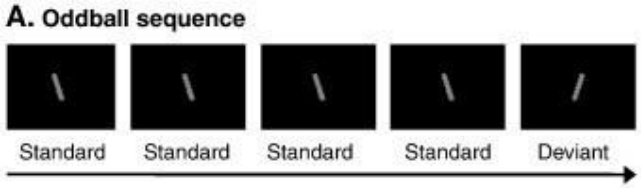
Prediction of vision from invisible stimuli

Bradley N. Jack

Discipline of Psychology, School of Health and Human Sciences, Southern Cross University, Coffs Harbour, Australia

What is visual mismatch negativity?



Stimulus duration: 100 ms; Stimulus onset asynchrony: 500 ms

Background Experiment Results & Discussion

Data from Kimura et al. (2009, 2010); Figure from Kimura (2012).

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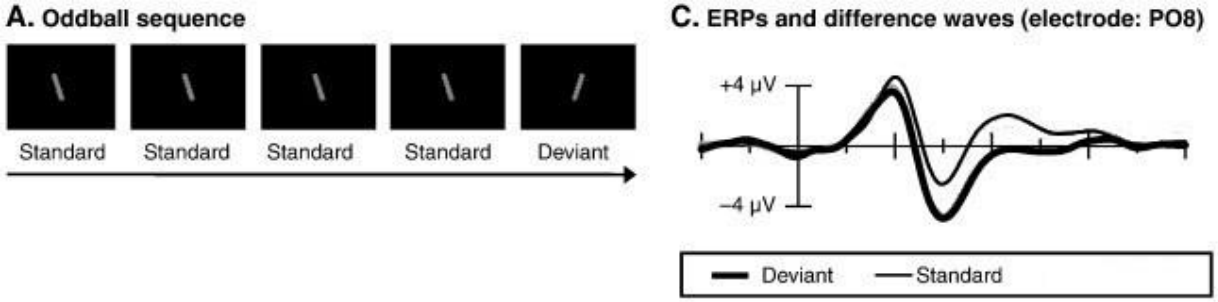

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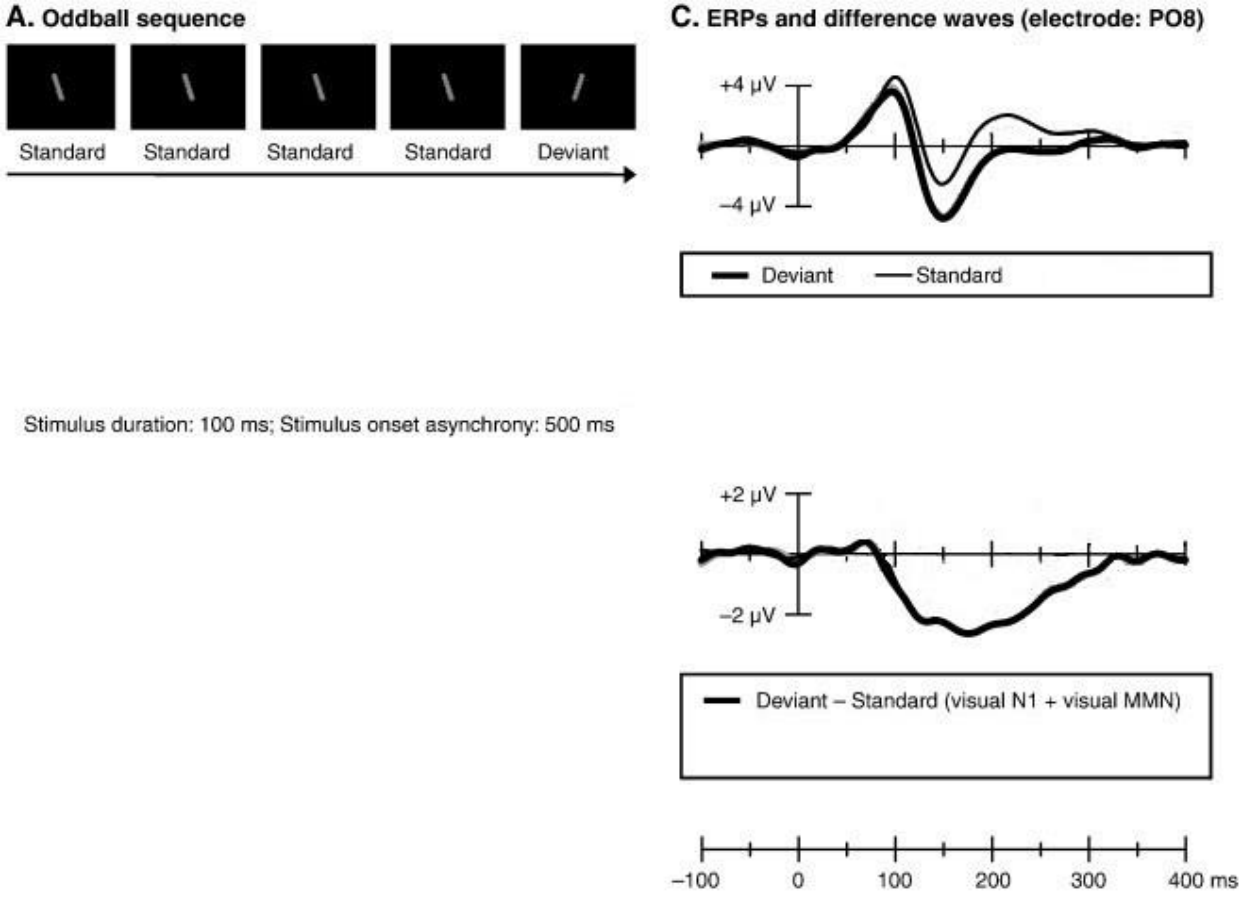

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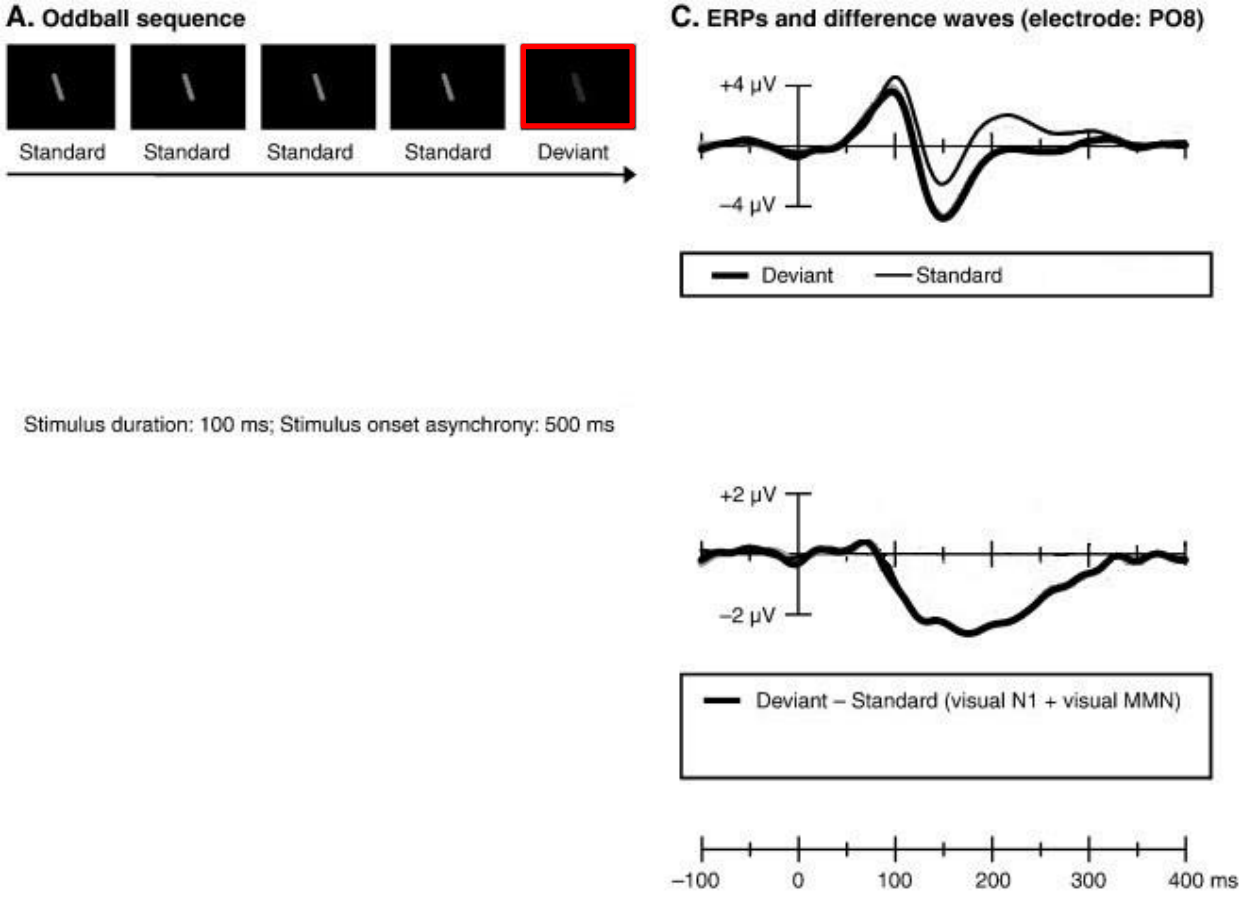

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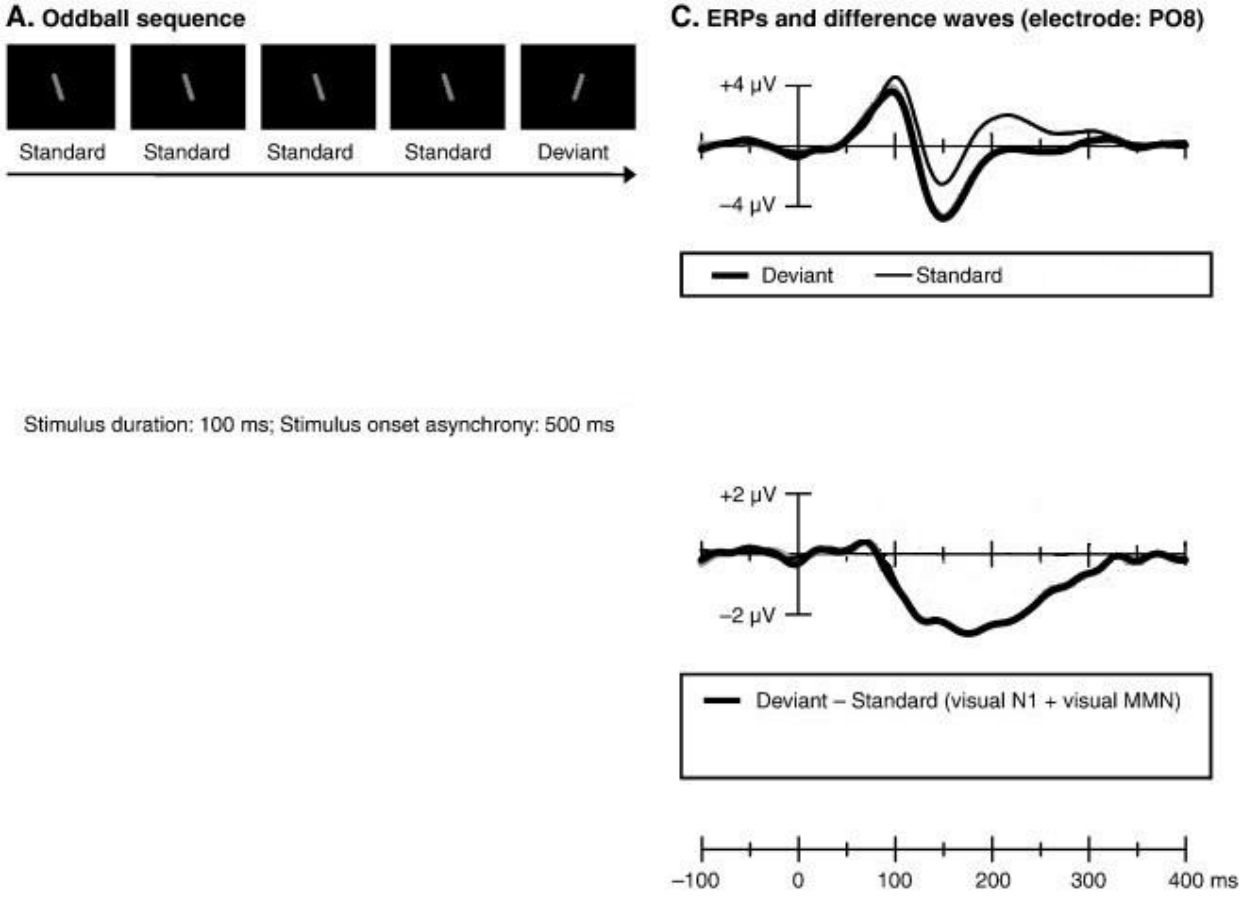

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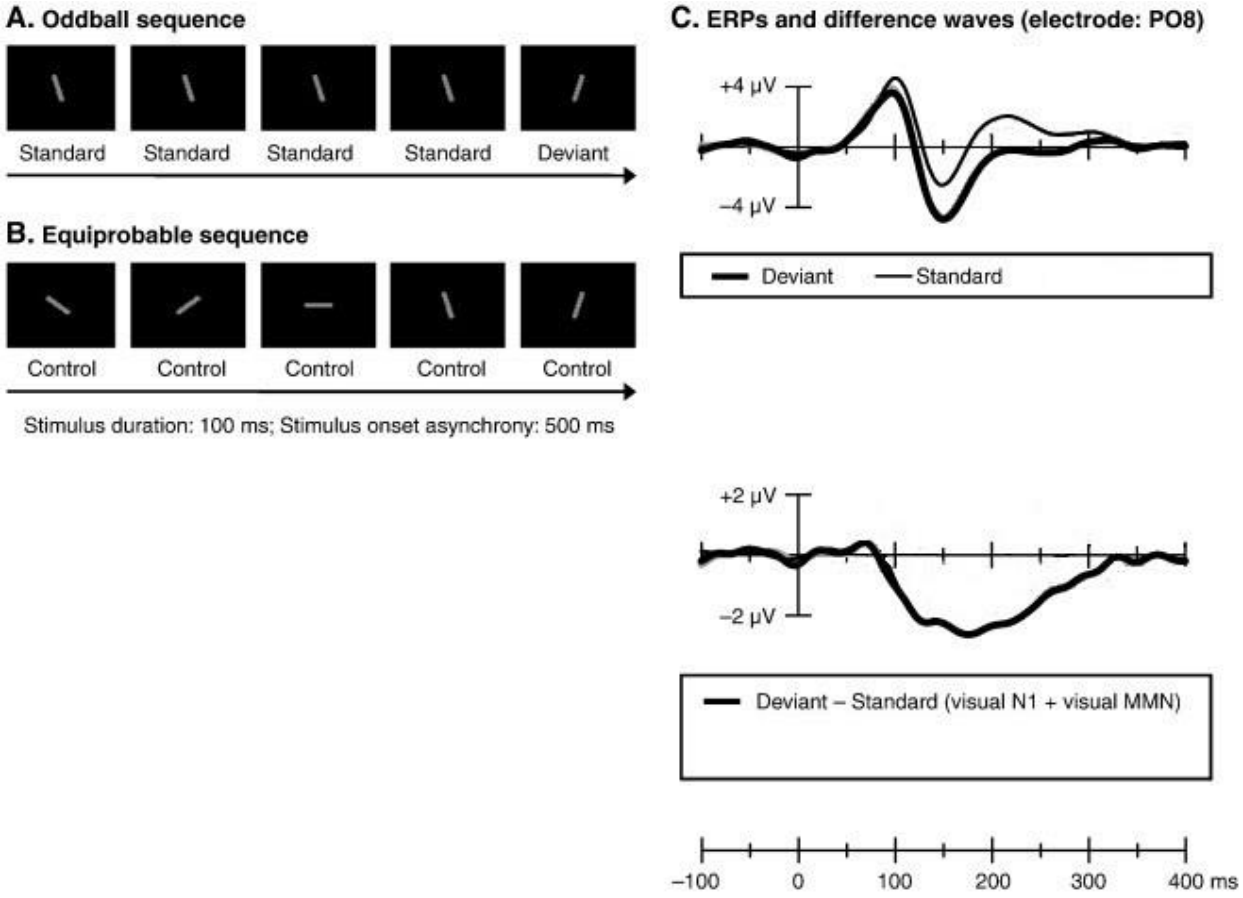

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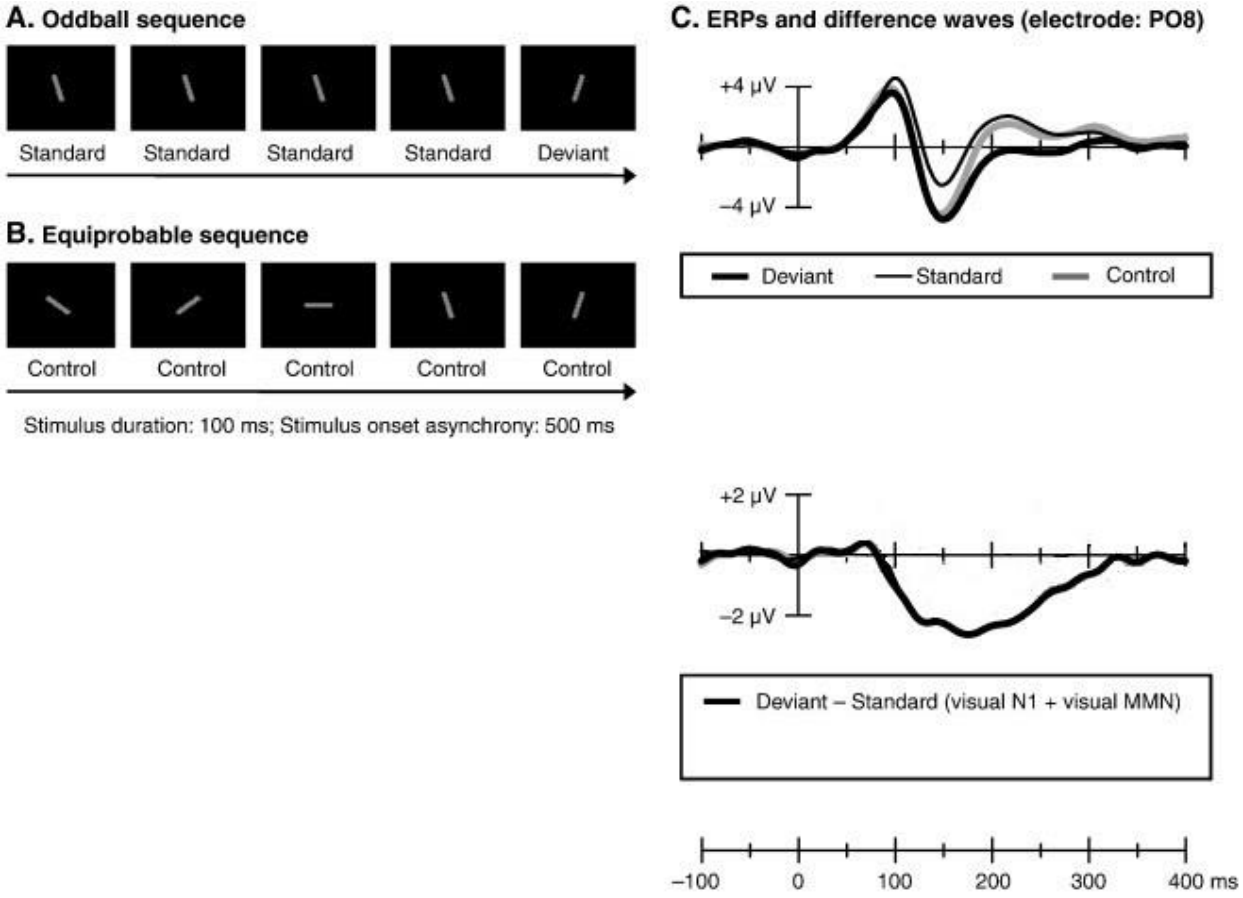

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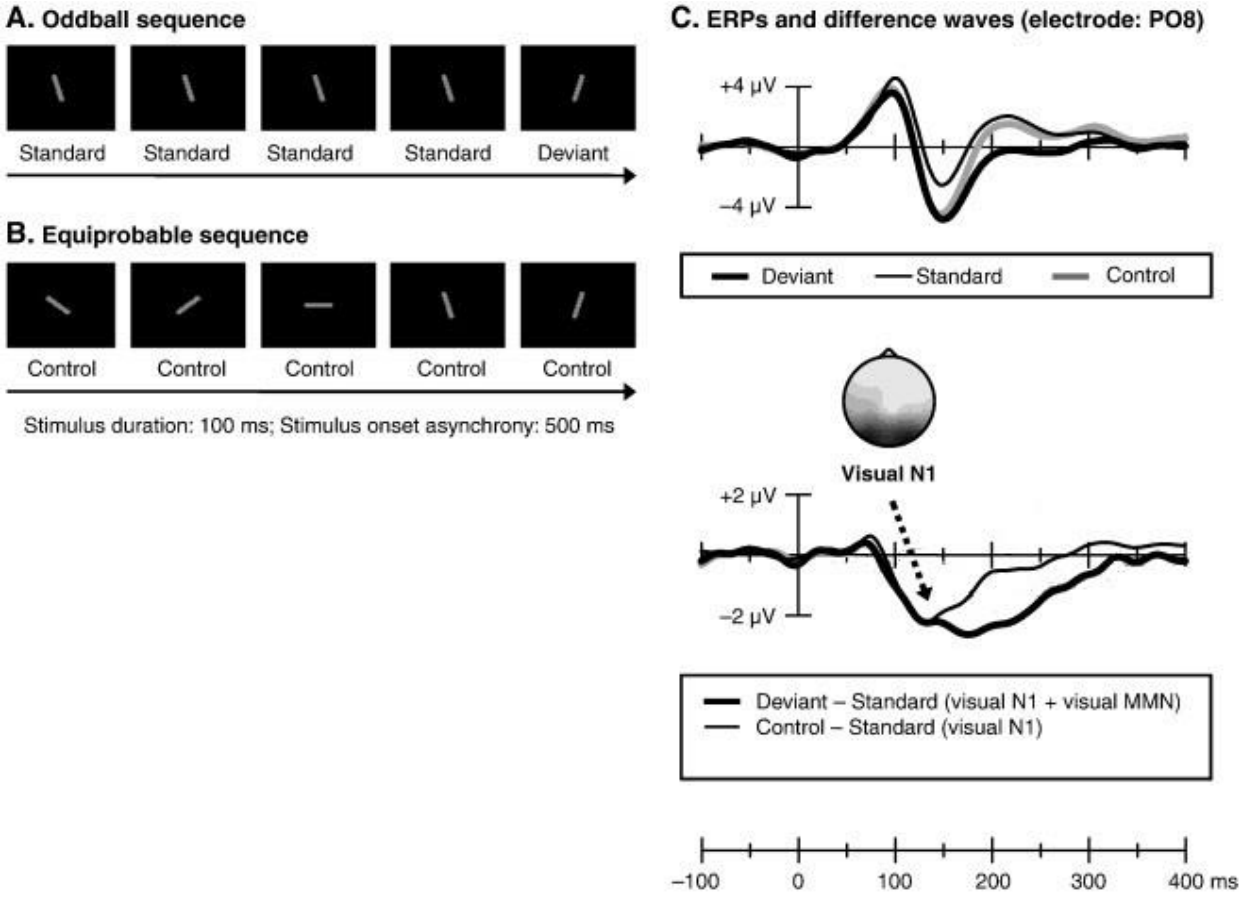

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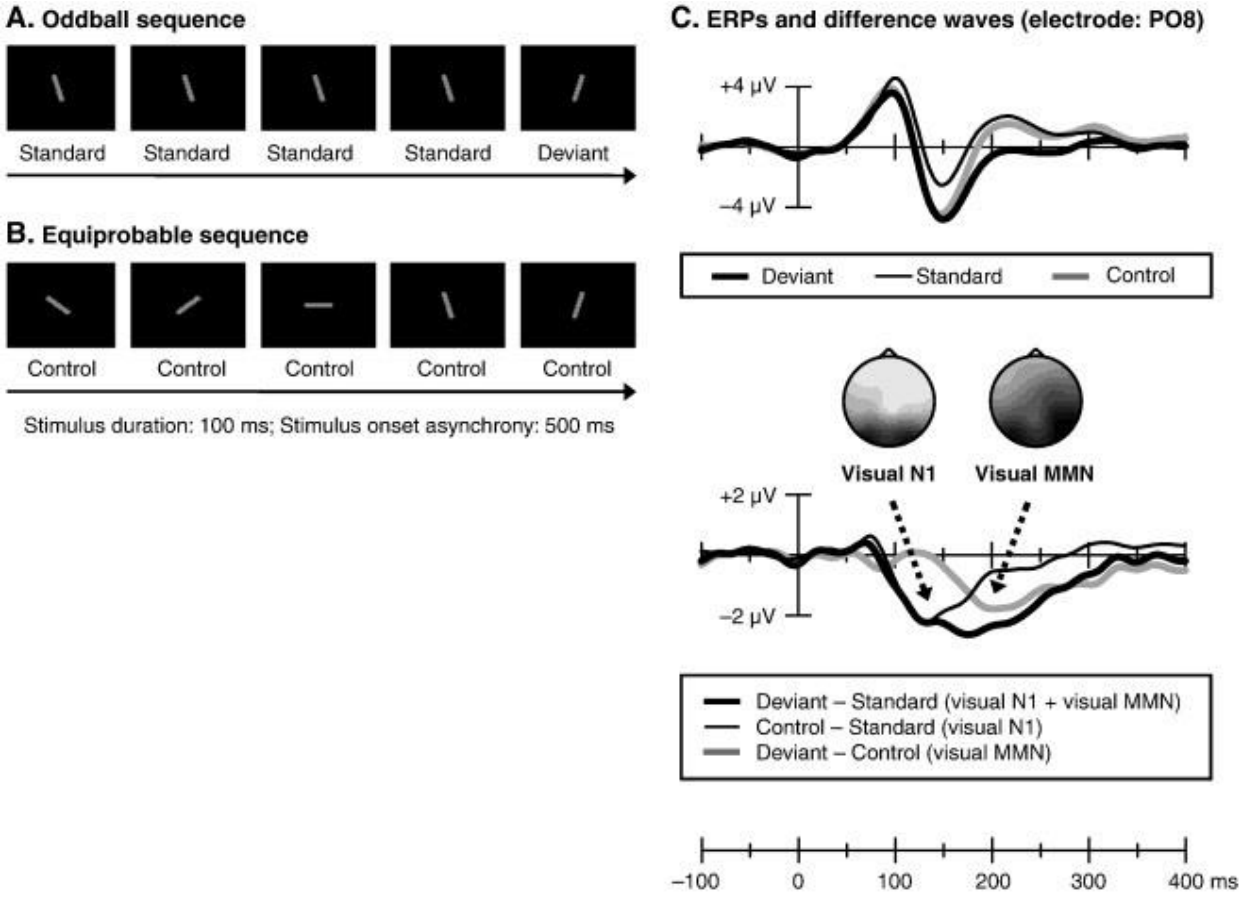

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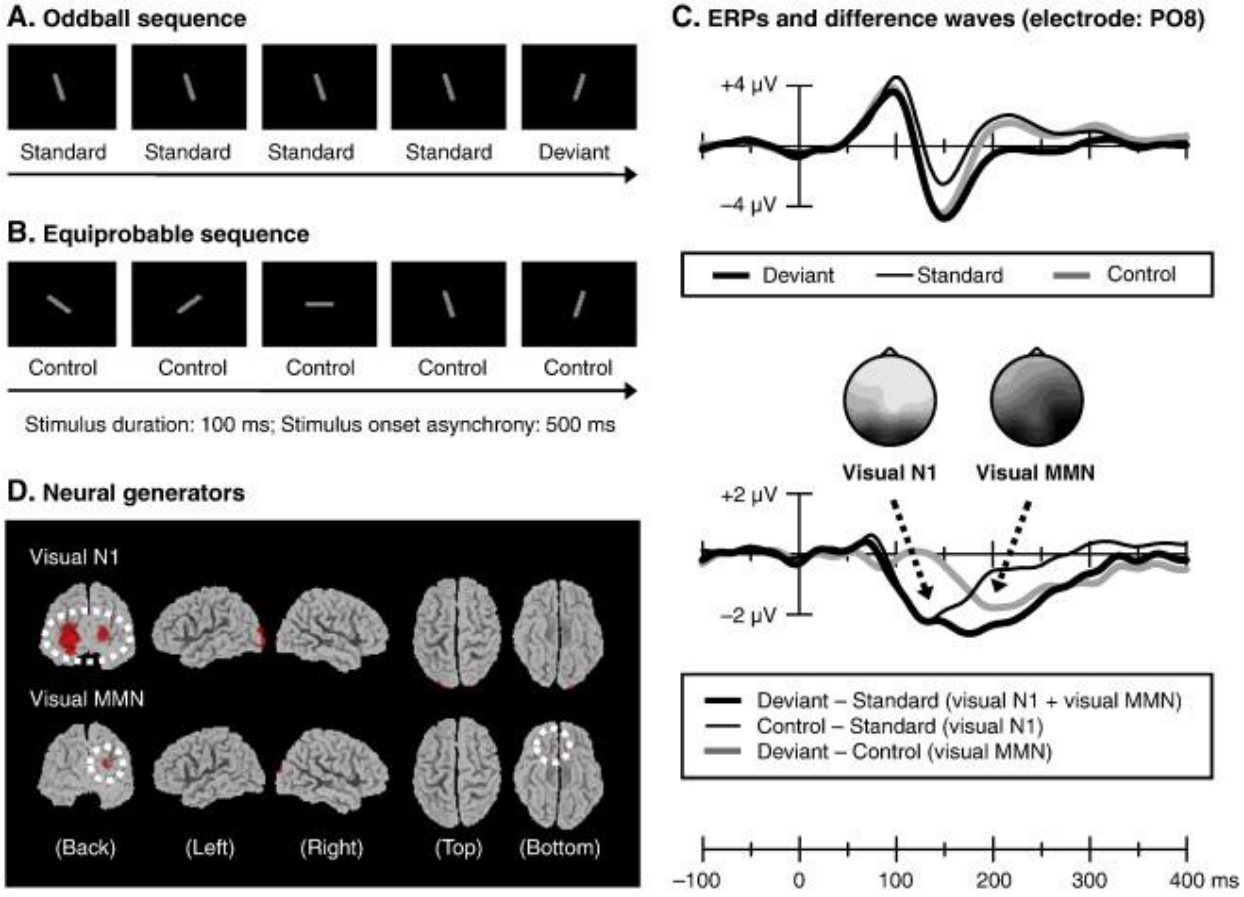

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Visual mismatch negativity: A predictive coding interpretation

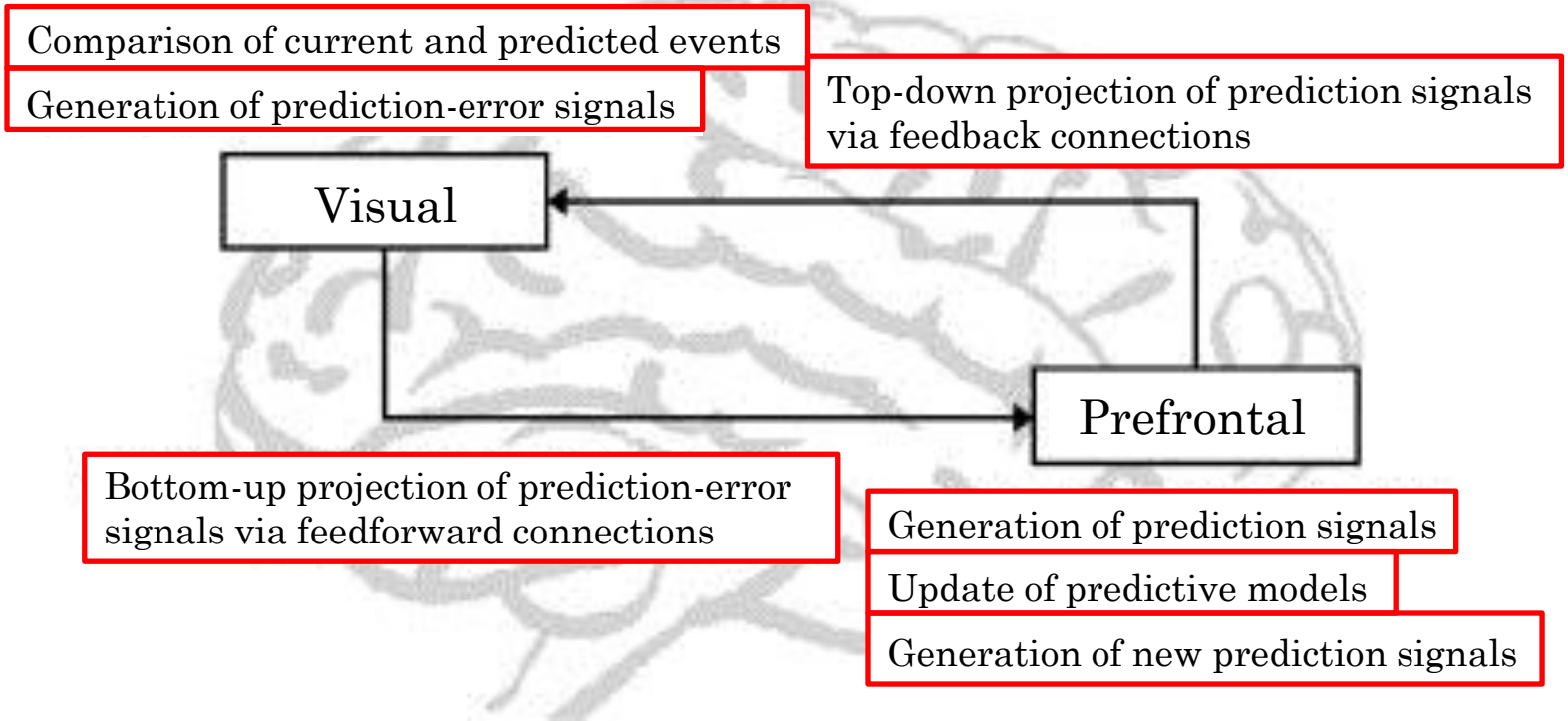

Figure from Kimura (2012).

Attention and consciousness: Two distinct brain processes

	Conscious	Not-conscious
Attention		
Inattention		

Figure from Koch and Tsuchiya (2007).

Attention and consciousness: Two distinct brain processes

	Conscious	Not-conscious
Attention	Attention with Consciousness	
Inattention		

Figure from Koch and Tsuchiya (2007).

Attention and consciousness: Two distinct brain processes

	Conscious	Not-conscious
Attention	• Working memory • Detection of unfamiliar stimuli • Full reportability	
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Figure from Koch and Tsuchiya (2007).

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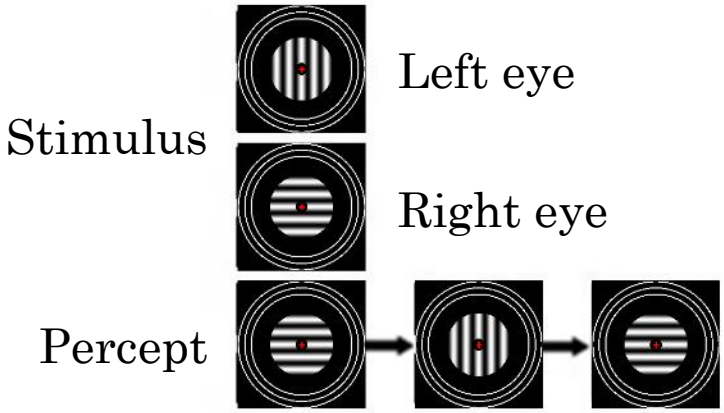

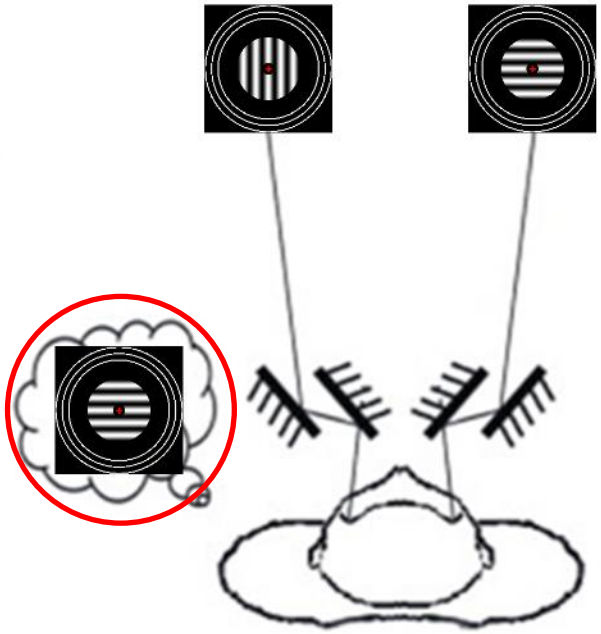

Blake and O'Shea (2009).

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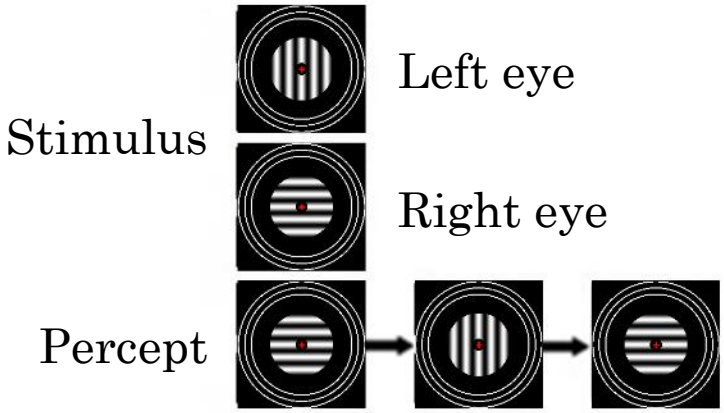

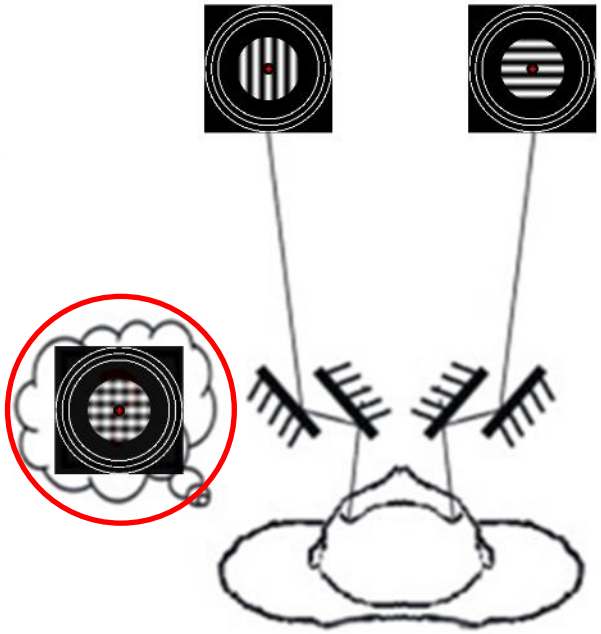

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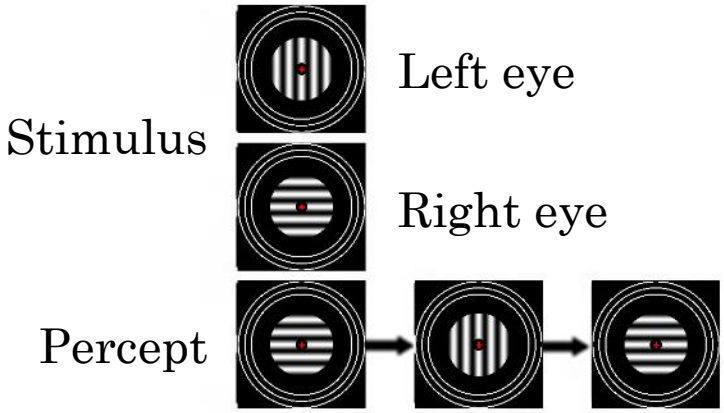

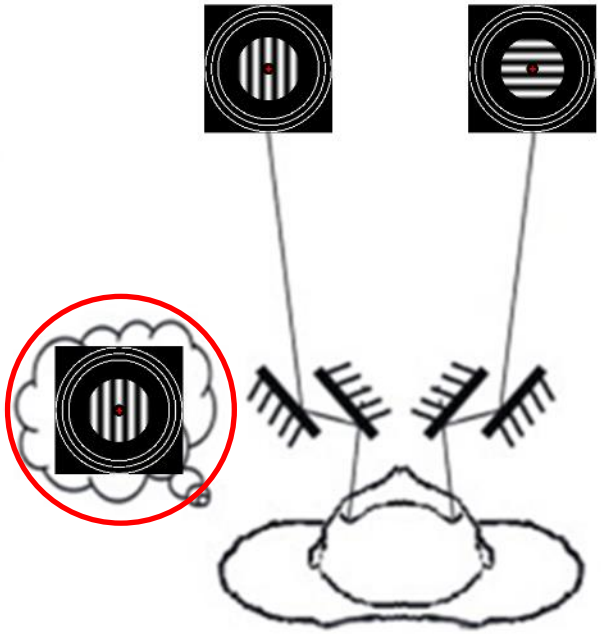

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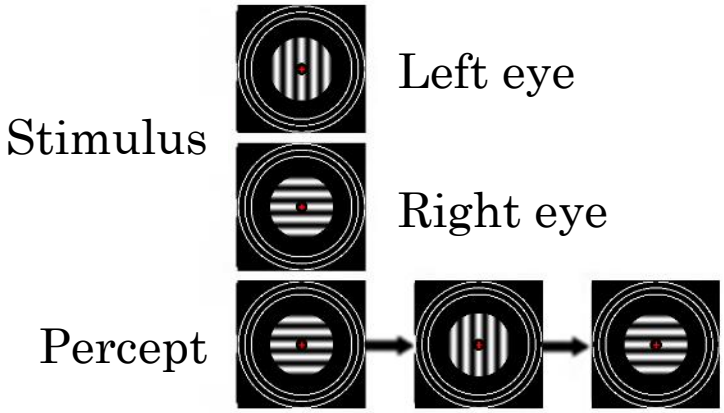

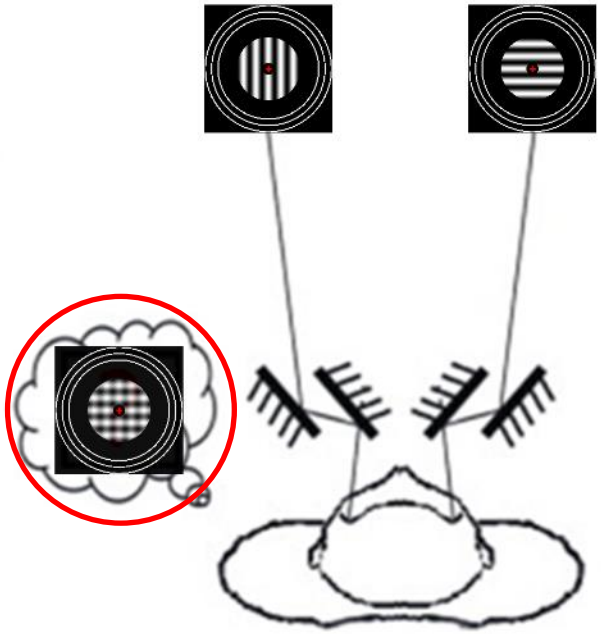

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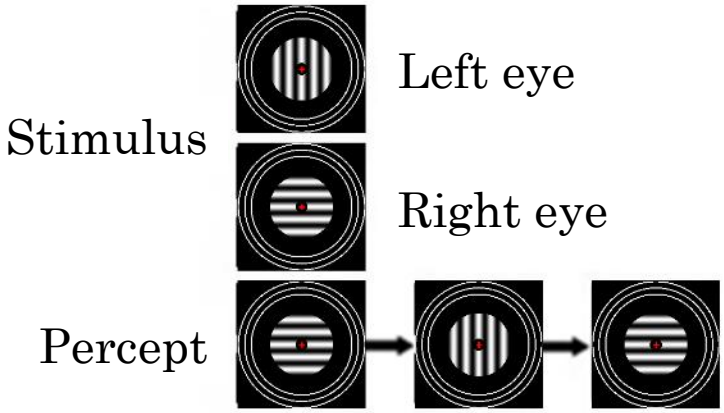
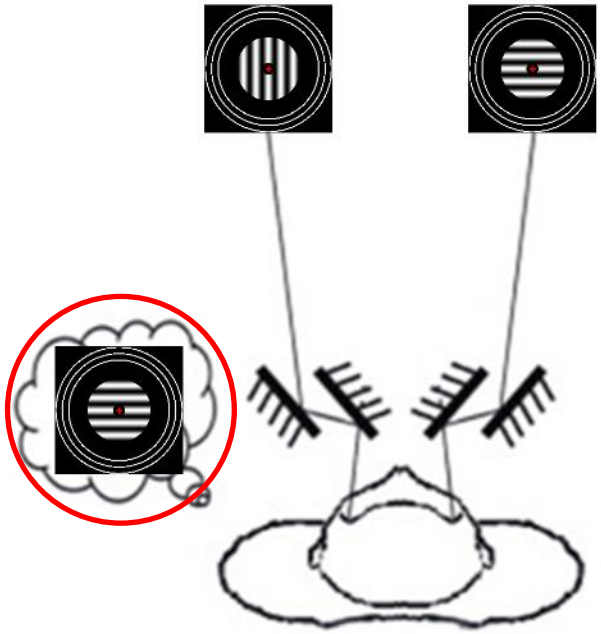


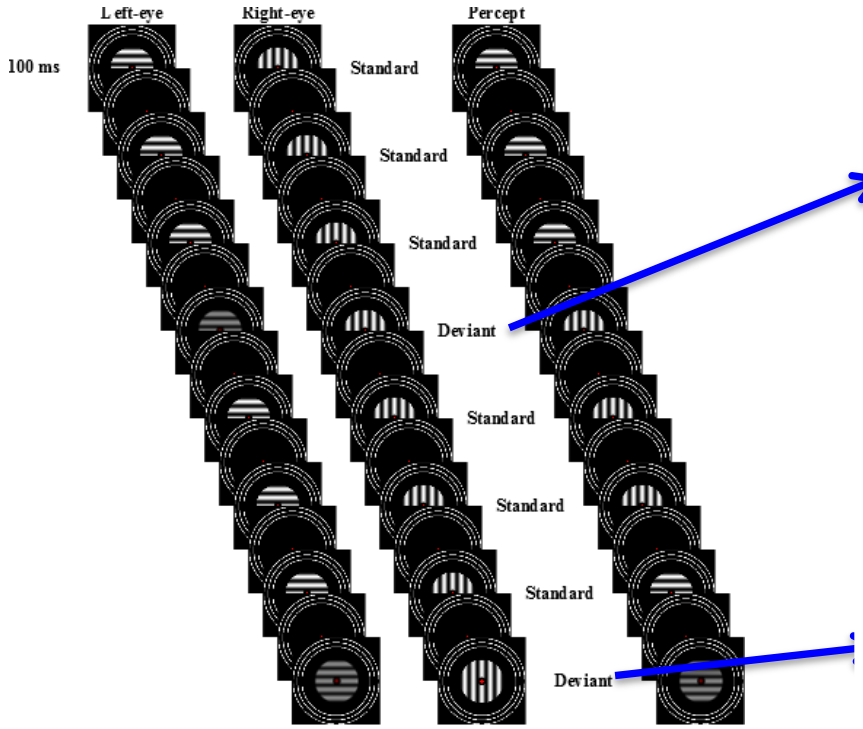


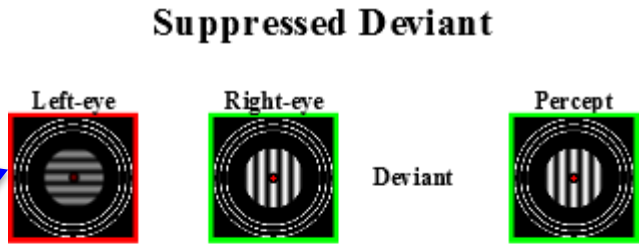
Blake and O'Shea (2009).

Experiment 1: Binocular rivalry

Oddball Sequence

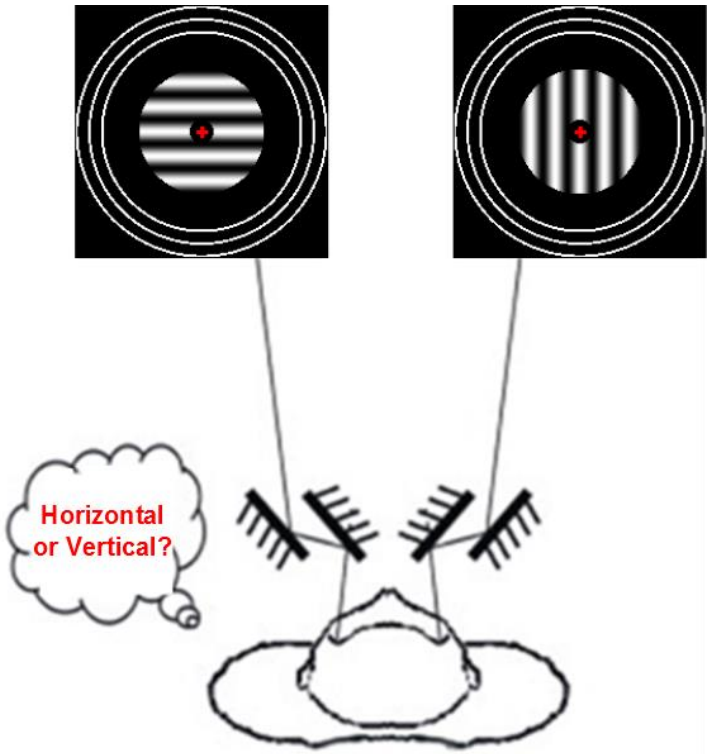
Deviant Percept



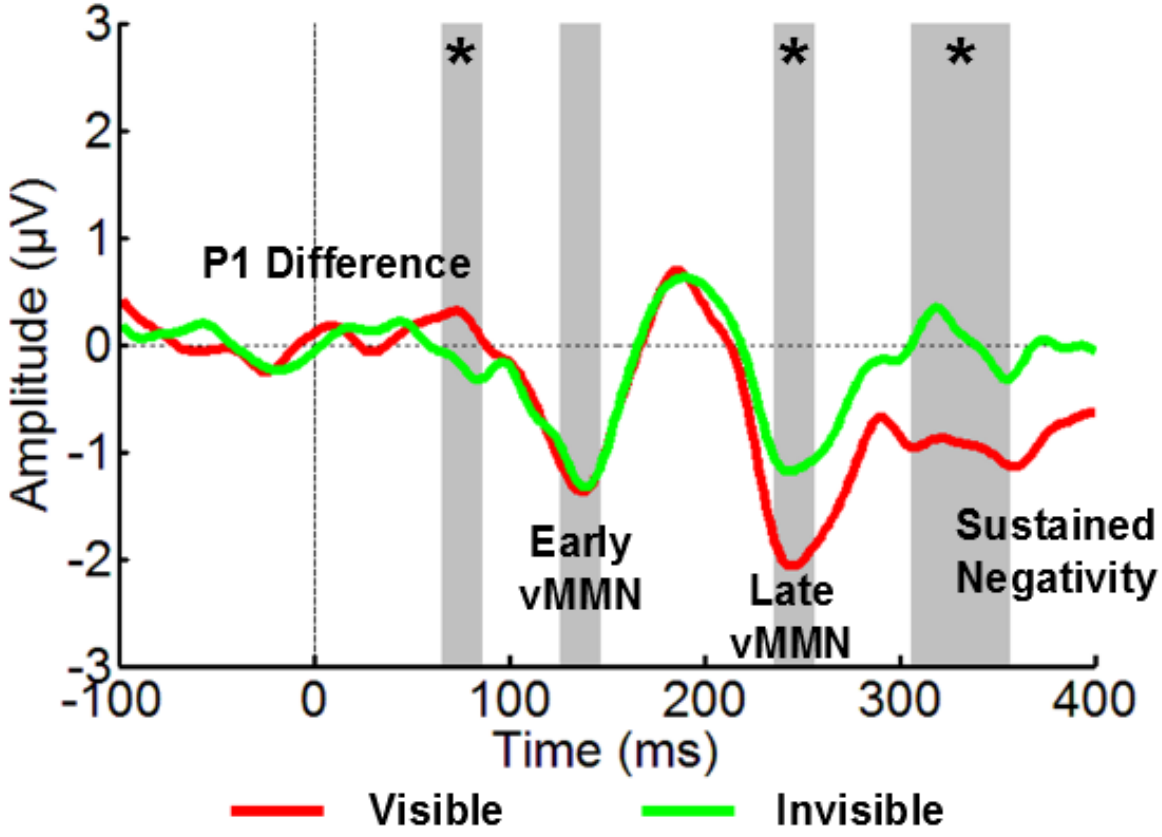


Experiment 1: Participant's task

- Binocular rivalry tracking task
  - Press and hold left key for horizontal
  - Press and hold right key for vertical
- Attend to fixation



Experiment 1: Difference waves (deviant-minus-standard)



Experiment 1: General discussion

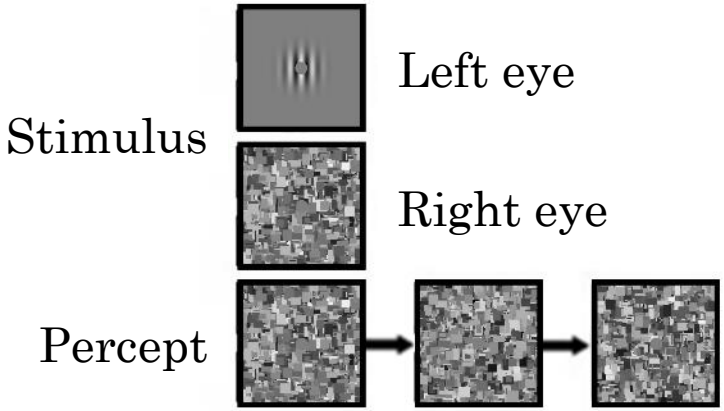
- Predictions of visual input can be violated in the absence of visual consciousness.
- With attention, visual consciousness increases our processing of predictability of visual inputs.
- Can predictions be established in the absence of visual consciousness?

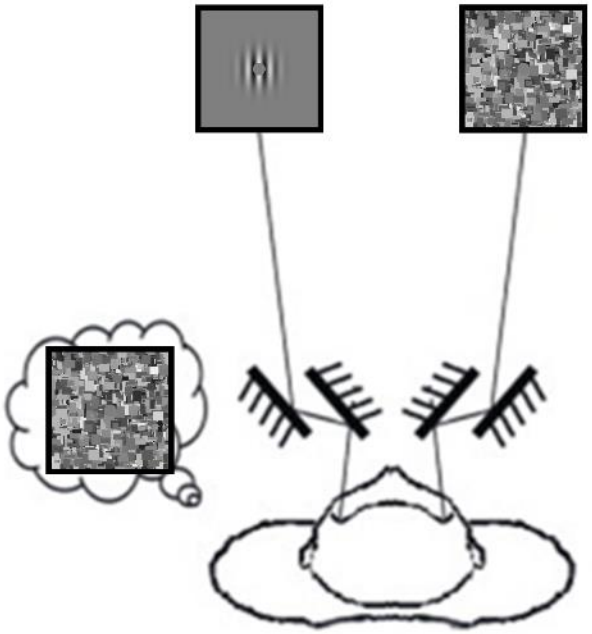
Experiment 2: Inattention and Consciousness

	Conscious	Not-conscious
Attention	Attention with Consciousness	Attention without Consciousness
Inattention	Consciousness without Attention	No attention, No consciousness

Figure from Koch and Tsuchiya (2007).

Experiment 2: Continuous flash suppression

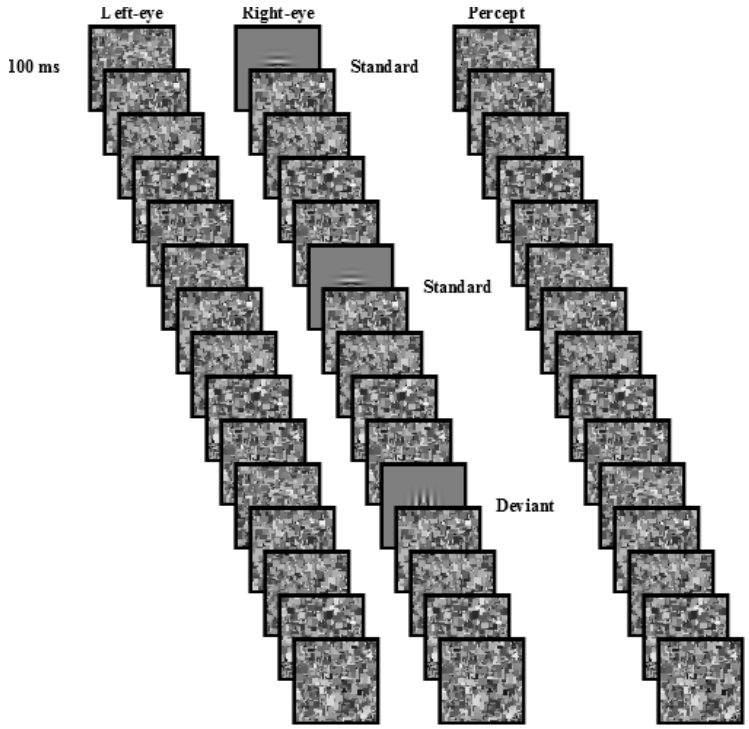




Tsuchiya and Koch (2005).

Experiment 2: Oddball sequence

Invisible Blocks



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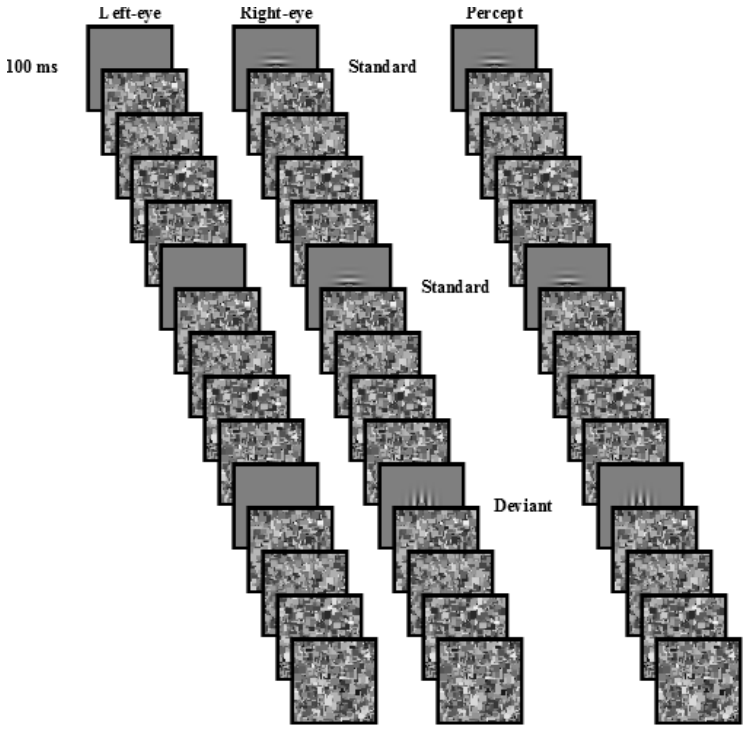

Experiment 2: Equiprobable sequence

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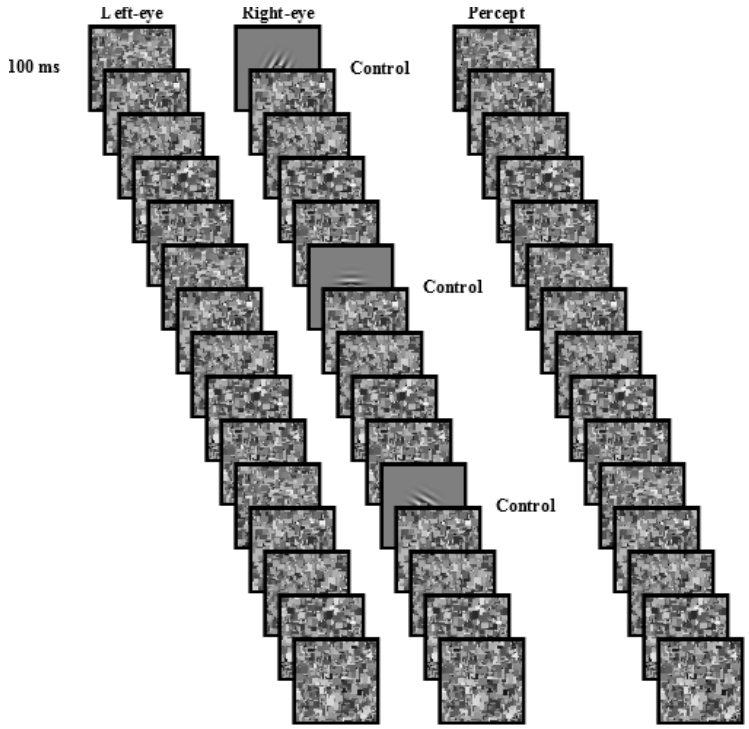

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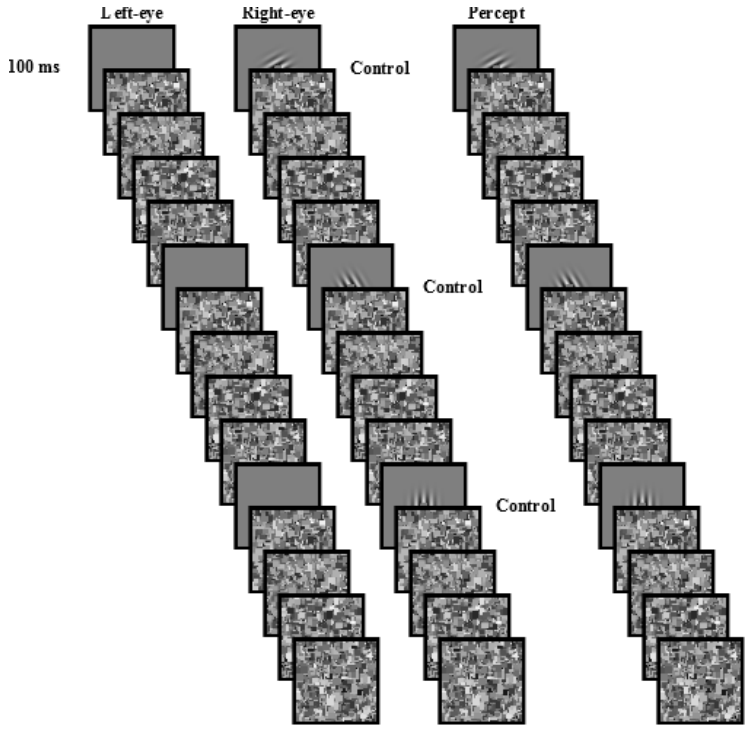

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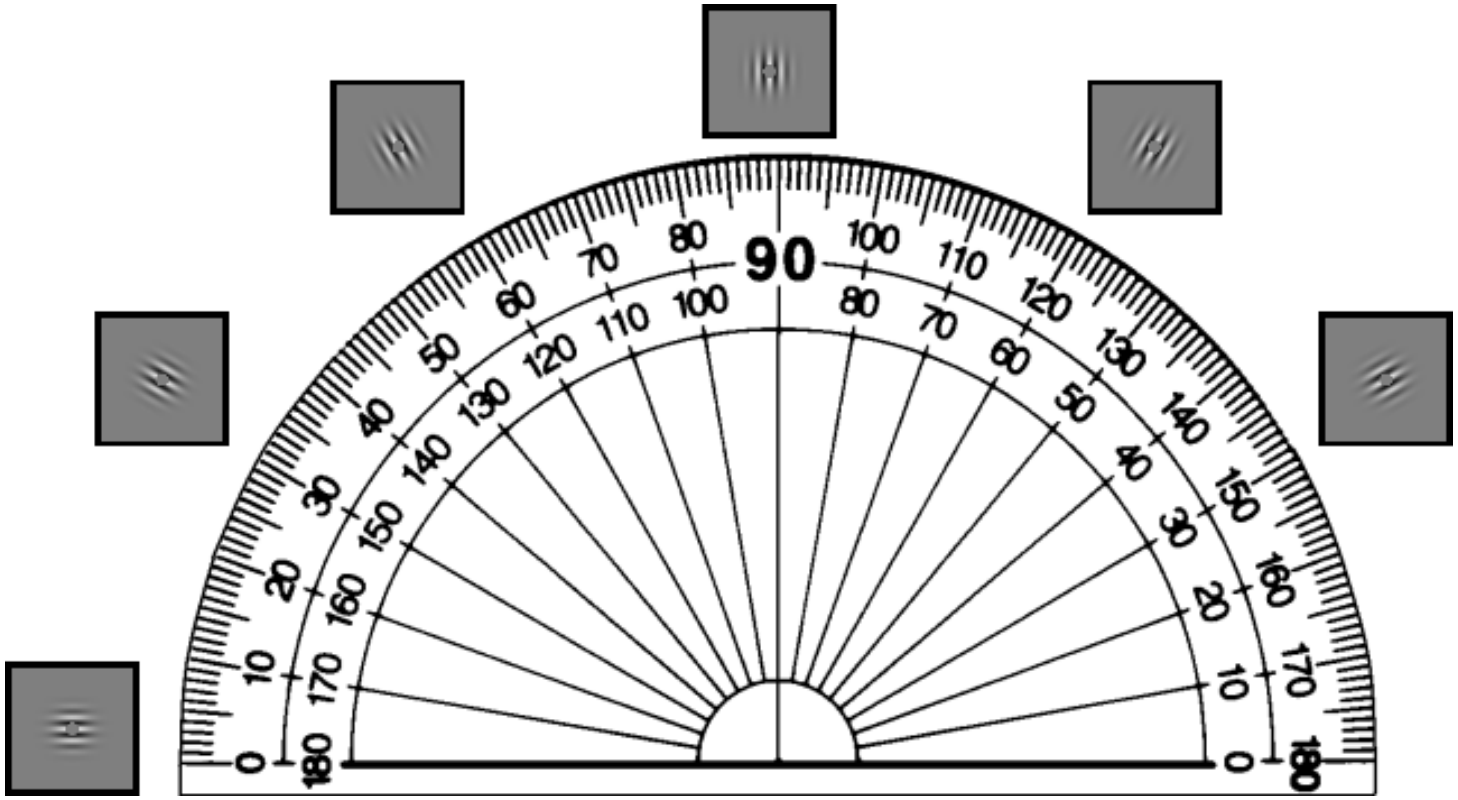
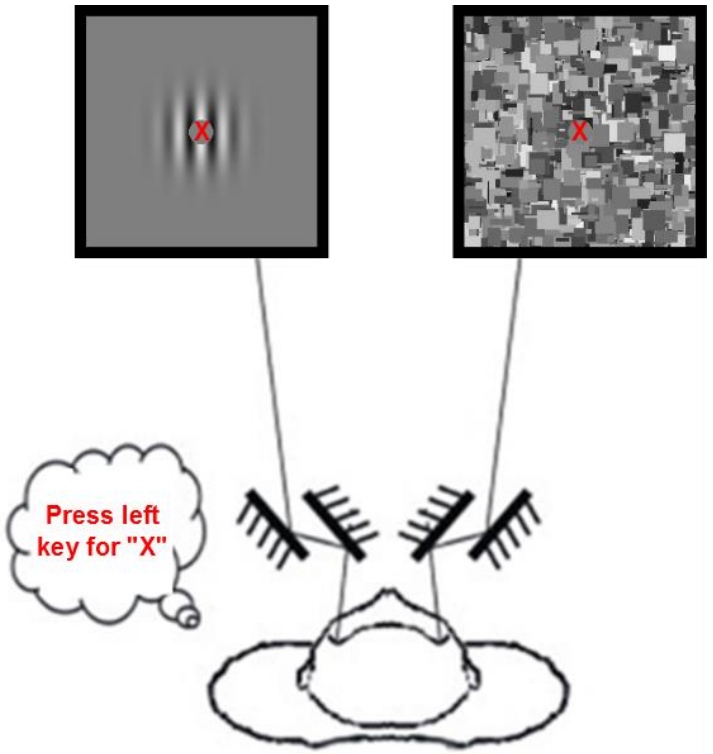


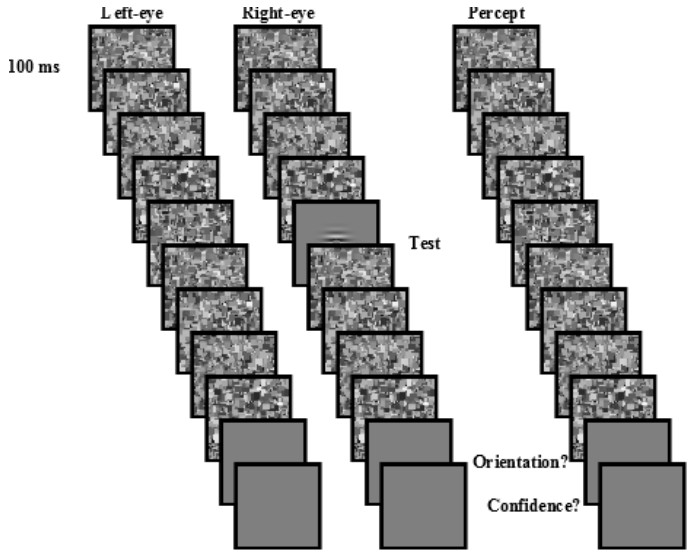
Experiment 2: Participant's task

- Target-detection task
  - Press left key for "X"
  - Press right key for "O"
- Target at fixation



Experiment 2: Post-test sequence

Invisible Blocks



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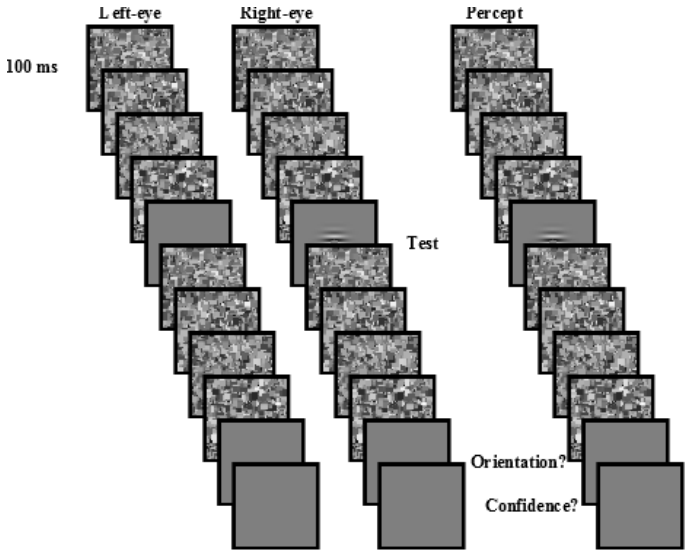
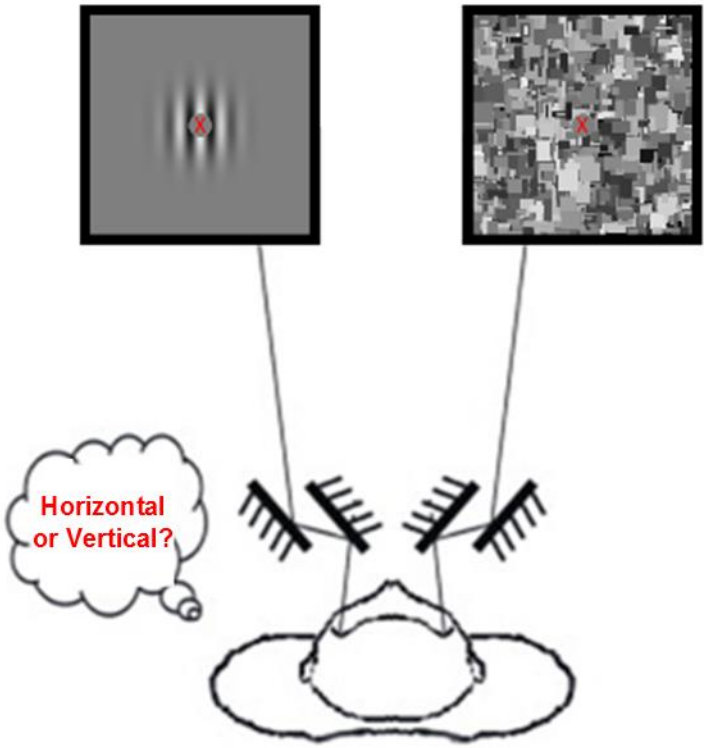


Experiment 2: Post-test orientation task



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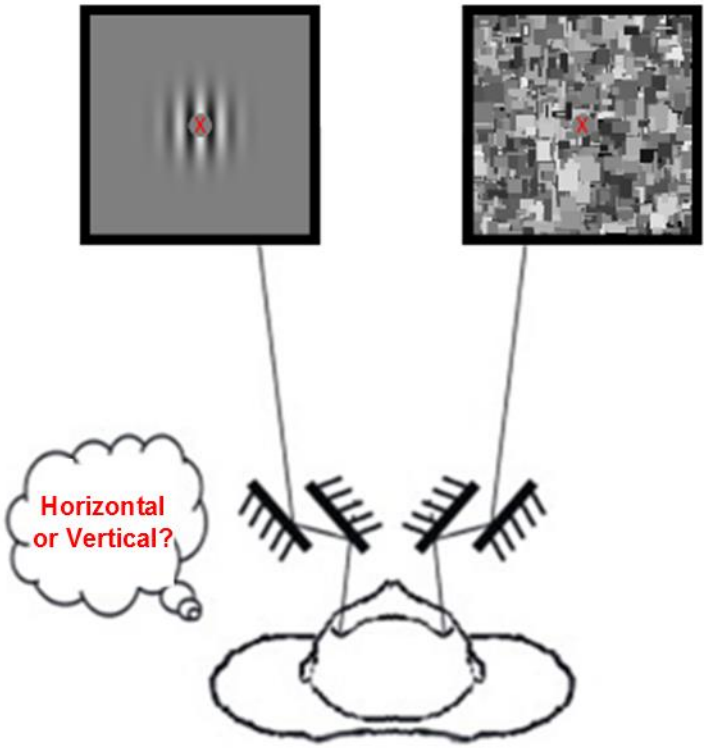

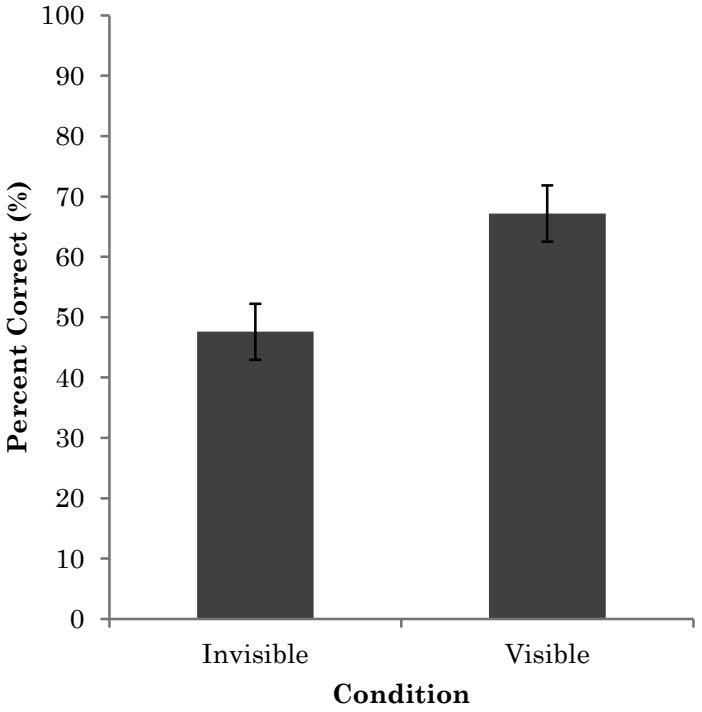

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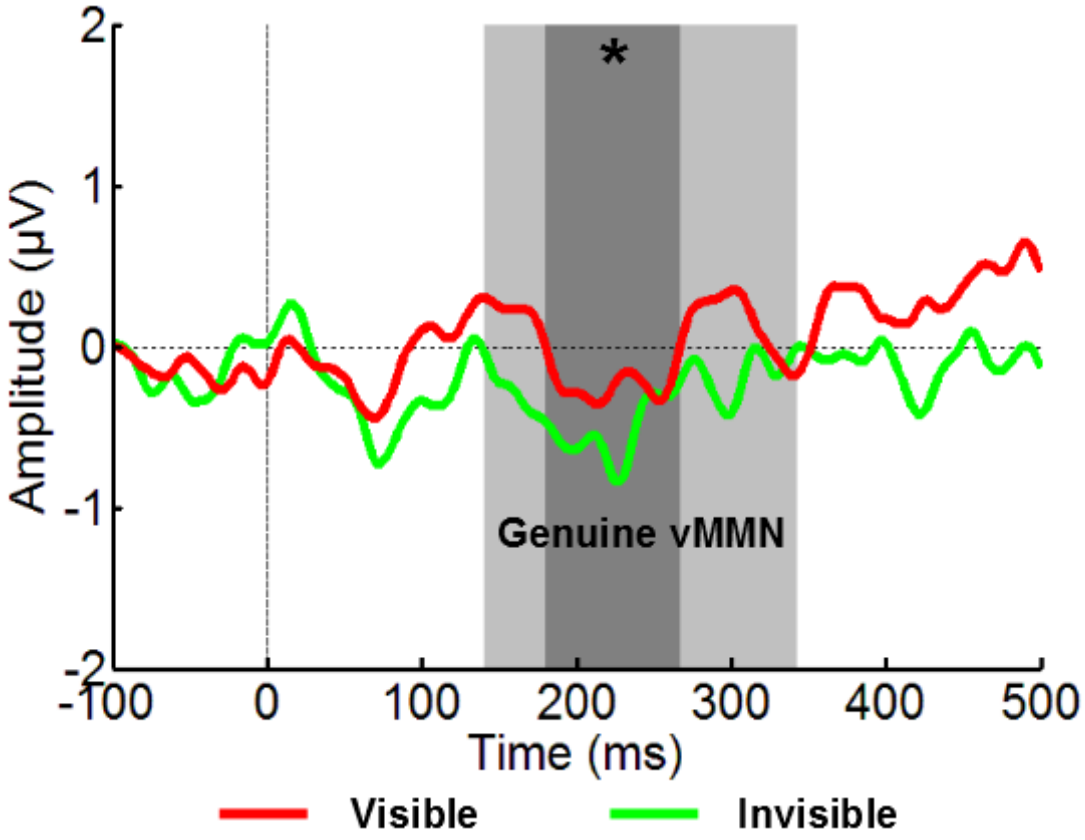

Experiment 2: General discussion

- So, can predictions be established in the absence of visual consciousness?
- **Yes!**
- Without attention, visual consciousness slows our processing of predictability of visual inputs.

Take-home messages

1. Predictions of visual input are established, tested, and updated in the absence of attention and visual consciousness.

2. Not-conscious processing of visual input is not simply a weaker version of conscious processing of visual input.

Thank you

Southern Cross University

Andreas Widmann

Robert P. O'Shea

Erich Schröger

Urte Roeber

- Martin Reiche
- Erin Corkett

The University of Sydney

DAAD
Deutscher Akademischer Austausch Dienst
German Academic Exchange Service

Thank you

Thank you for your attention and consciousness!

References

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- Tsuchiya, N., & Koch, C. (2005). Continuous flash suppression reduces negative afterimages. *Nature Neuroscience*, *8*, 1096–1101.

Visual mismatch negativity is an automatic brain response

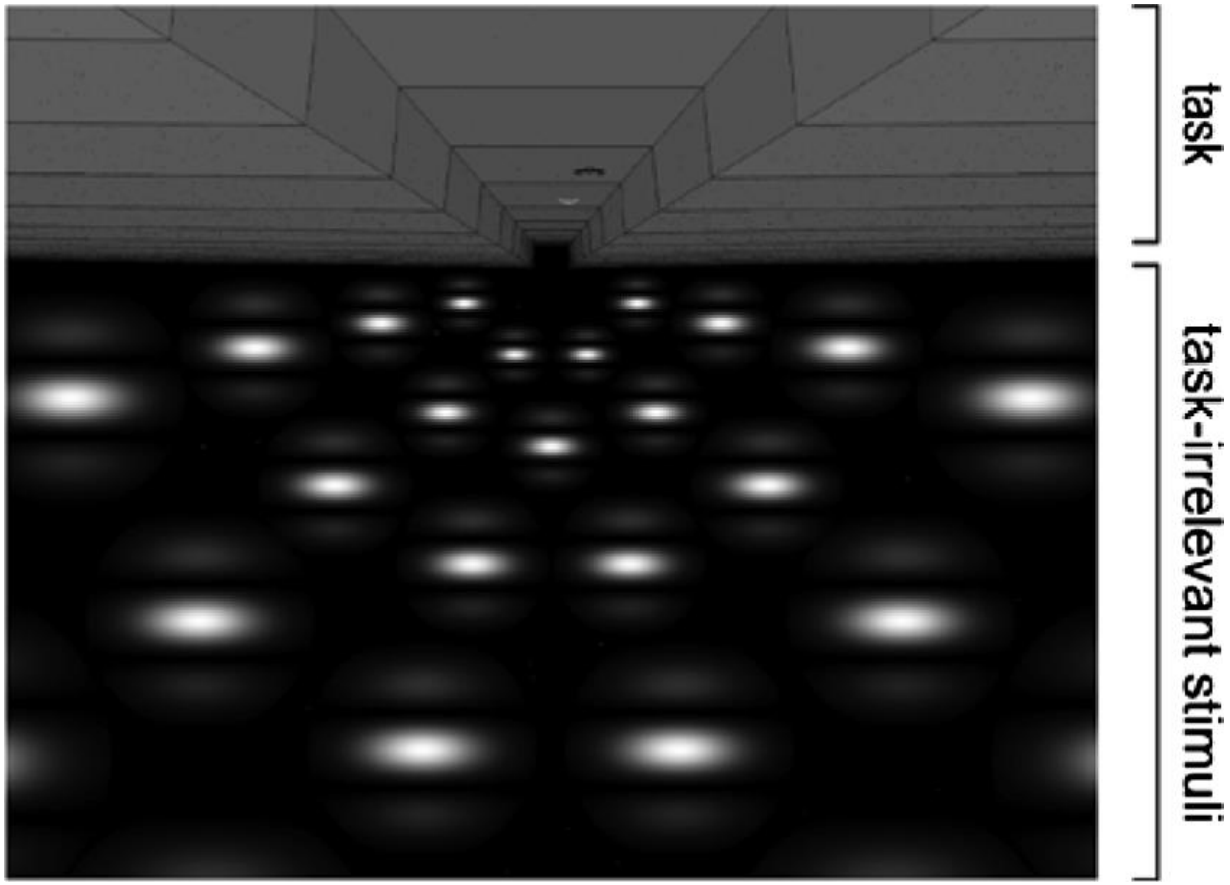

Figure from Sulykos, Kecskés-Kovács, and Czigler (2013).

Attention and consciousness: Two distinct brain processes

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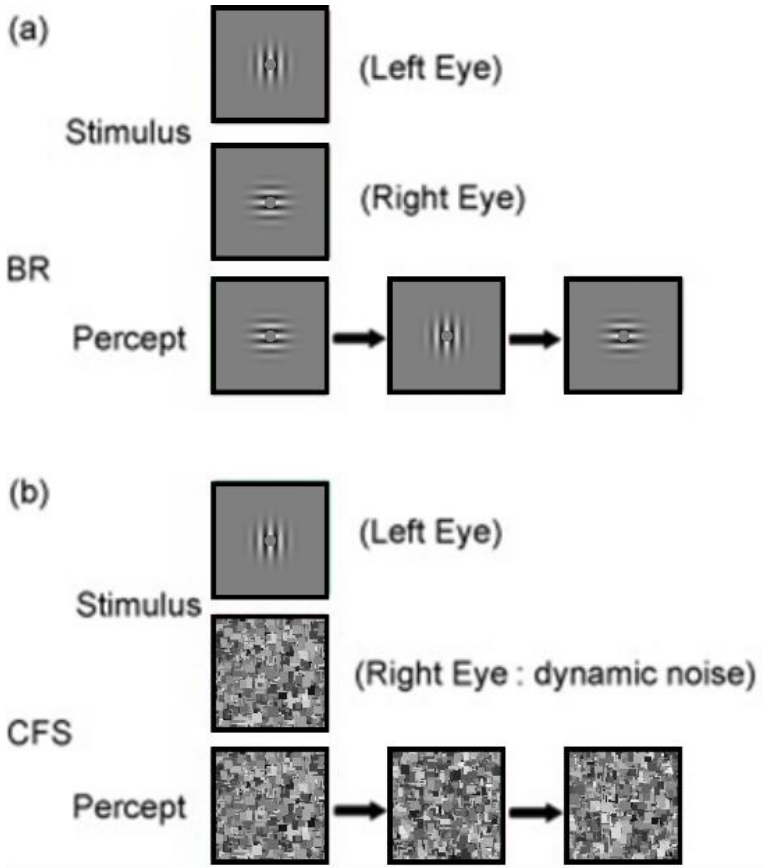
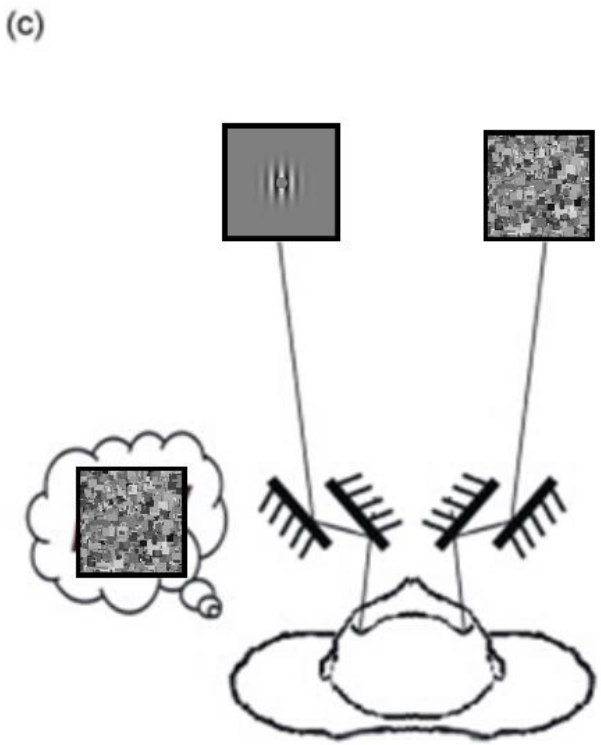
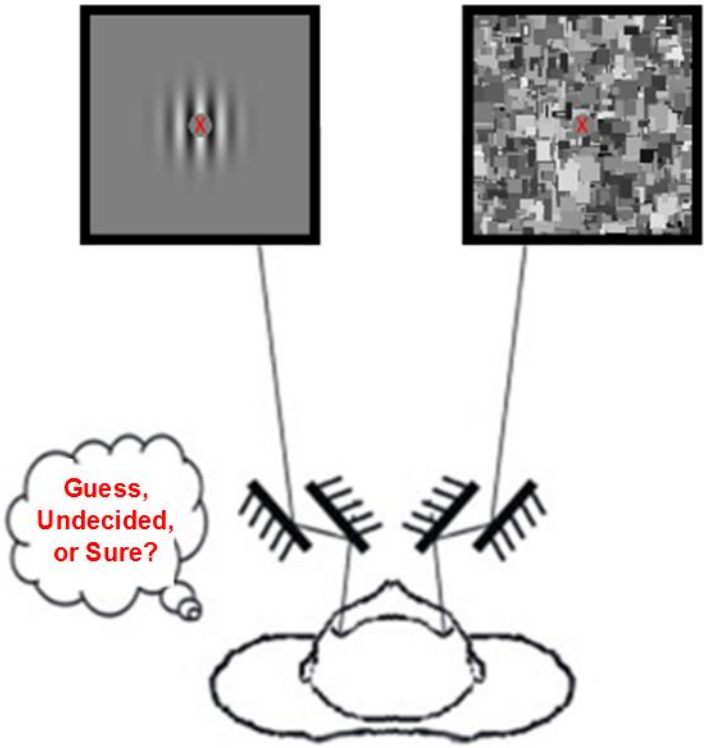
Figure adopted from Koch and Tsuchiya (2007).

Binocular rivalry and continuous flash suppression

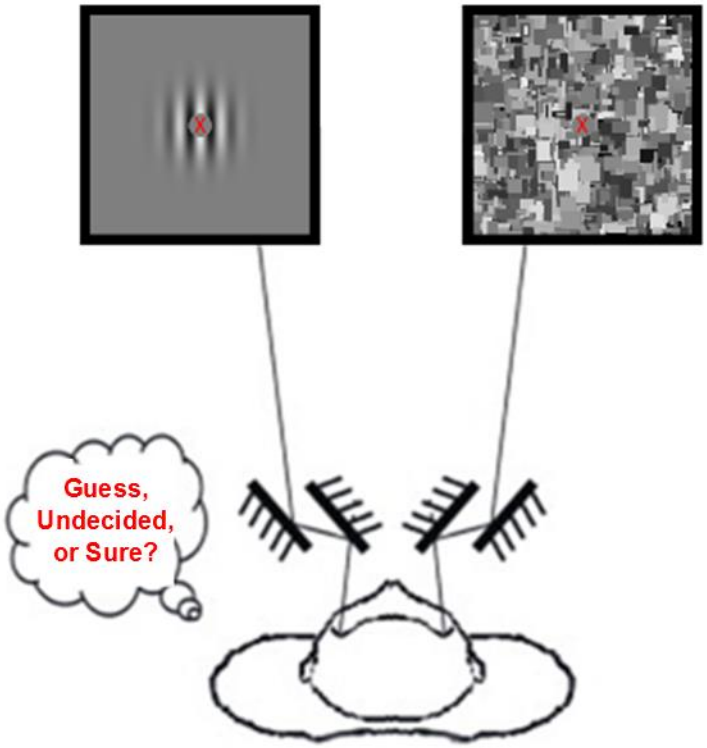


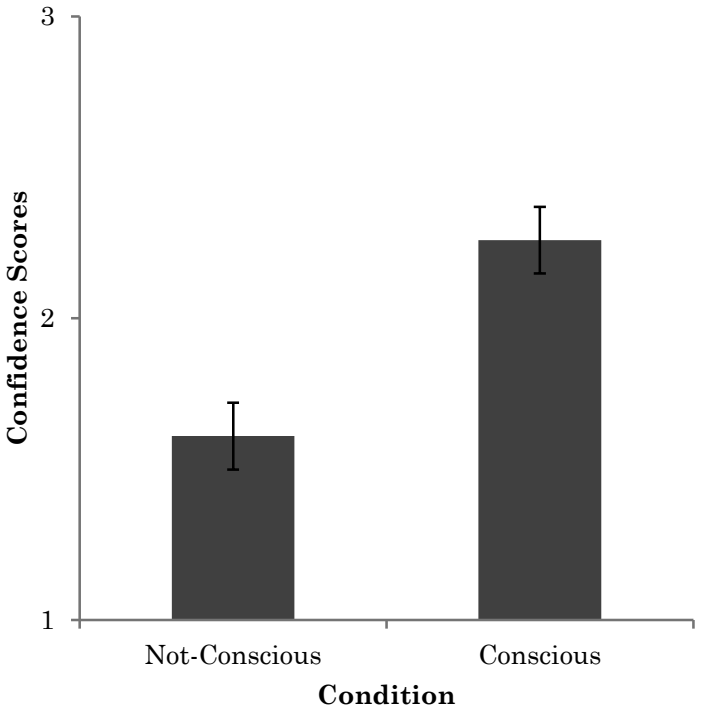


Experiment 2:
Post-test confidence task

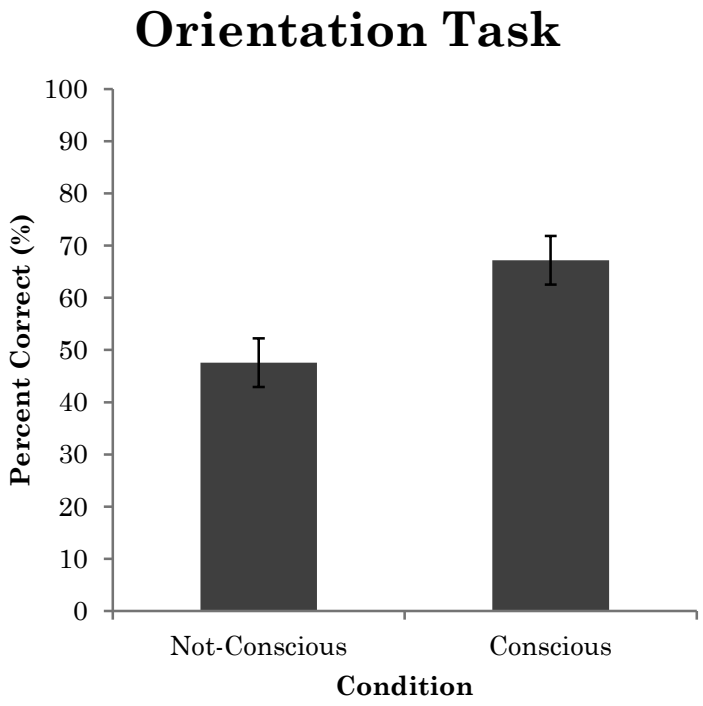


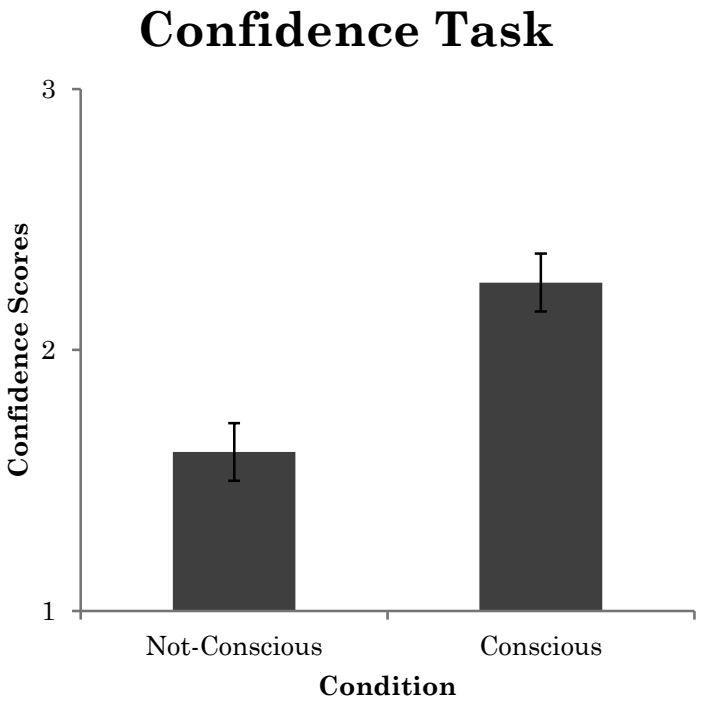
Experiment 2: Post-test confidence task





Post-test results





Take-home messages

1. Predictions of visual input are established, tested, and updated in the absence of attention and visual consciousness.

2. With attention, visual consciousness increases our processing of predictability of visual inputs.

3. Without attention, visual consciousness slows our processing of predictability of visual inputs.

Take-home messages

4. Not-conscious processing of visual input is not simply a weaker version of conscious processing of visual input.

5. Top-Down Attention ≠ Consciousness.