

Multisensory integration depends on the cortical state and cognitive resources



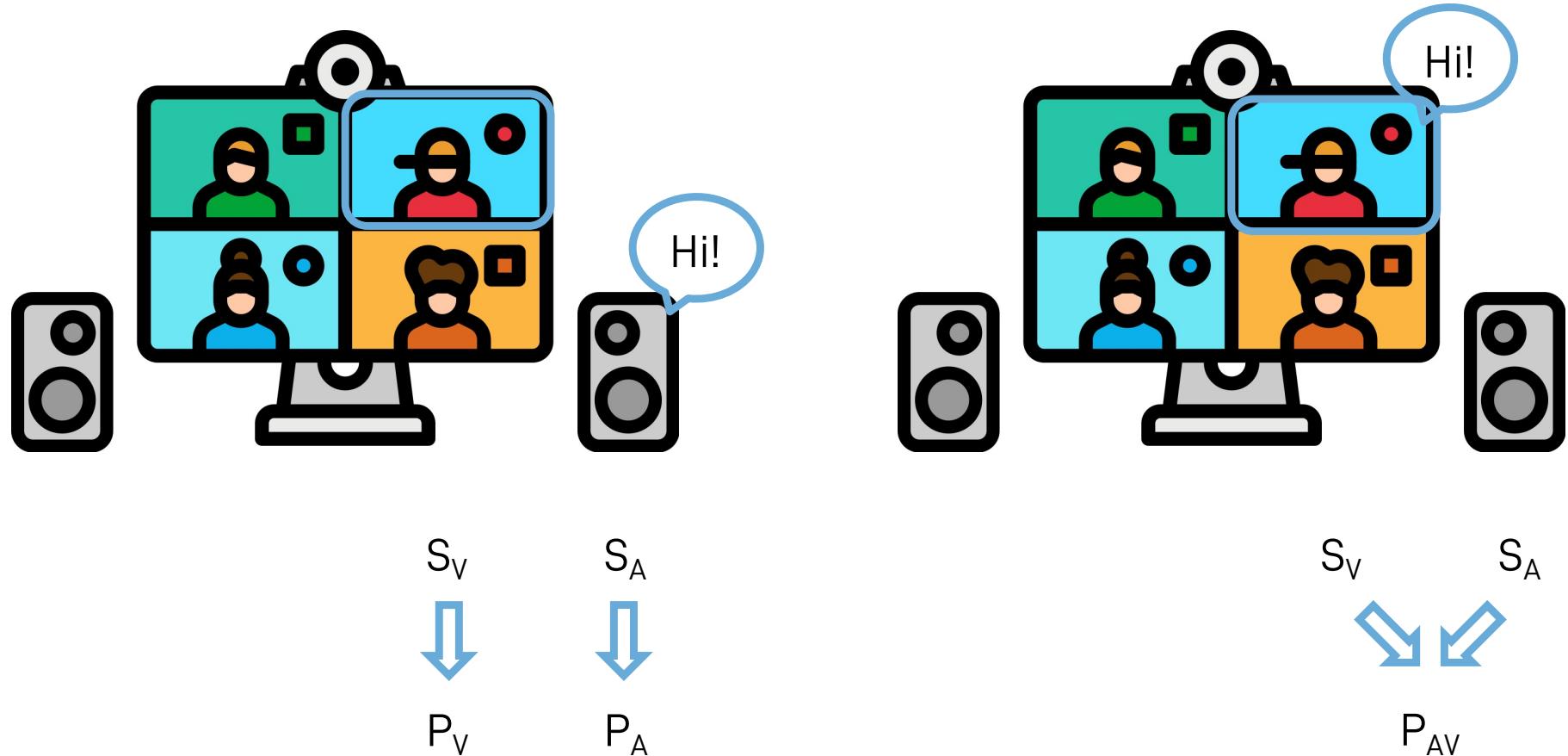
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<https://tinyurl.com/Keil-Aarhus-2021>

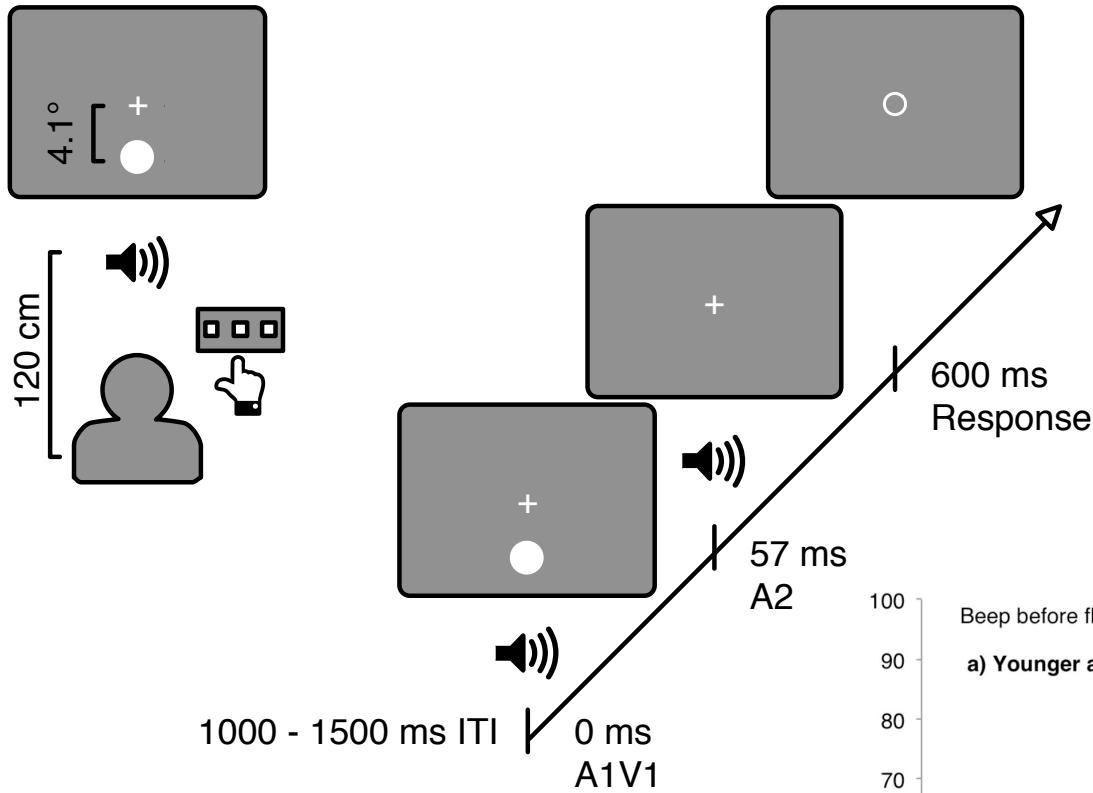
To integrate or not to integrate?



Hirst et al., 2020

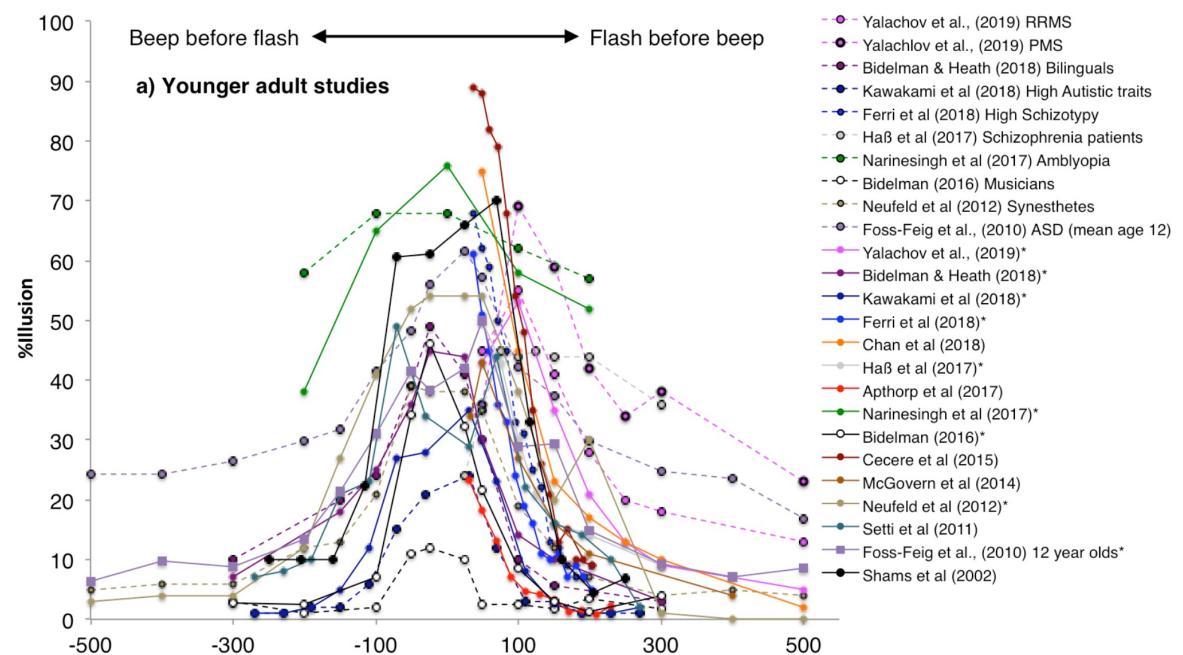
Bizley et al., 2016

Sound Induced Flash Illusion

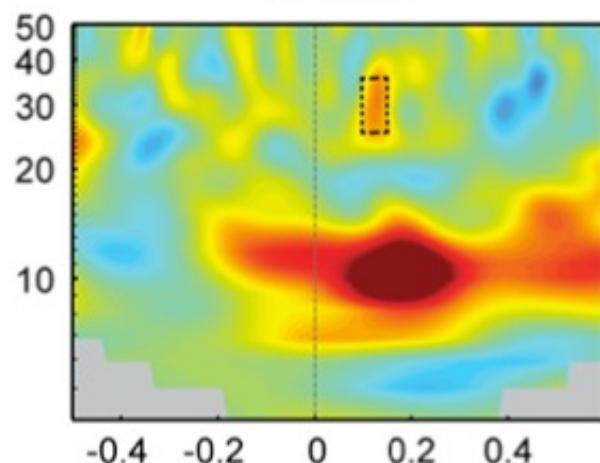
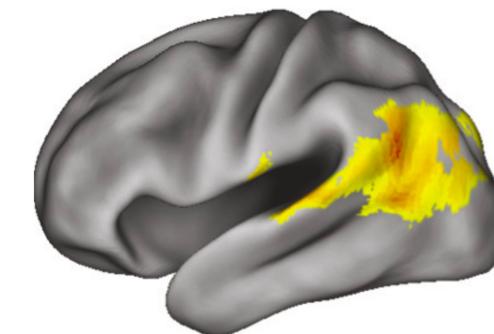
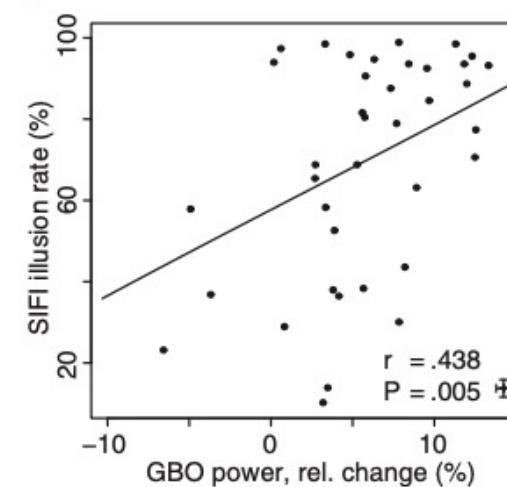
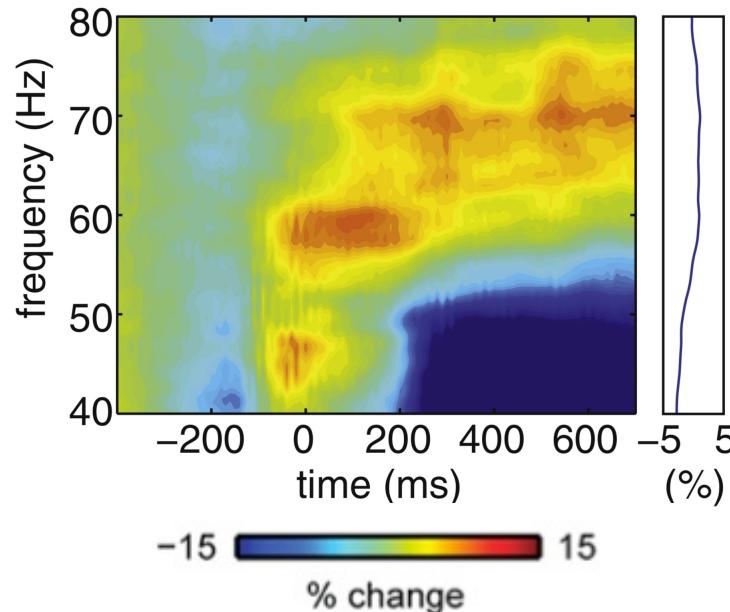


Hirst et al., 2020
Keil, 2020

- Integration...
 - Is automatic
 - Depends on stimulus characteristics



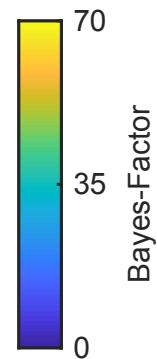
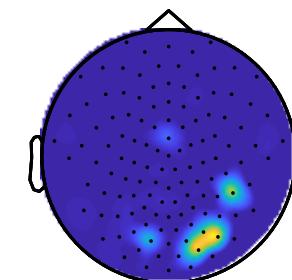
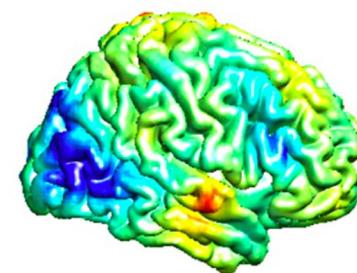
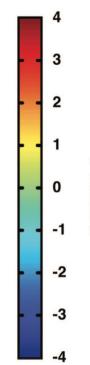
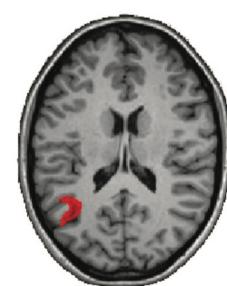
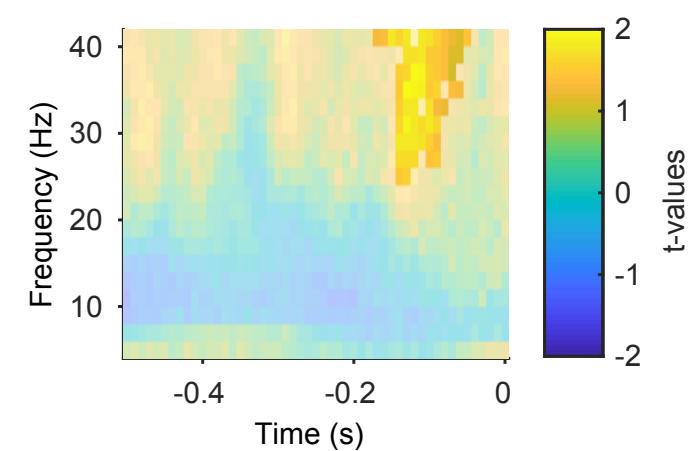
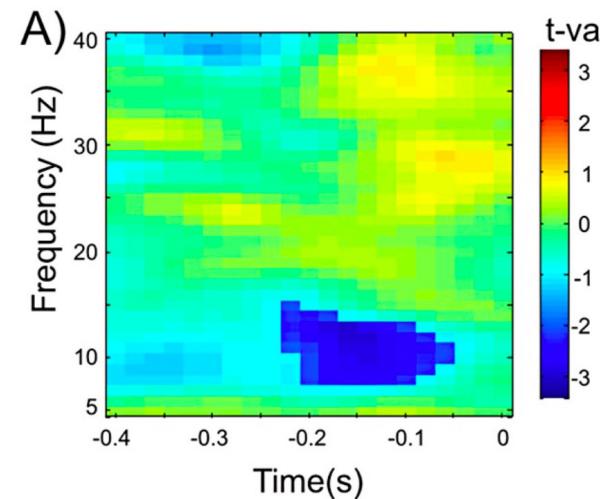
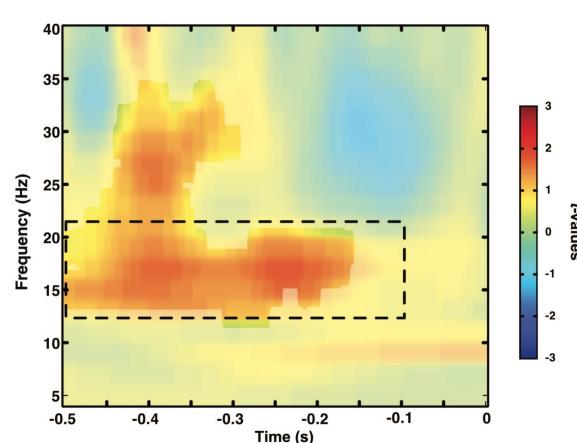
Gamma band power reflects illusion perception



- Increased gamma band power correlates with integration
- higher gamma band power for illusion vs. no-illusion perception

Cortical state influences perception

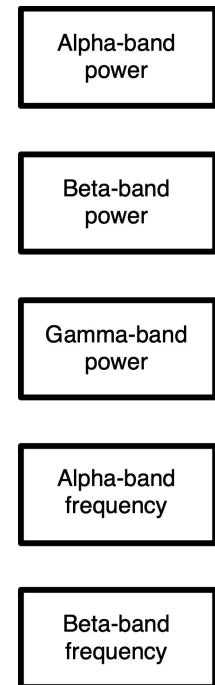
Increased beta and reduced alpha band power for illusion vs. no-illusion



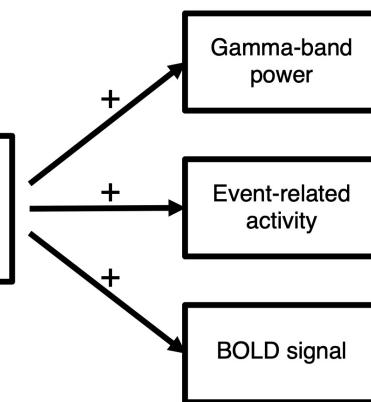
Keil et al., 2014; Lange et al., 2013; Kaiser et al., 2019

Sound Induced Flash Illusion

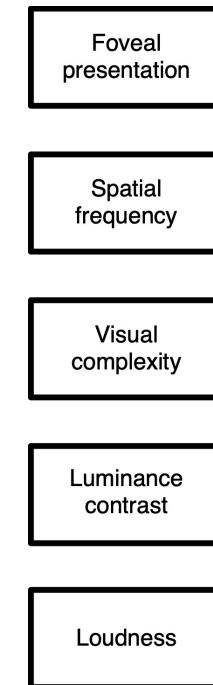
Cortical states



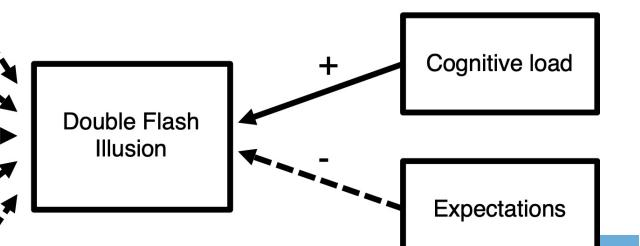
Cortical correlates



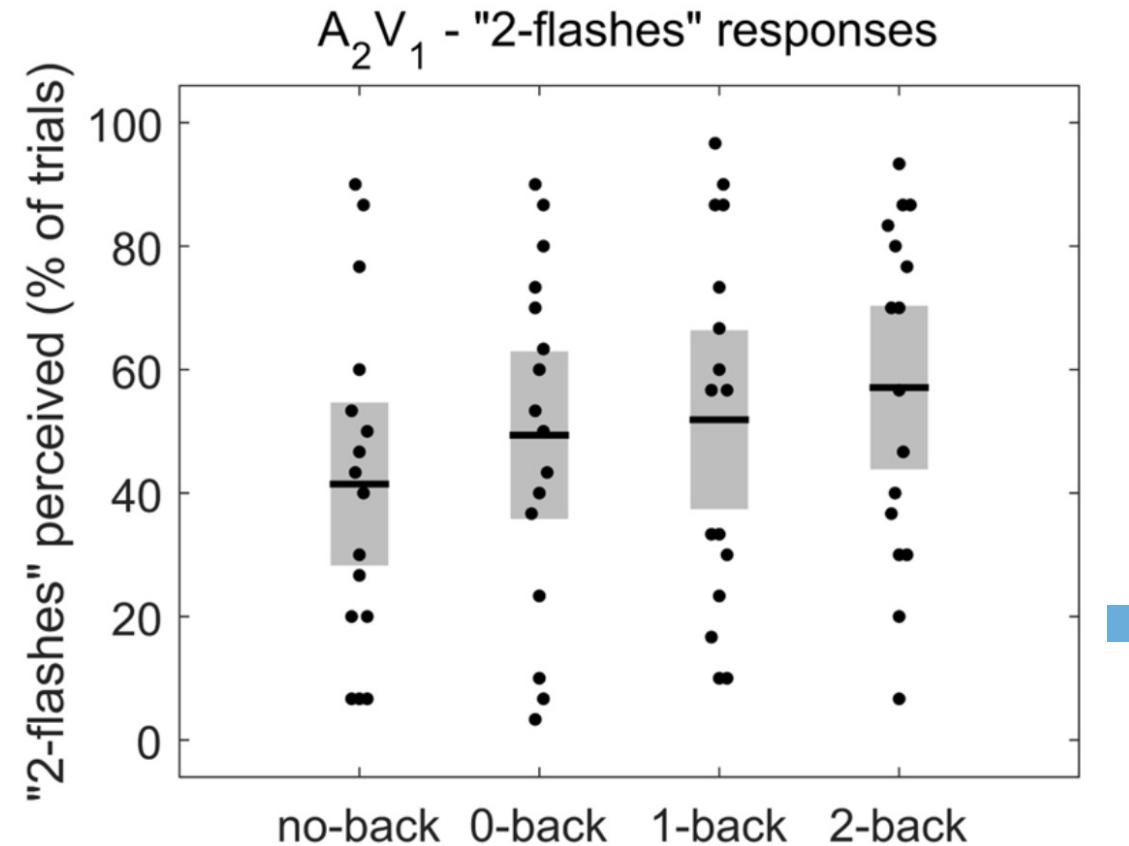
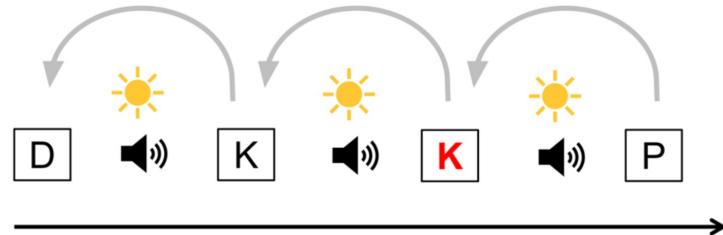
Stimulus properties



Cognitive Influences



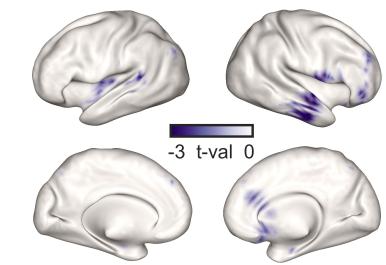
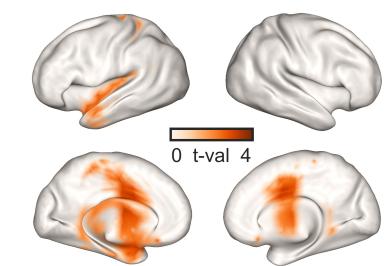
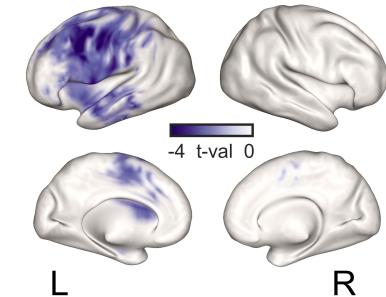
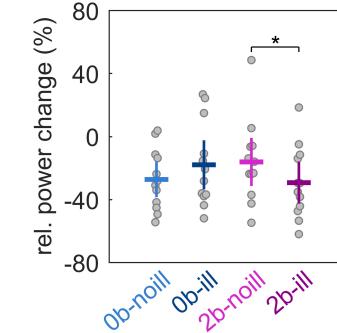
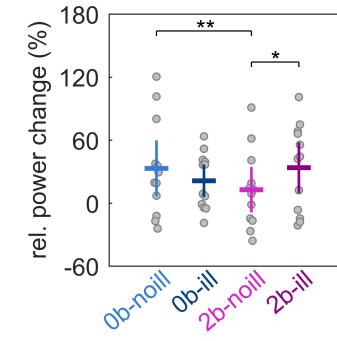
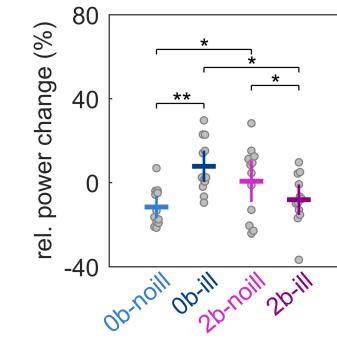
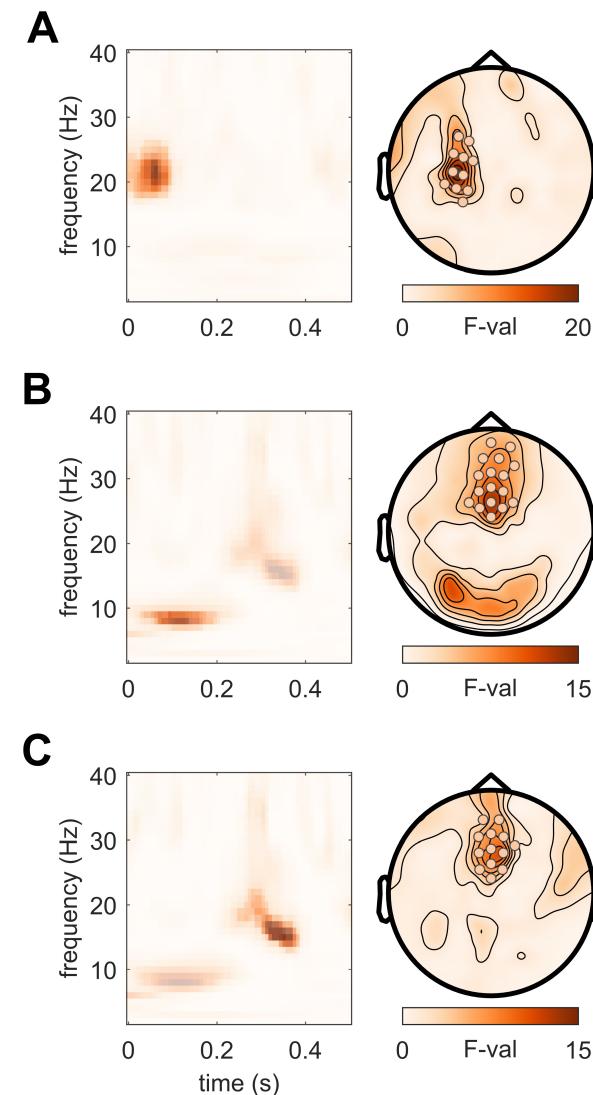
Experiment 1: Influence of Cognitive Load



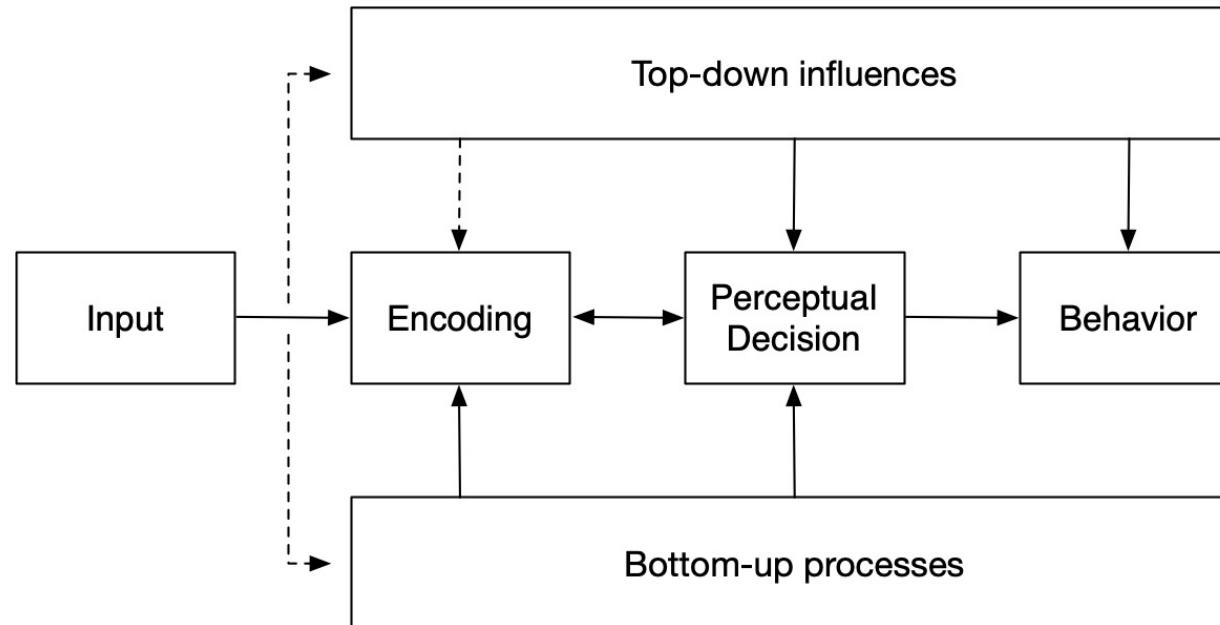
- N-back task increased cognitive load and depletes resources
- Cognitive load increases the SIFI

Experiment 2: Neural Mechanisms

- Replication: Cognitive load increases the SIFI
- Theta and beta power reflect interaction between load and perception



Multisensory integration depends on the cortical state and cognitive resources

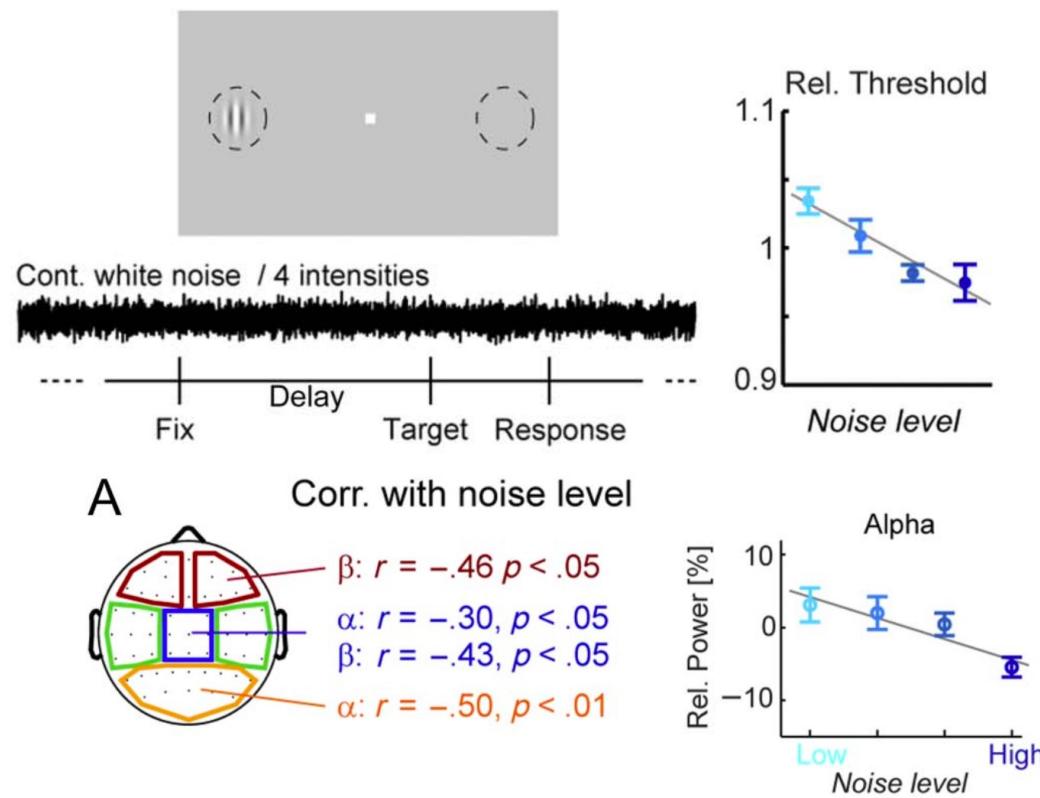


- Local cortical activity reflects cortical excitability and influences stimulus processing
- Depleting cognitive resources influences integration, but not initial processing
- Cognitive load leads to increased demand of top-down resources to resolve intersensory conflict

Next step: Change the cortical state without cognitive manipulations

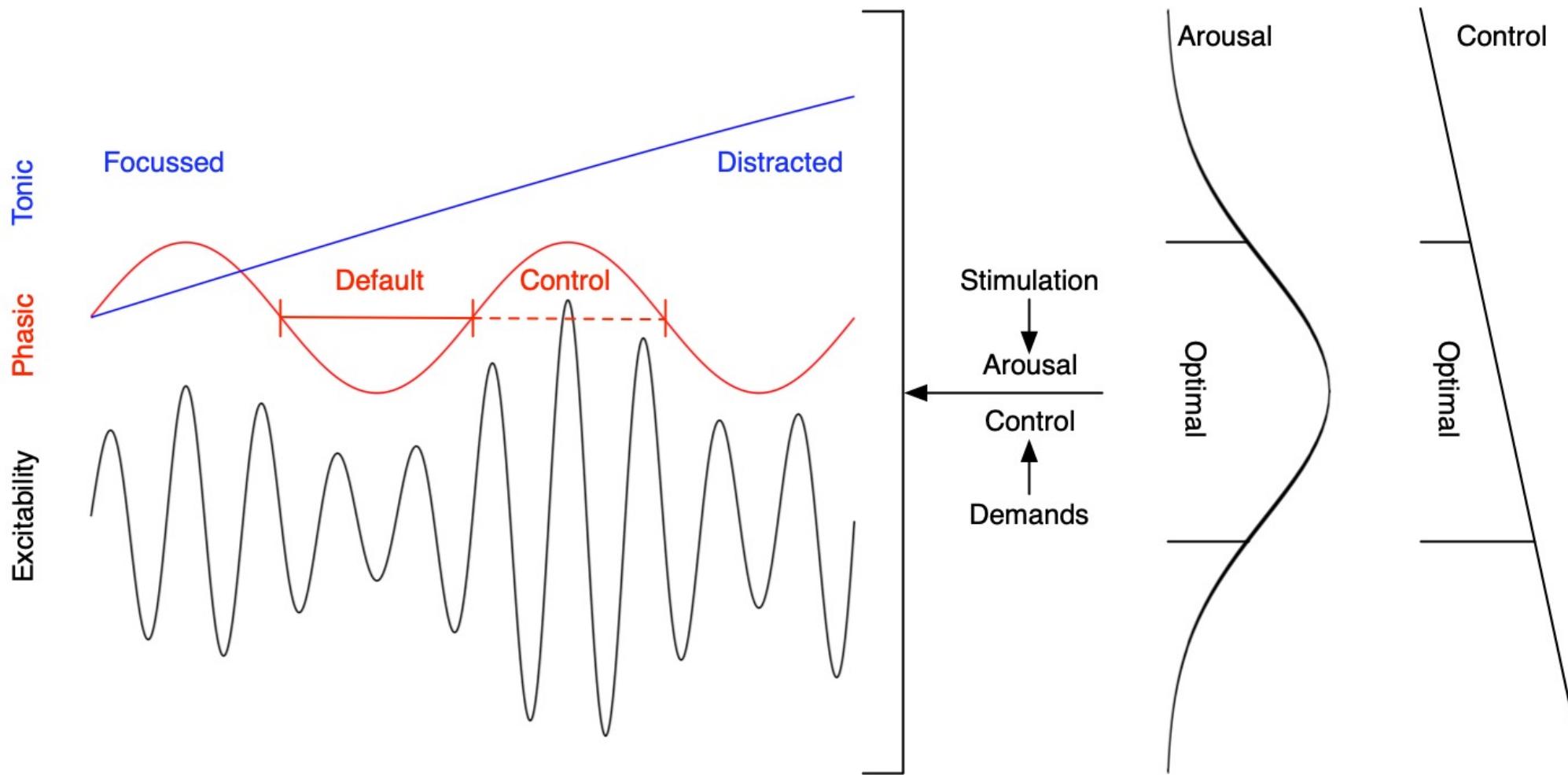
Idea: Stochastic Resonance

- Intermediate noise improves information transfer in complex systems (Moss et al., 2004)
 - What is the underlying mechanism?



Gleiss & Kayser, 2014; Keil et al., in prep.

Proposal: Interplay between excitability, arousal, and cognitive control



Thank you!



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Mathis Kaiser, Dr. James Moran,
Dr. Georgios Michail



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KE1828/4-1 (2016-2021)
KE1828/(?)

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