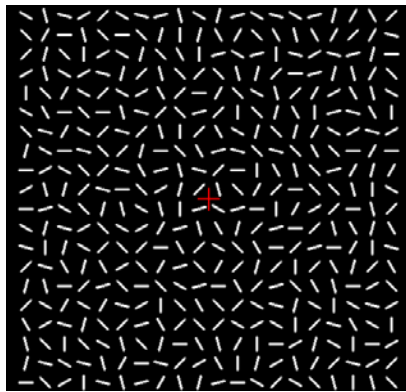
Diamond: 60

Awareness assessment

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

<input type="checkbox"/> Yes	<input type="checkbox"/> No
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2) If you did see any patterns, please describe (or draw) what you saw in as much detail as possible:



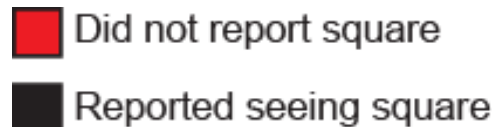
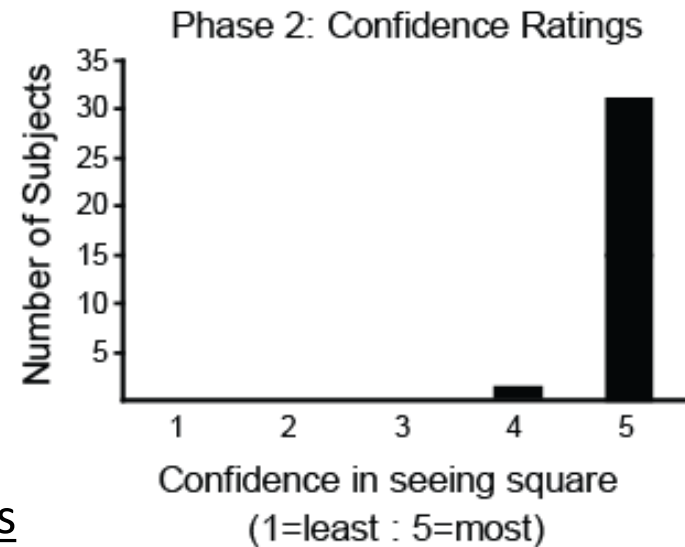
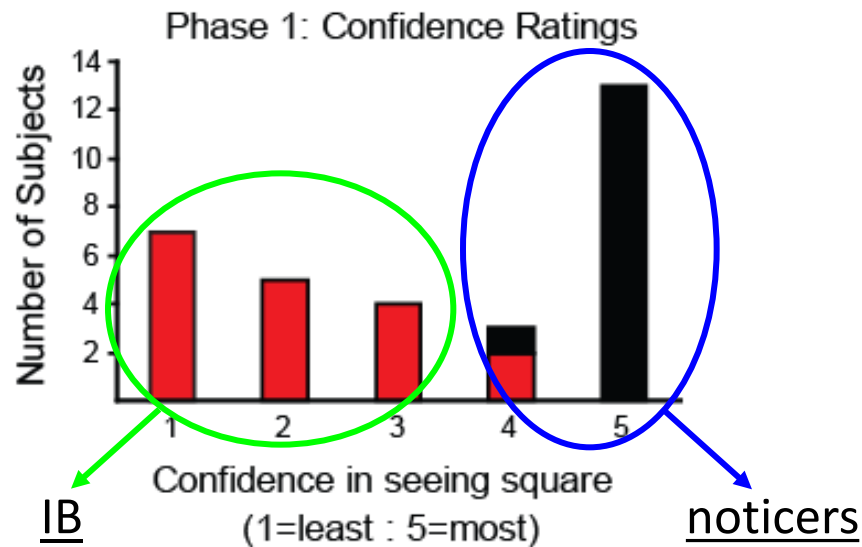
3) Rate how confident you are that you saw each pattern during the experiment.

Please use the following scale:

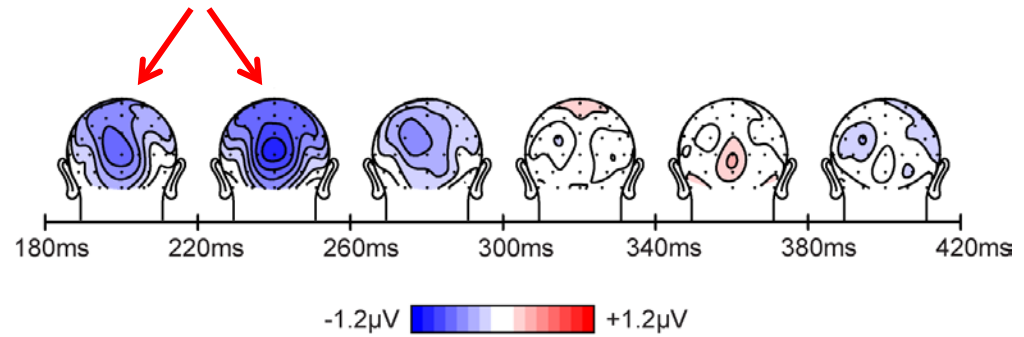
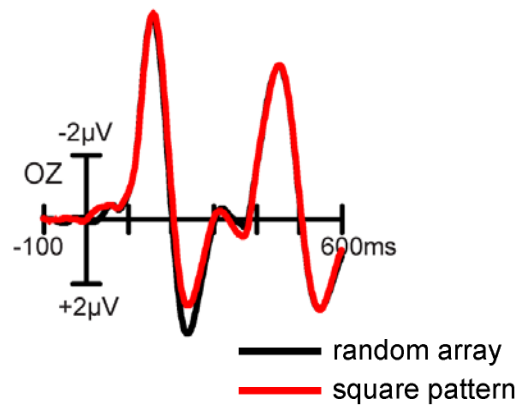
- 1 = very confident I *did not* see it
- 2 = confident I *did not* see it
- 3 = uncertain
- 4 = confident I saw it
- 5 = very confident I saw it

Diamond	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
Horizontal Rectangle	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
X Pattern	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
One Big Square	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
Four Small Squares	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
Vertical Rectangle	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5

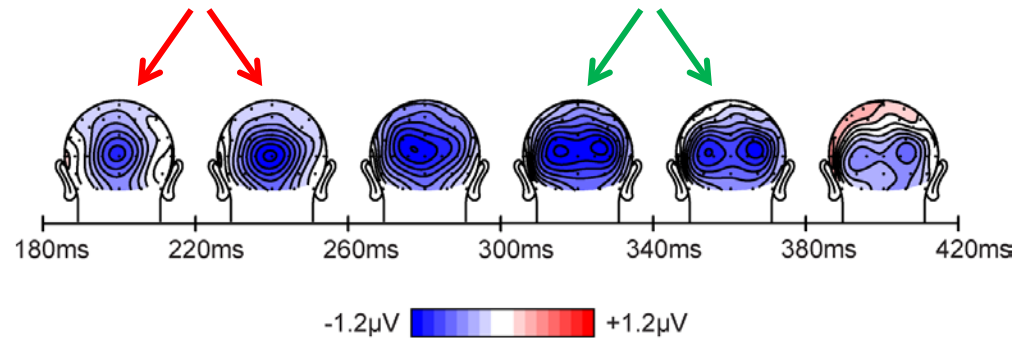
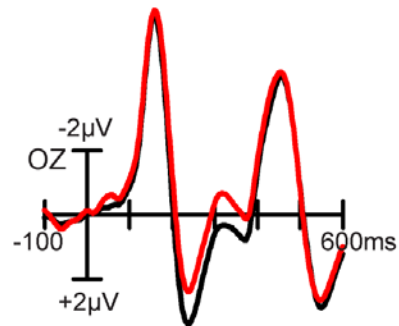
Behavioral results (awareness reports)



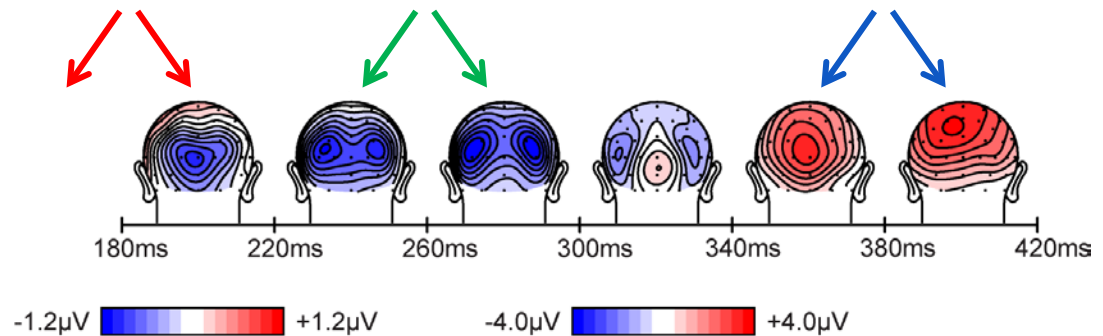
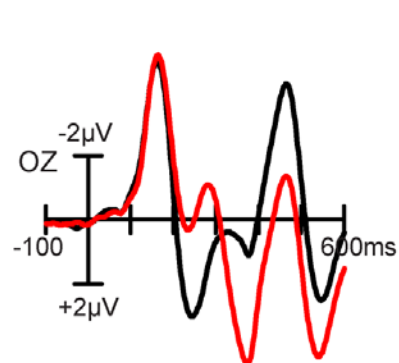
Phase 1:



Phase 2:

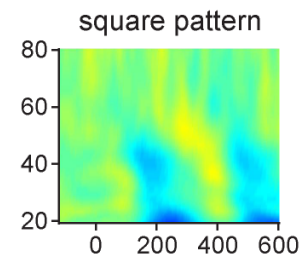
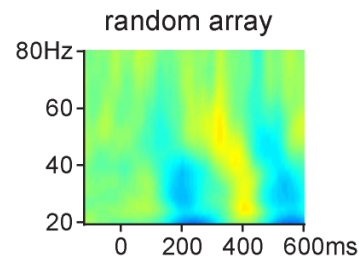
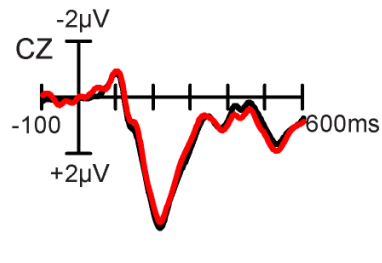


Phase 3:

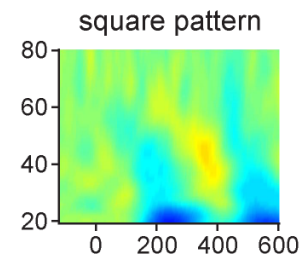
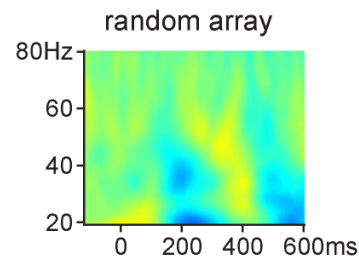
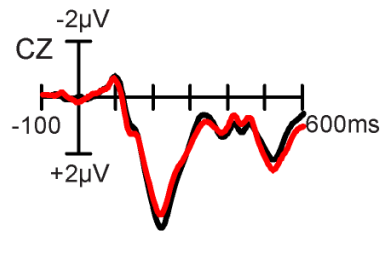


phase 1:

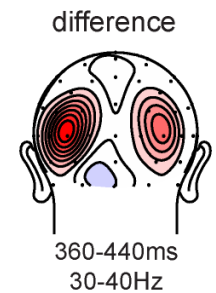
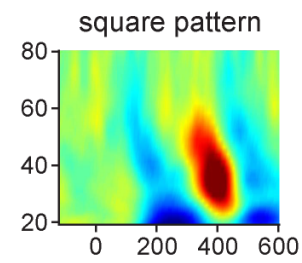
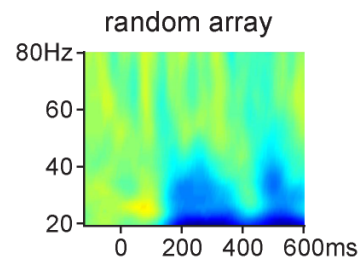
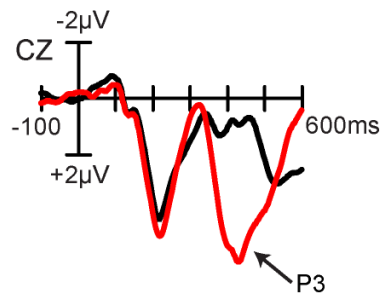
Pitts et al. (2014) *NeuroImage*



phase 2:



phase 3:



— random array
— square pattern

-4 +4µV

-0.5 +0.5µV

-0.5 +0.5µV

Results Summary

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

- Phases 1, 2, & 3



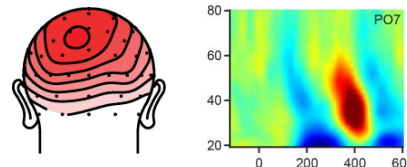
- Subsequent (~260ms) ERP difference *only when* subjects can report awareness of shapes.

- Phases 2 & 3



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

- Phase 3



Interpretations

RP Theory



V. Lamme

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

- Phases 1, 2, & 3



NCC

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

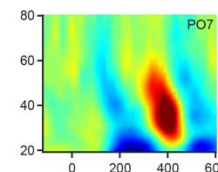
- Phases 2 & 3



Attention / Memory

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

- Phase 3



Task-based
categorization

Interpretations

GNW Theory



S. Dehaene

- 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

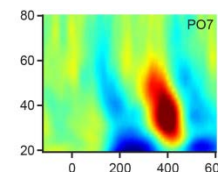


Attention...

but why no P3/gamma?

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

- Phase 3

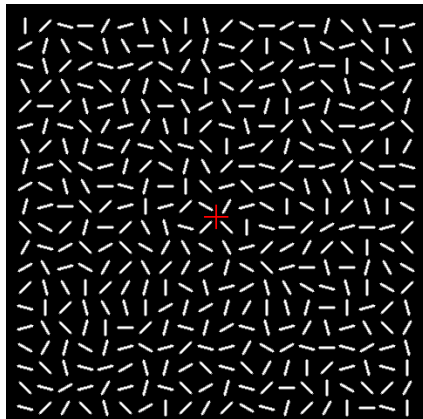


NCC

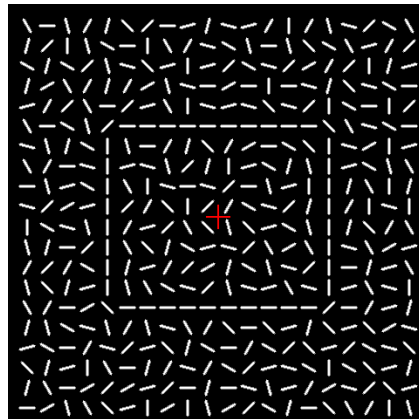
Why no P3 or gamma?



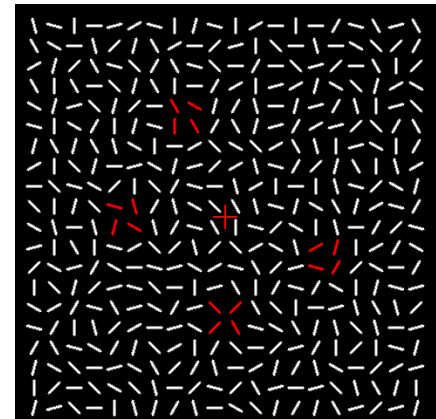
Random Array:



Shape Pattern:

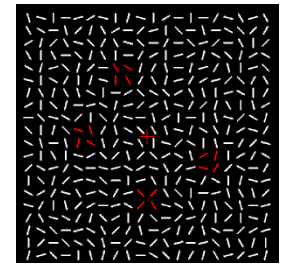
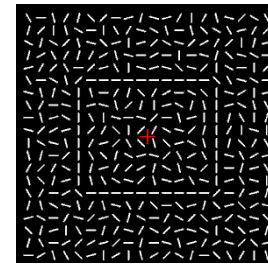


Color Patches:

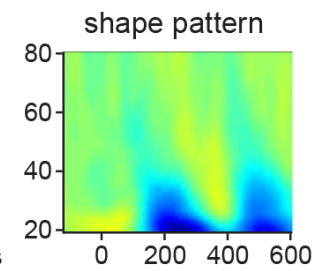
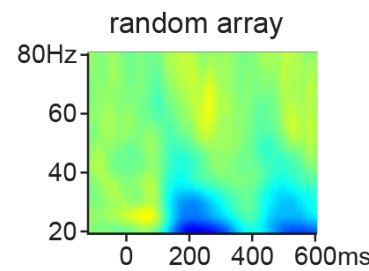
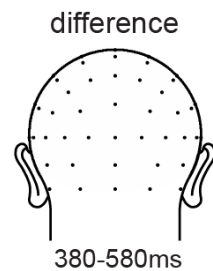
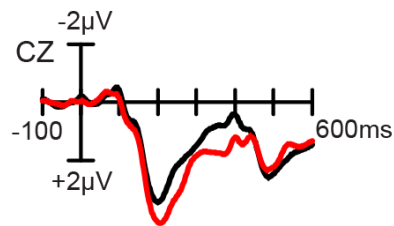


- Shape or color task (counterbalanced blocks)
- P3, gamma for consciously perceived, but task-irrelevant stimuli?

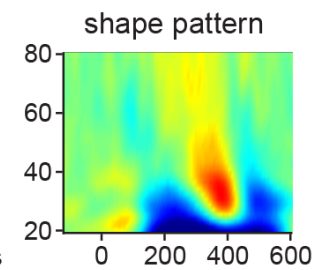
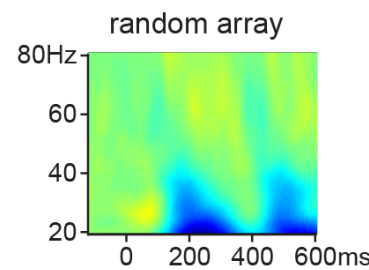
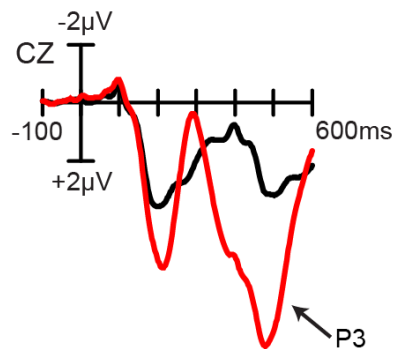
P3 & gamma: NCC or task-based process?



shapes task-irrelevant



shapes task-relevant



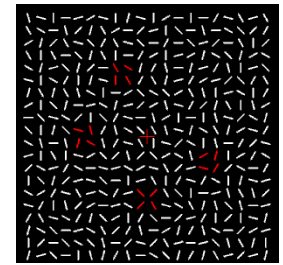
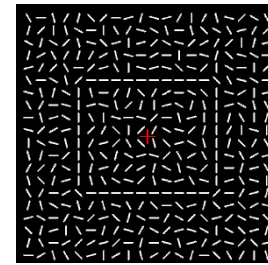
— random array
— shape pattern

-6 +6µV

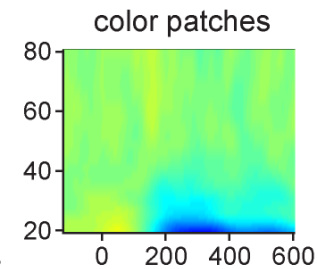
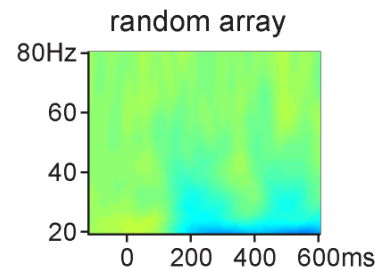
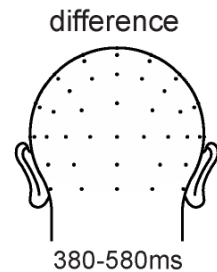
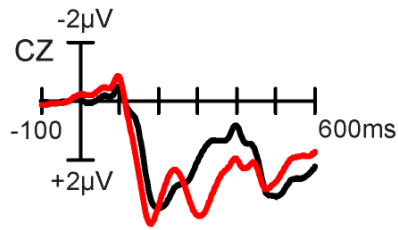
-0.5 +0.5µV

-0.5 +0.5µV

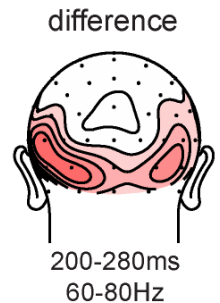
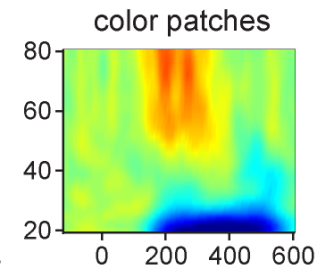
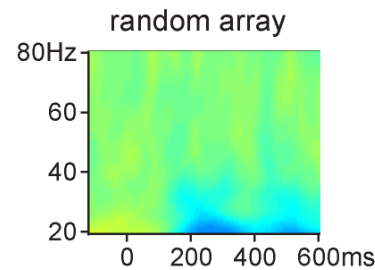
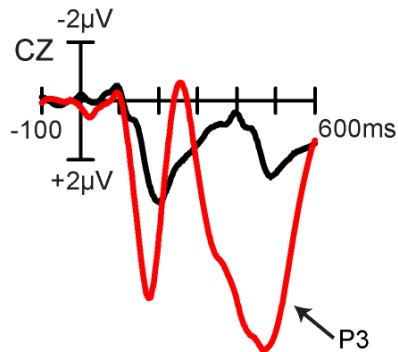
P3 & gamma: NCC or task-based process?



color task-irrelevant



color task-relevant



— random array
— color patches

-7 +7µV

-0.4 +0.4µV

-0.3 +0.3µV

Interpretations

GNW Theory



Dehaene

- 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.

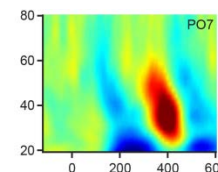
- Phases 2 & 3



Attention

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

- Phase 3



NCC

Interpretations

GNW Theory



Dehaene 2.0

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

- Phases 1, 2, & 3



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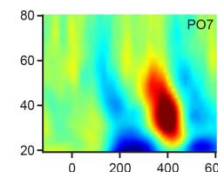
- Phases 2 & 3



Attention or NCC ?

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

- Phase 3



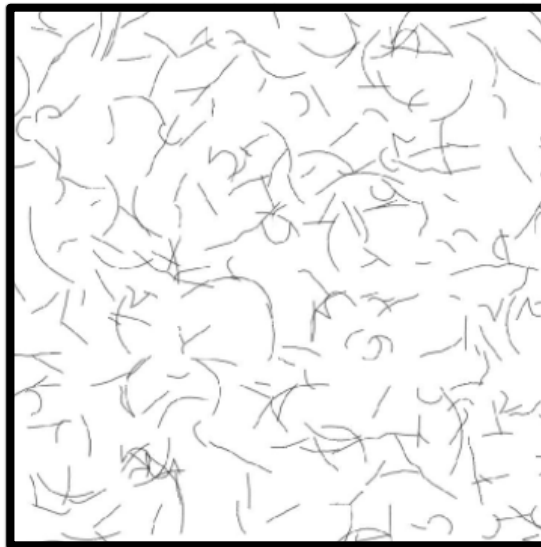
Task-based
categorization

Inattention blindness to faces

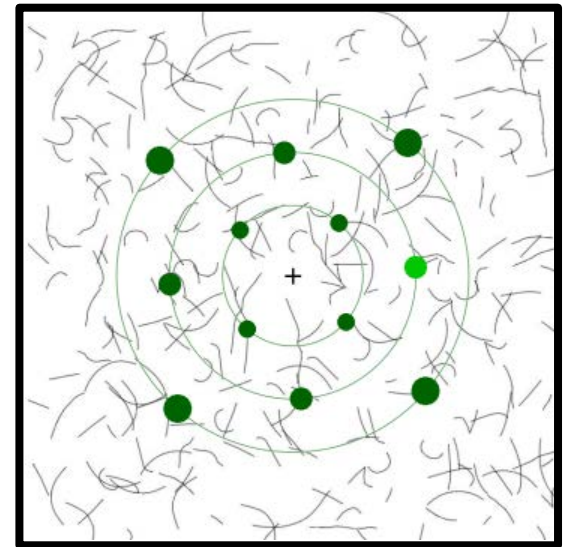
Face Pattern



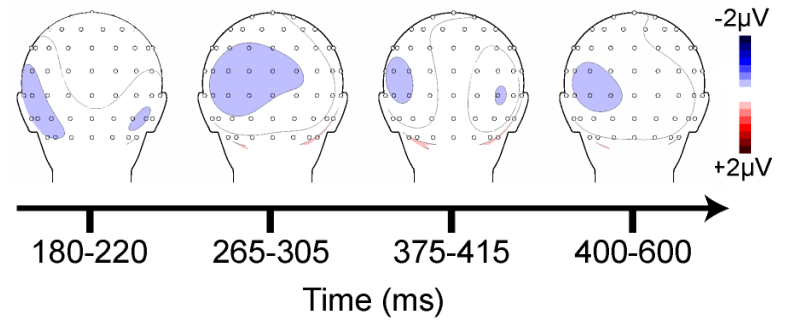
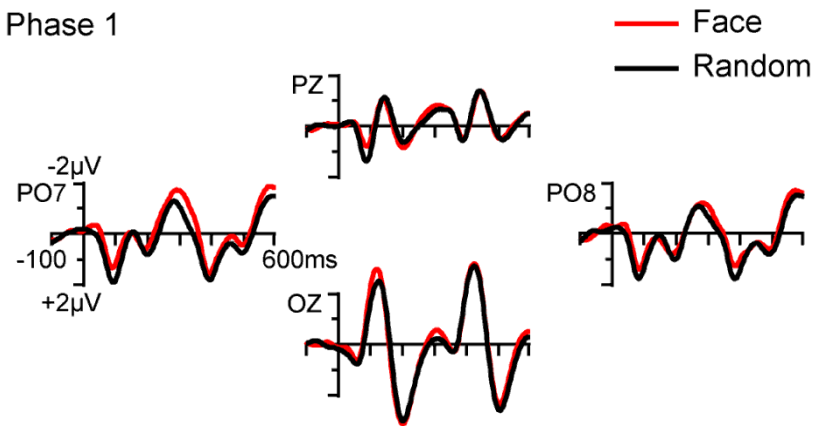
Random Array



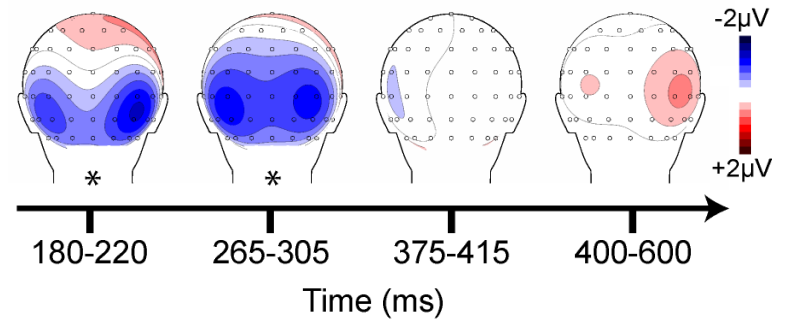
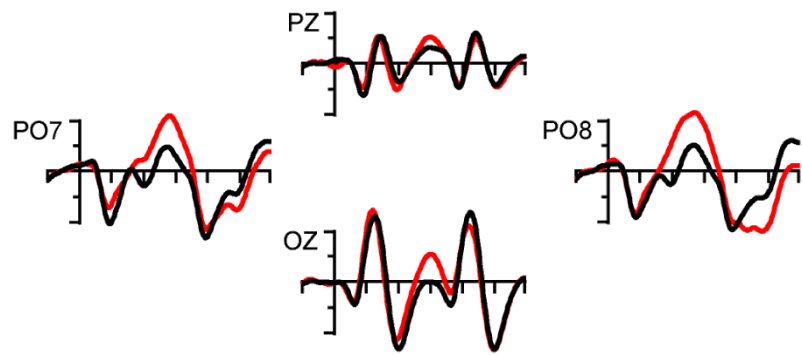
Distracter Task



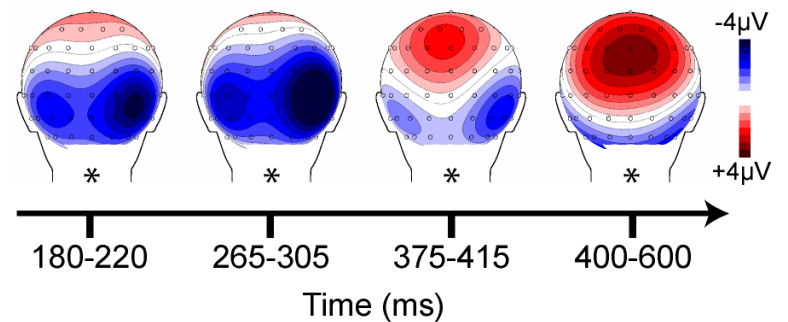
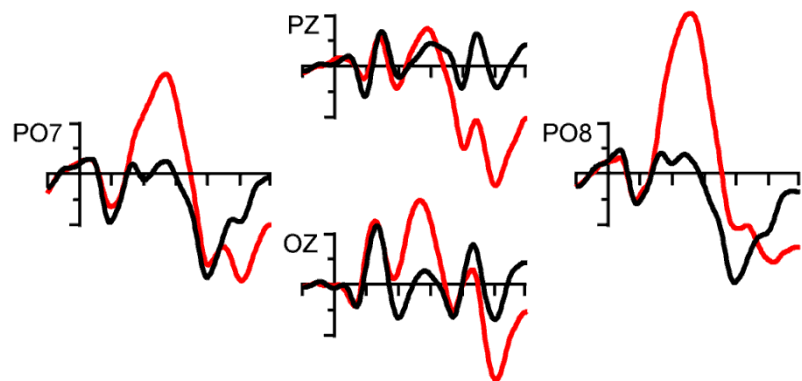
Phase 1



Phase 2



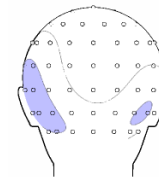
Phase 3



Results Summary

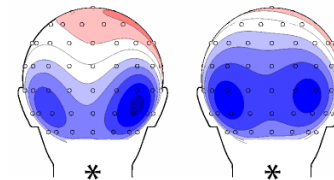
- No ERP differences when subjects fail to report faces.

- Phase 1 (inattention blindness)



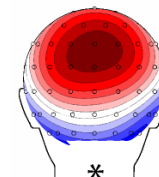
- N170 *and* subsequent (~260ms) ERP difference *only when* subjects can report seeing faces.

- Phases 2 & 3



- P3 (>300ms) *only when* subjects report faces trial-by-trial.

- Phase 3



Interpretations

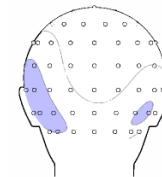
GNW Theory



Dehaene 2.0

- No ERP differences when subjects fail to report faces.

- Phase 1 (inattentional blindness)

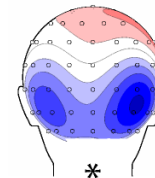


Unconscious

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

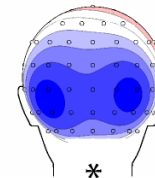
- Phases 2 & 3

Attention



*

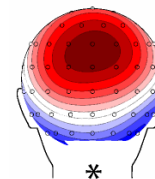
NCC



*

- P3 (>300ms) *only when* subjects report faces trial-by-trial.

- Phase 3



*

Task-based
categorization

Interpretations

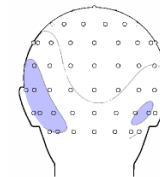
RP Theory



Lamme

- No ERP differences when subjects fail to report faces.

- Phase 1 (inattentional blindness)

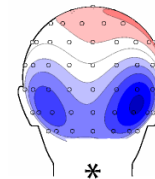


Unconscious

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

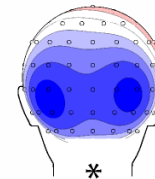
- Phases 2 & 3

Attention



*

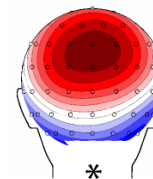
NCC



*

- P3 (>300ms) *only when* subjects report faces trial-by-trial.

- Phase 3



*

Task-based
categorization

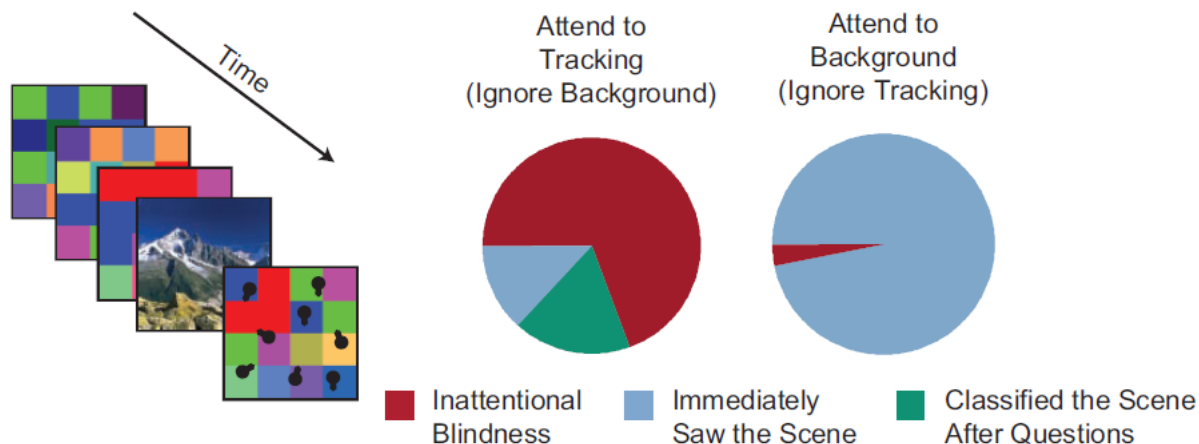
Attention ↔ Awareness

	No Awareness	Awareness
No Attention	<ul style="list-style-type: none">• rapid vision• zombie behaviors• basic summary stats• afterimages	<ul style="list-style-type: none">• iconic memory ?• gist• animal detection (dual task)• partial reportability
Attention	<ul style="list-style-type: none">• pop-out• priming• adaptation• visual search• thoughts	<ul style="list-style-type: none">• detection of unexpected stimuli• working memory• full reportability

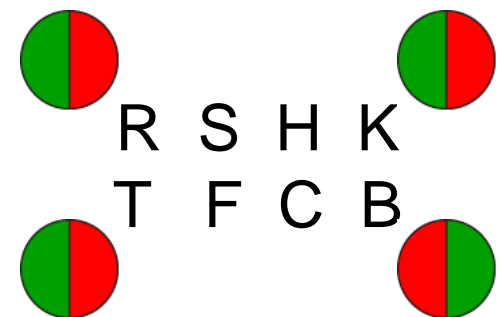
Awareness without Attention?

Recent evidence against:

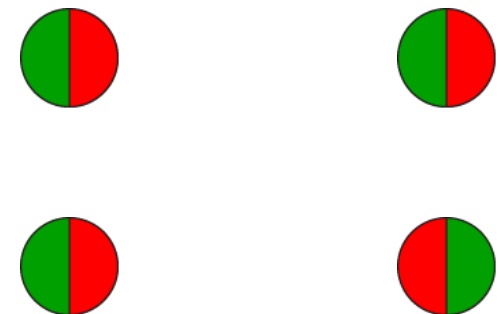
- Cohen et al. (2011) *Psychological Science*
- Mack & Clarke (2012) *Visual Cognition*
- Huang (2015) *PLoS One*
- Mack et al. (2015) *Consciousness & Cognition*
- Mack et al. (2016) *Consciousness & Cognition*



Trials 1-100



Critical Trial 101



Awareness → Attention

	No Awareness	Awareness
No Attention	<ul style="list-style-type: none">• rapid vision• zombie behaviors• basic summary stats• afterimages	<ul style="list-style-type: none">• iconic memory• gist• animal detection (dual task)• partial reportability
Attention	<ul style="list-style-type: none">• pop-out• priming• adaptation• visual search• thoughts	<ul style="list-style-type: none">• detection of unexpected stimuli• working memory• full reportability

Attention → Awareness

	No Awareness	Awareness
No Attention	<ul style="list-style-type: none">• rapid vision• zombie behaviors• basic summary stats• afterimages	
Attention	<ul style="list-style-type: none">• pop-out• priming• adaptation• visual search• thoughts	<ul style="list-style-type: none">• detection of unexpected stimuli• working memory• reportability (partial & full)• iconic memory• gist• animal detection (dual task)

Thank you for your attention and awareness!



Collaborators:

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