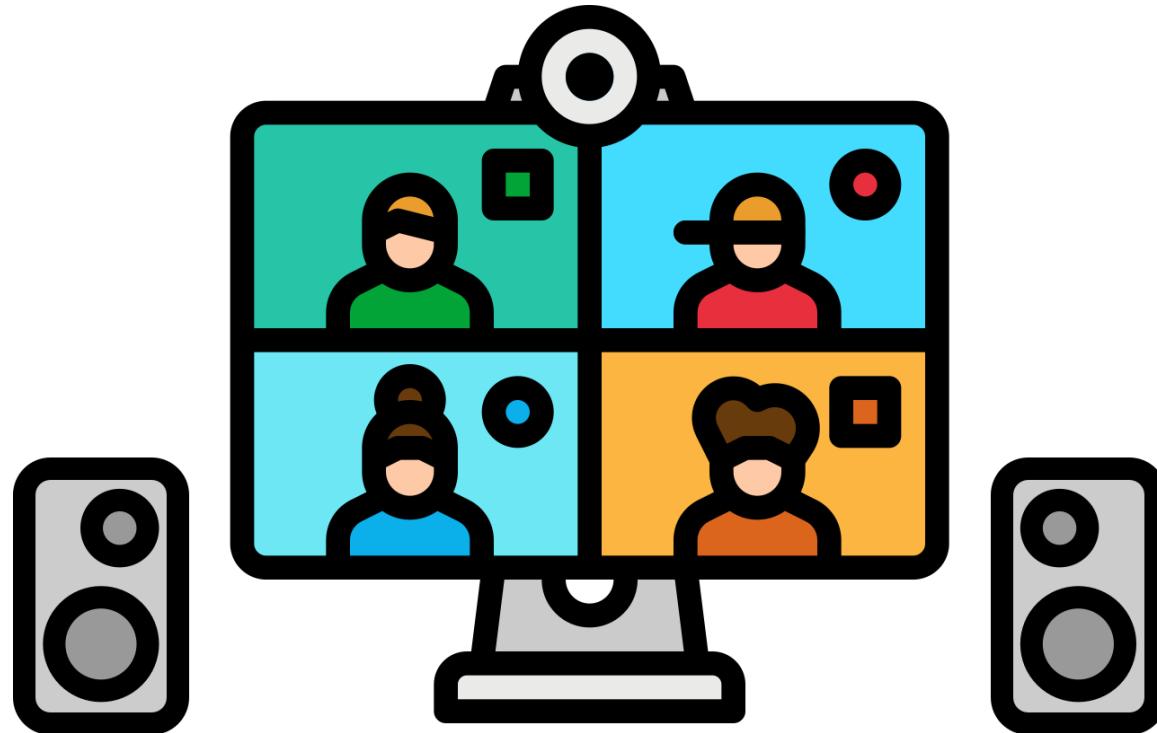


# Changing perception: Influences on multisensory integration



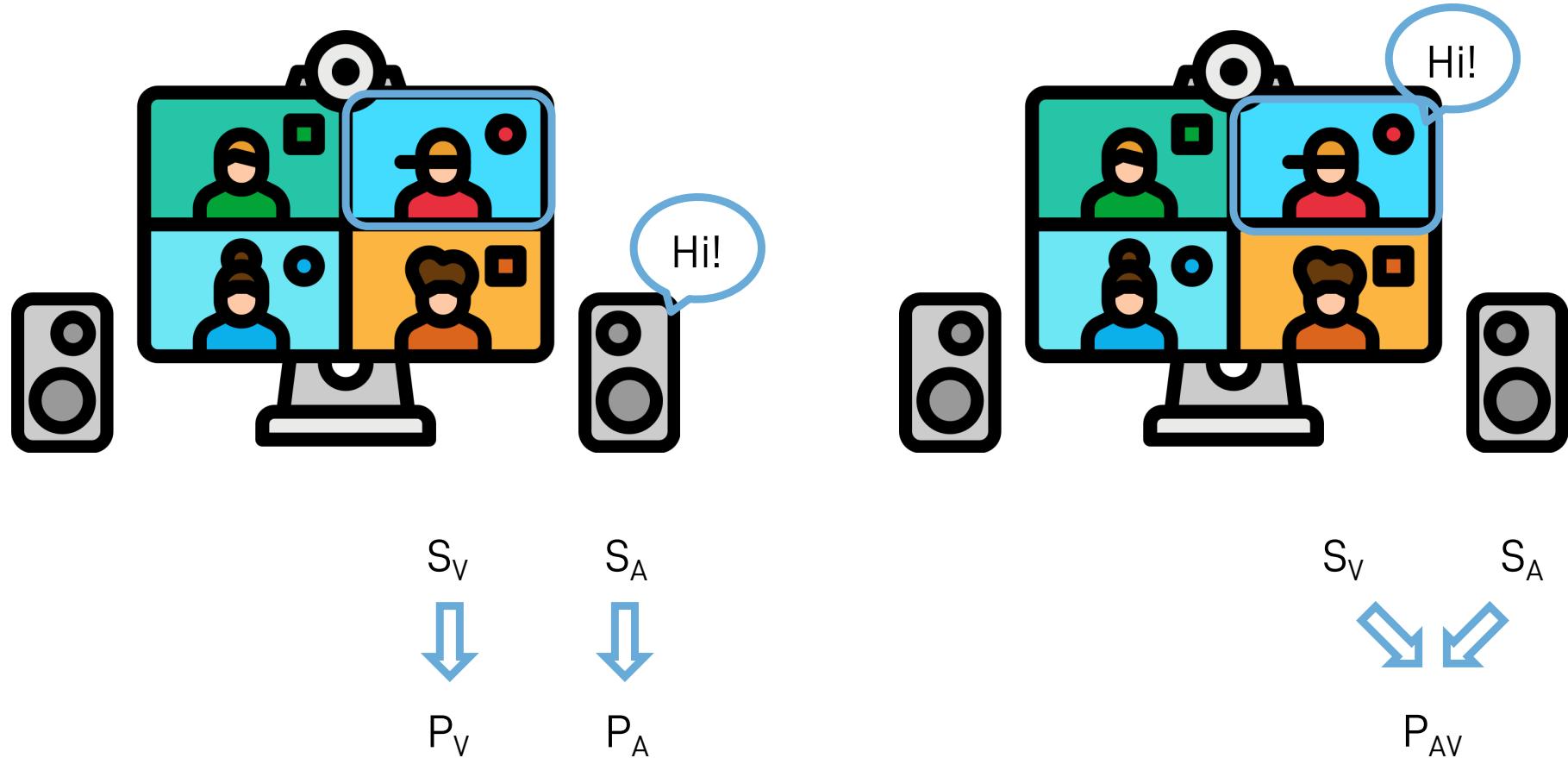
Dr. Julian Keil

Biologische Psychologie

[www.biopsych.uni-kiel.de](http://www.biopsych.uni-kiel.de) | [keil@psychologie.uni-kiel.de](mailto:keil@psychologie.uni-kiel.de) | [@drjuliankeil](https://twitter.com/drjuliankeil)

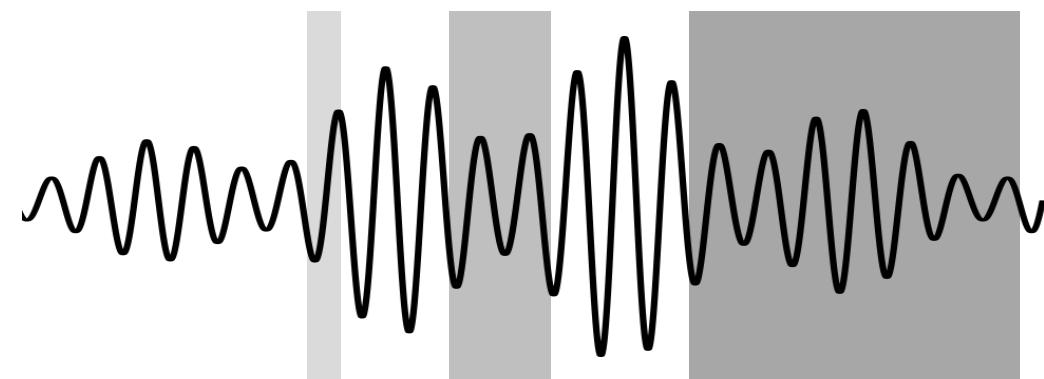
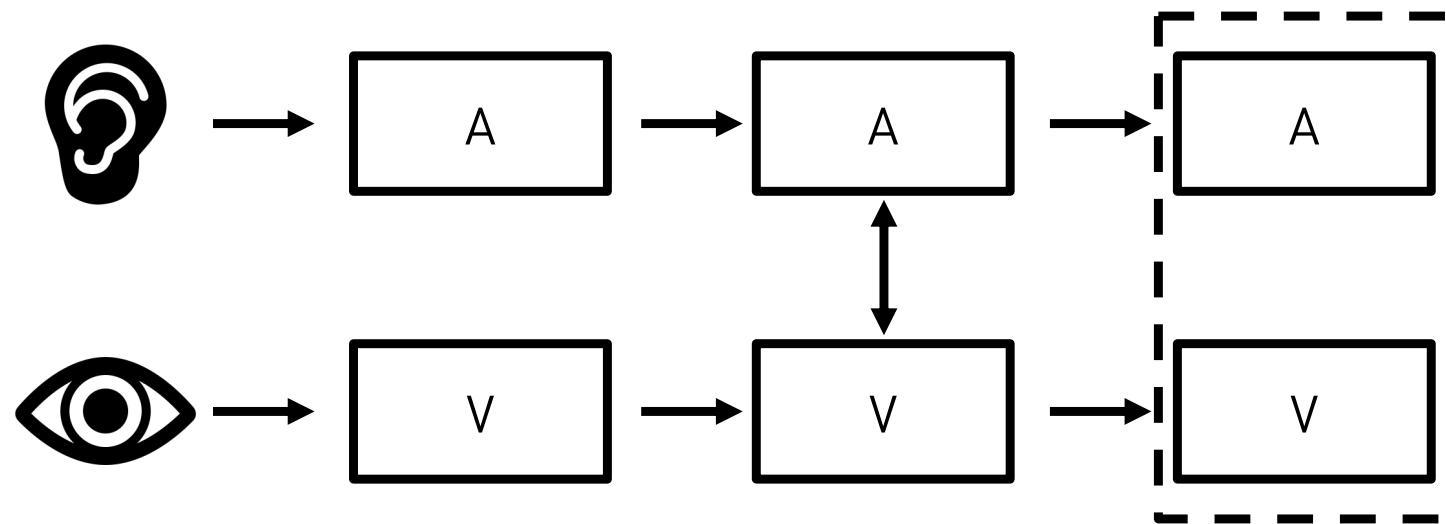
<https://github.com/juliankeil/Slides>

# To integrate or not to integrate?

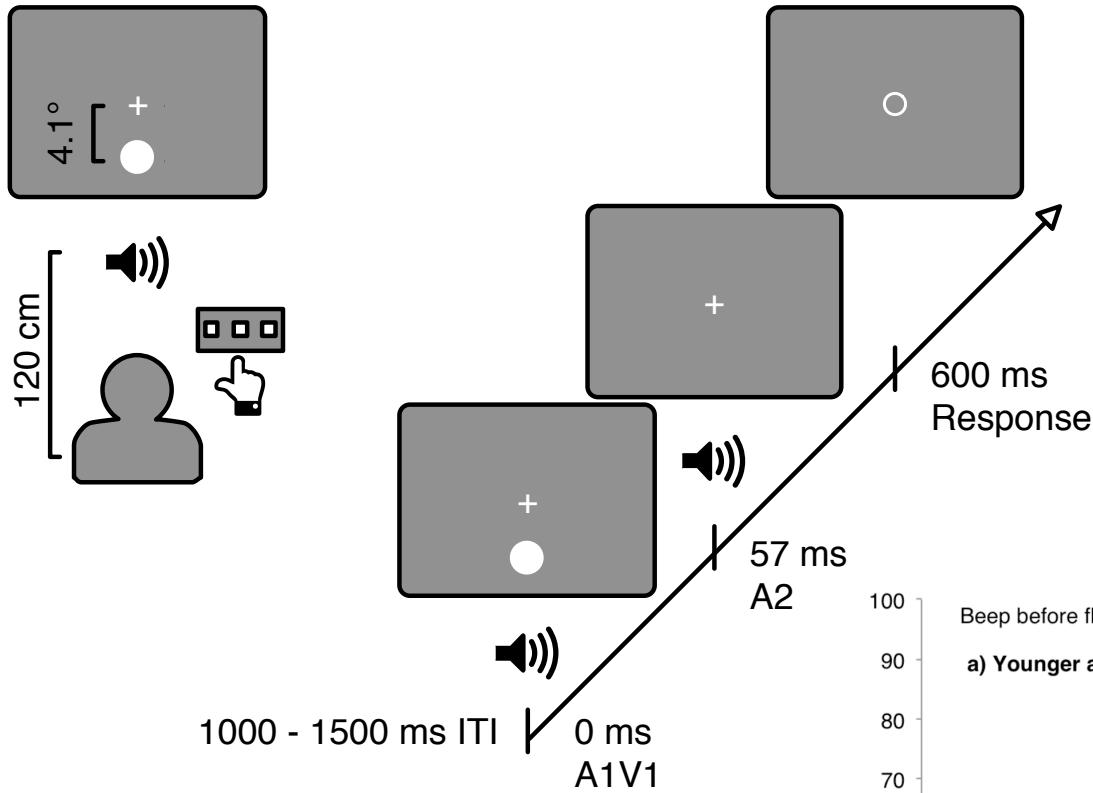


# Overview

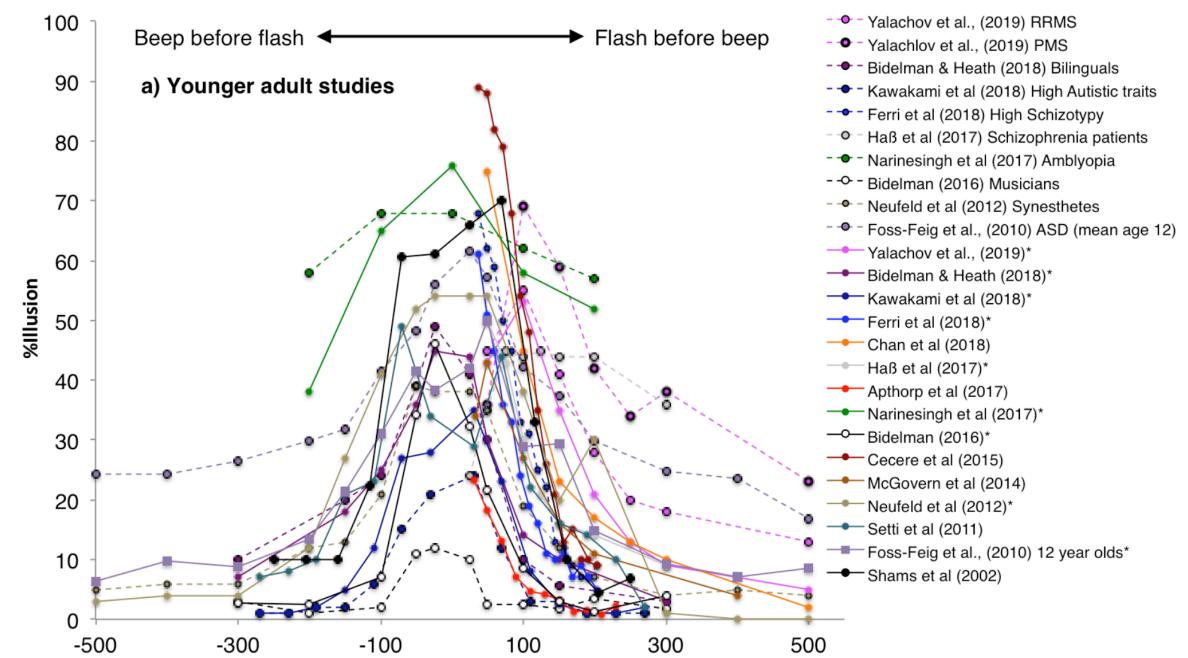
Stimulation      Encoding      Evaluation      Integration



# Sound Induced Flash Illusion



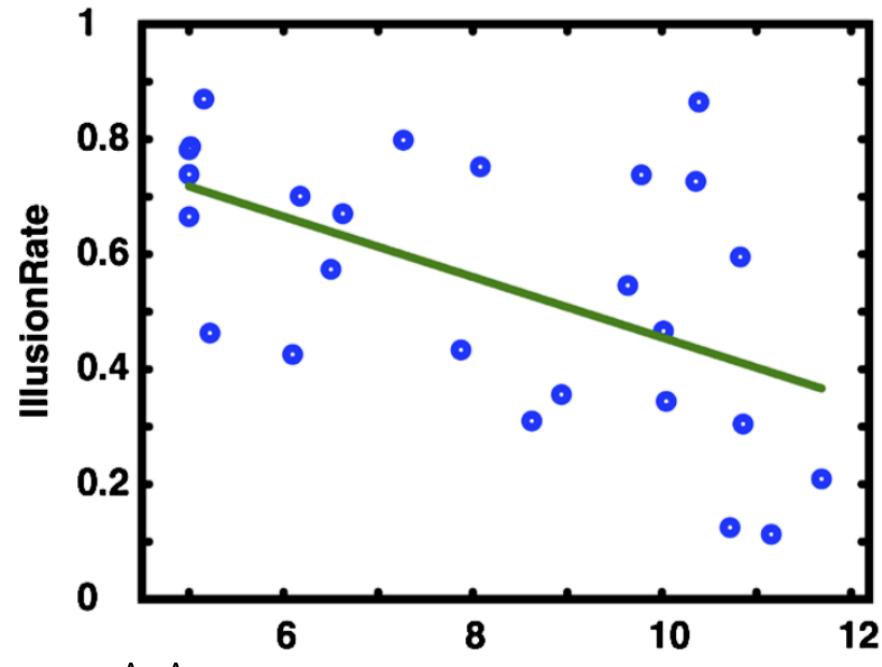
Hirst et al., 2020; Keil, 2020



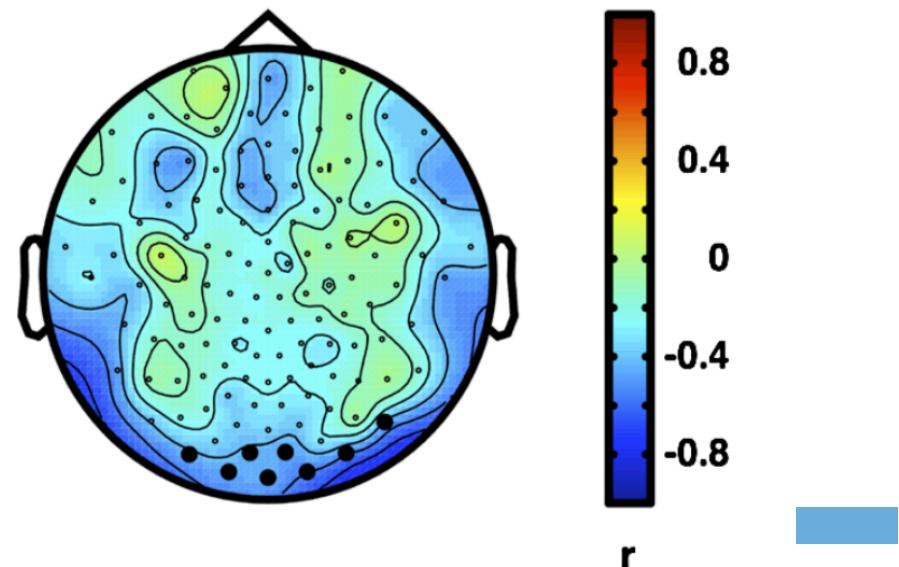
# Window: Temporal Binding

A

$$r = -0.5388 \quad p = 0.0045$$

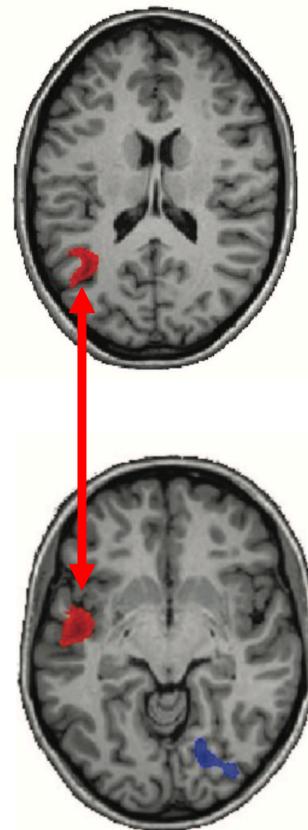
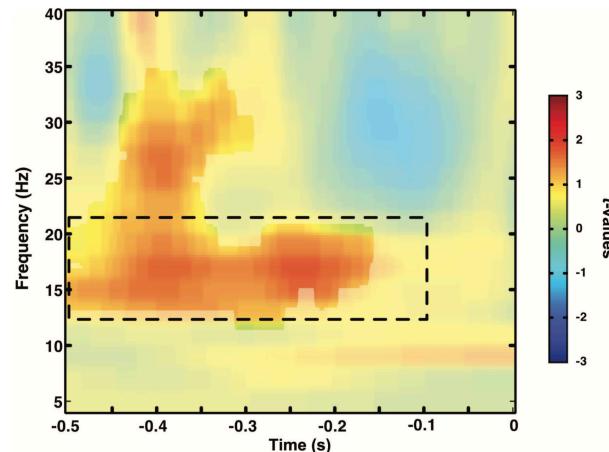


B



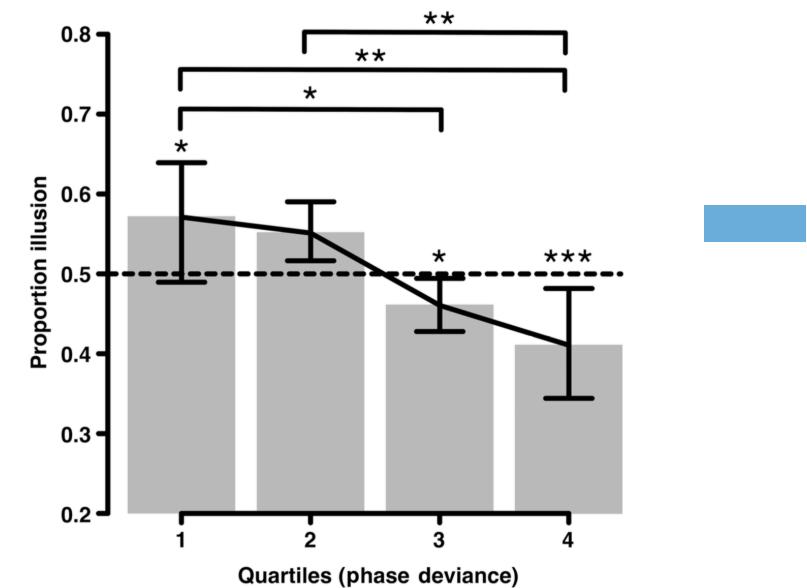
Alpha oscillation as a temporal binding window: Stimuli within one cycle are more likely to be integrated

# State: Local and Network Activity

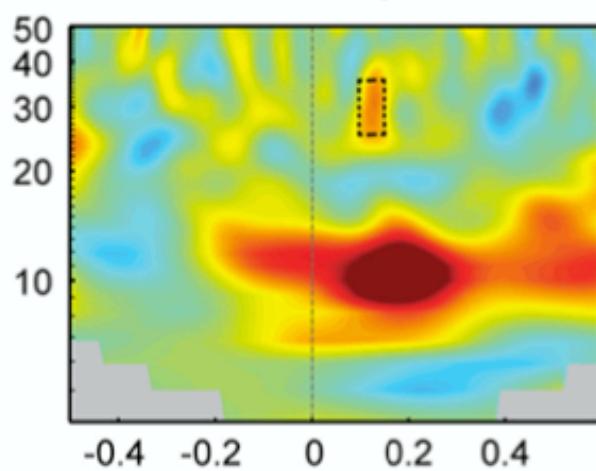
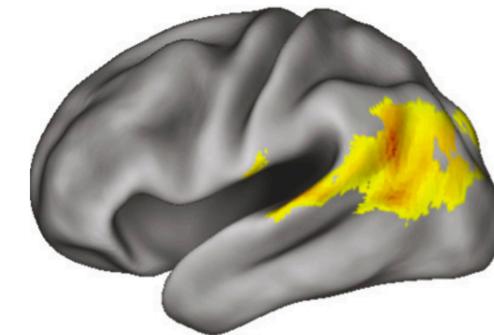
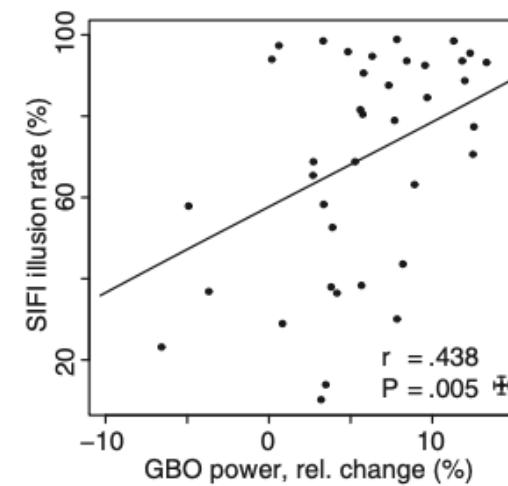
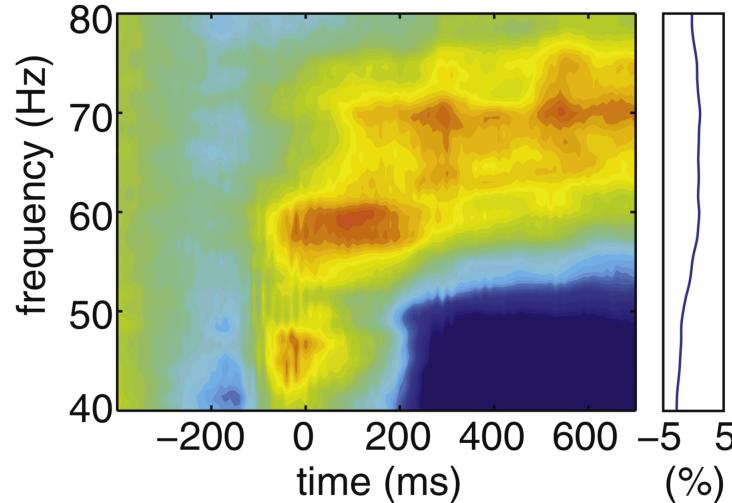


Beta connectivity reflects crossmodal influences: Similar phase angle supports integration

Beta power reflects state of integration areas: High power supports integration

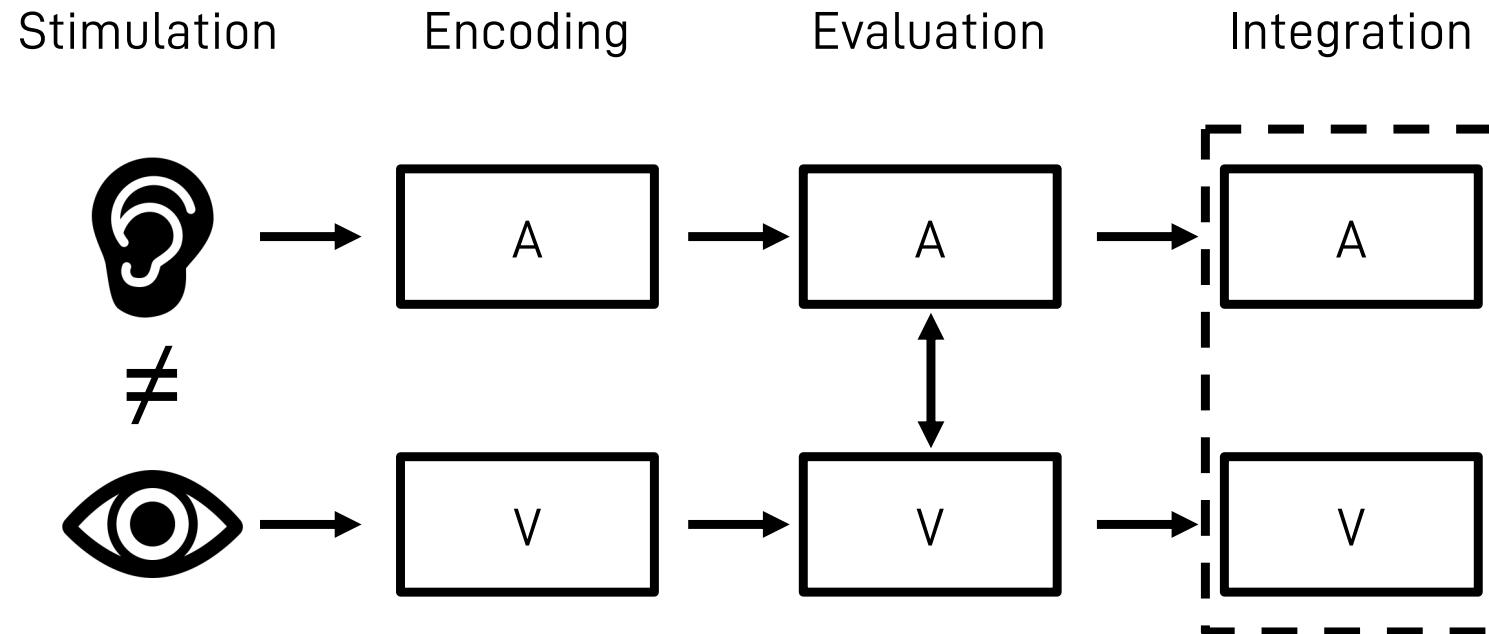


# State: Local and Network Activity



Increased gamma band power correlates with integration (illusion rate), higher gamma band power for illusion compared to no-illusion perception

# Interim Summary 1



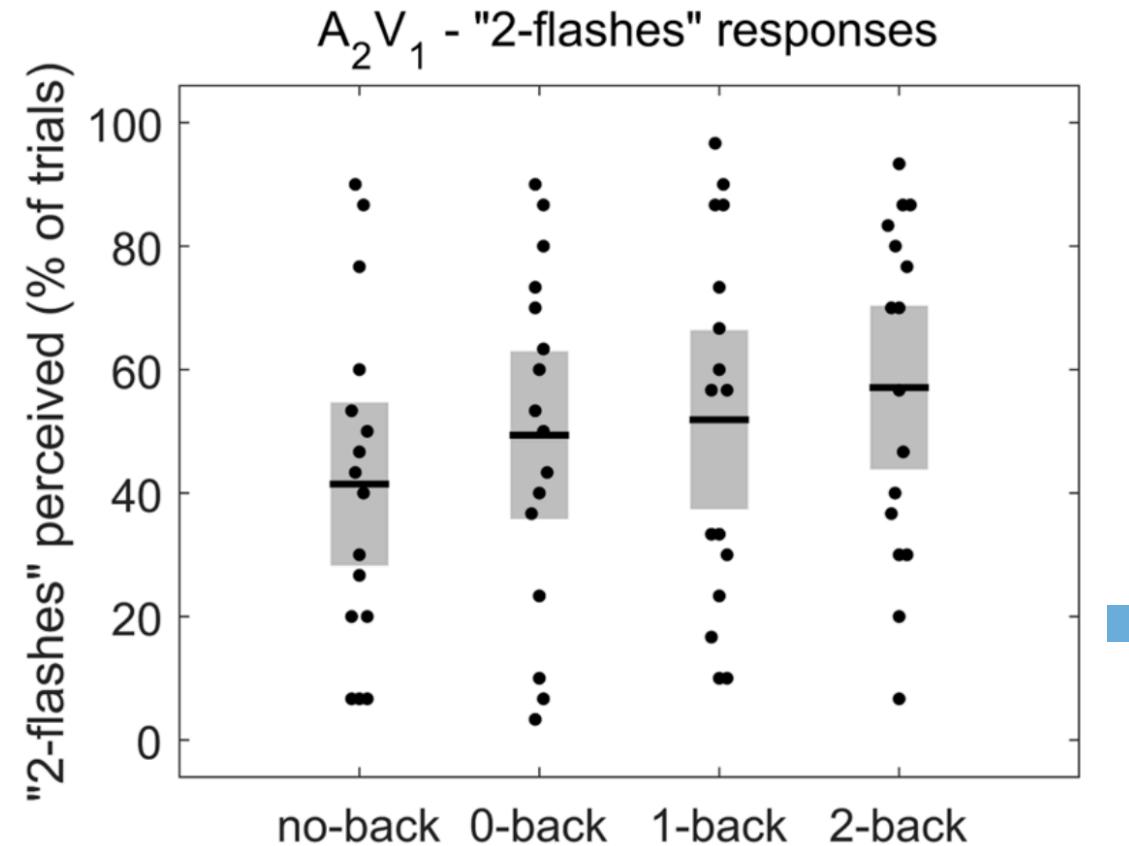
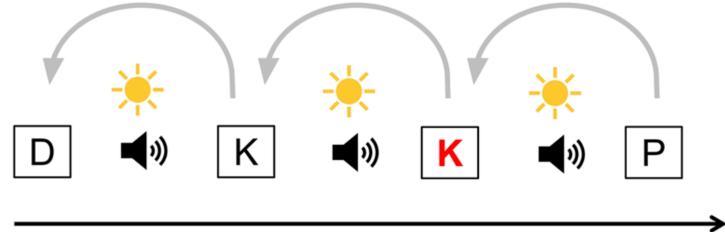
Encoding: Local and network states influence stimulus processing

- Alpha frequency as temporal binding window
- Beta power, beta connectivity as state of crossmodal communication

Evaluation and Integration: Local power reflects multisensory integration

- Gamma power in multisensory integration areas correlates with illusion perception

## Context: Cognitive Load



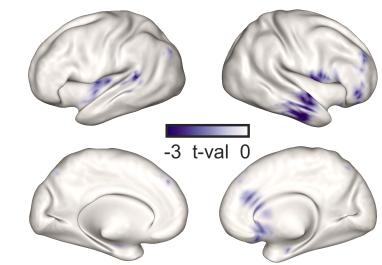
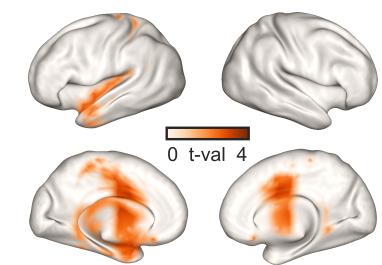
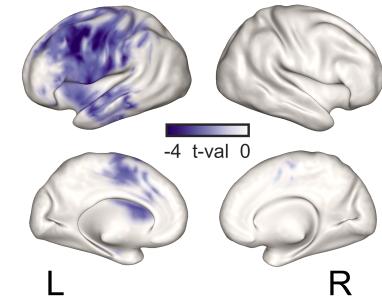
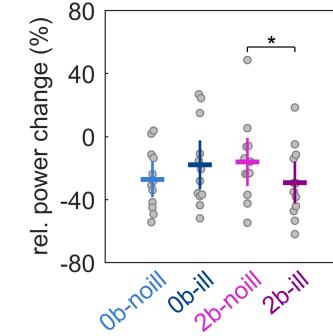
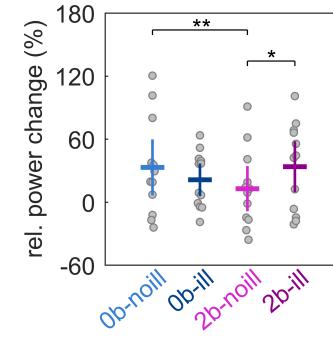
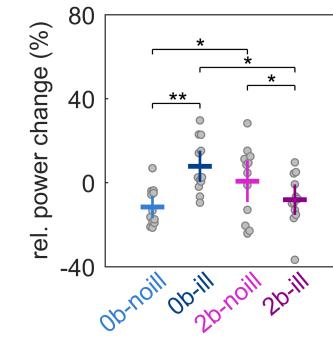
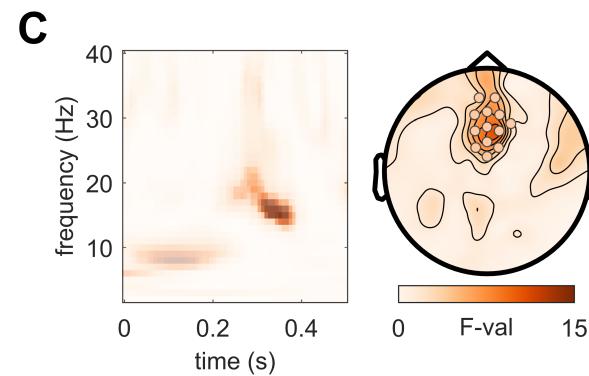
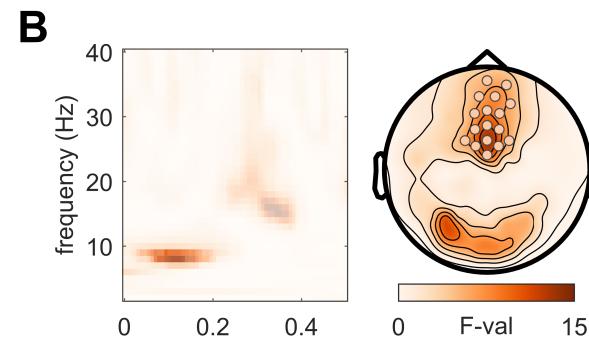
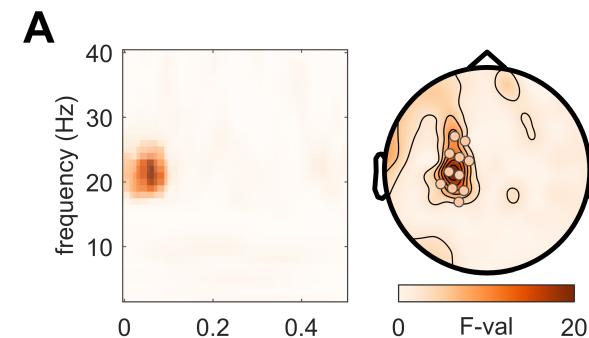
N-back task increased cognitive load and depletes resources

Cognitive load increases integration (illusion rate)

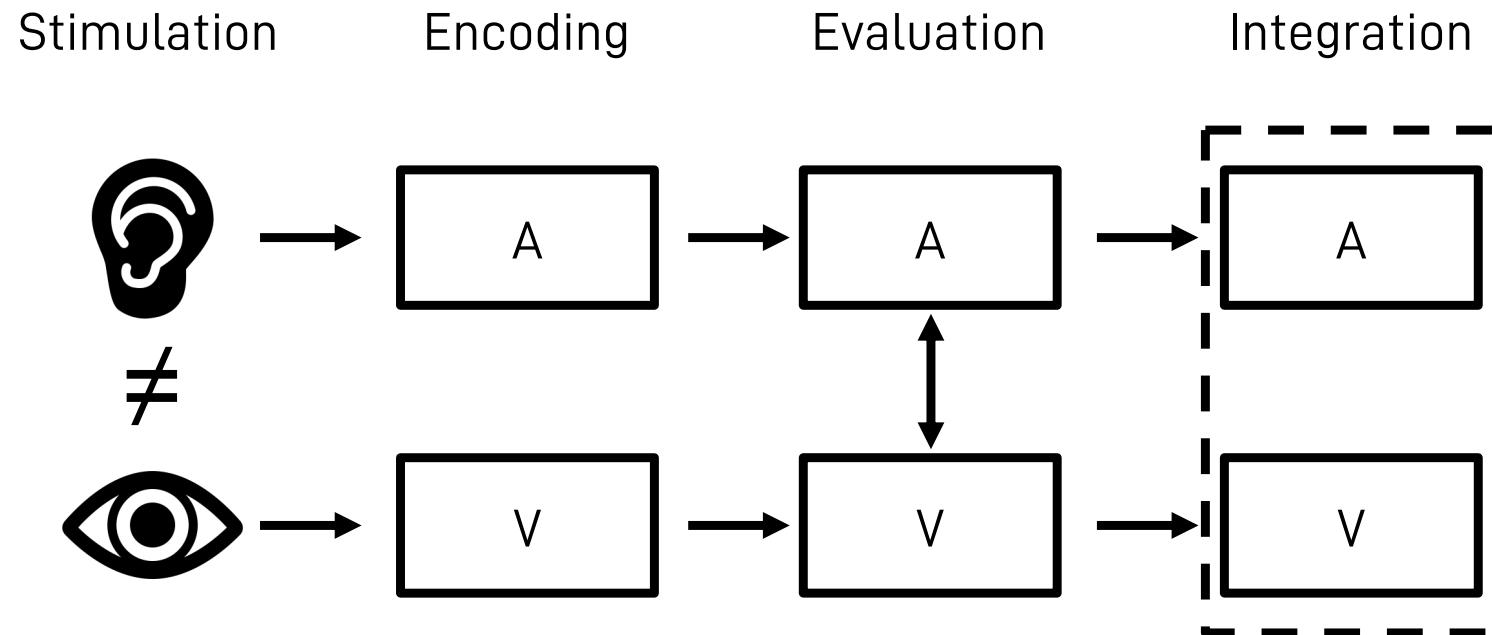
# Context: Cognitive Load

Replication:  
Cognitive load  
increases the  
SIFI

Theta and beta  
power reflect  
evaluation and  
integration  
under low  
resources



## Interim Summary 2



Encoding: Local and network states influence stimulus processing

- Alpha frequency, beta power, beta connectivity

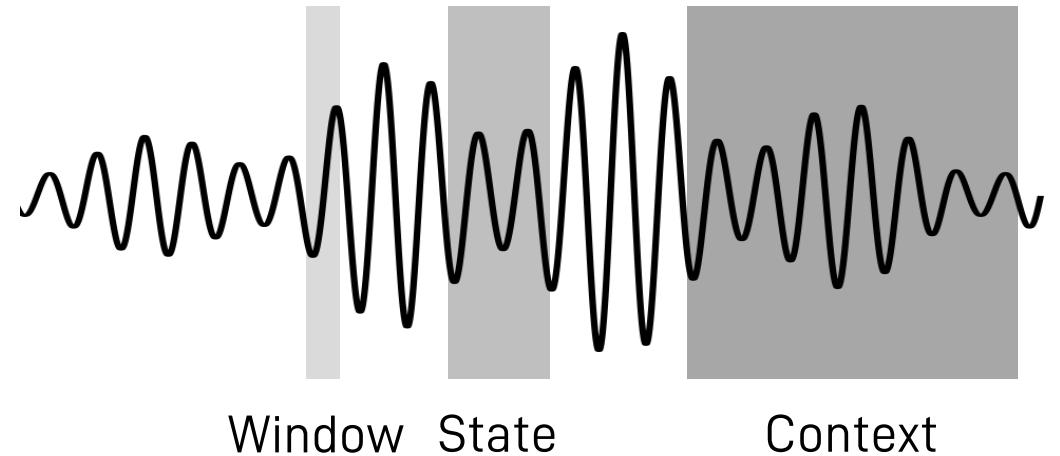
Evaluation and Integration: Cognitive load influences perception

- Gamma power reflects bottom-up integration
- Theta and beta power reflect top-down control in crossmodal evaluation and integration

# Outlook

Multisensory integration and perception depends on:

- Window: Local cortical oscillation
- State: Local and network configuration
- Context: Available resources

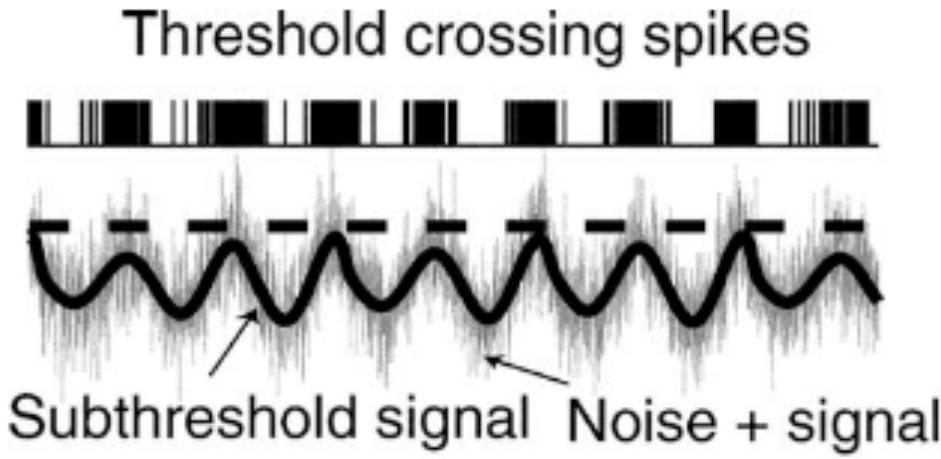


Next step:

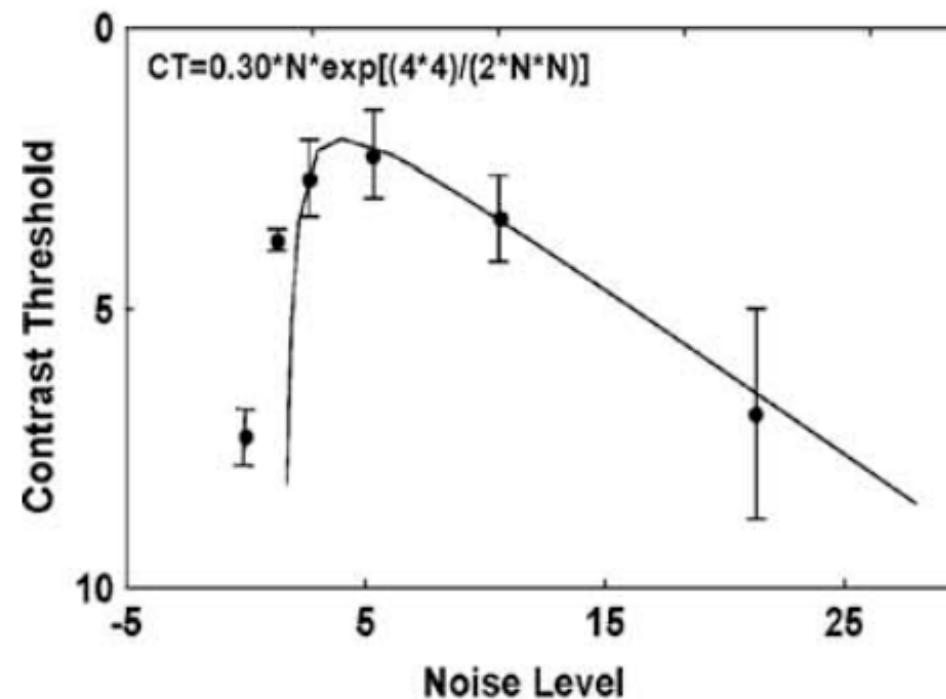
- Influence global cortical state by boosting arousal



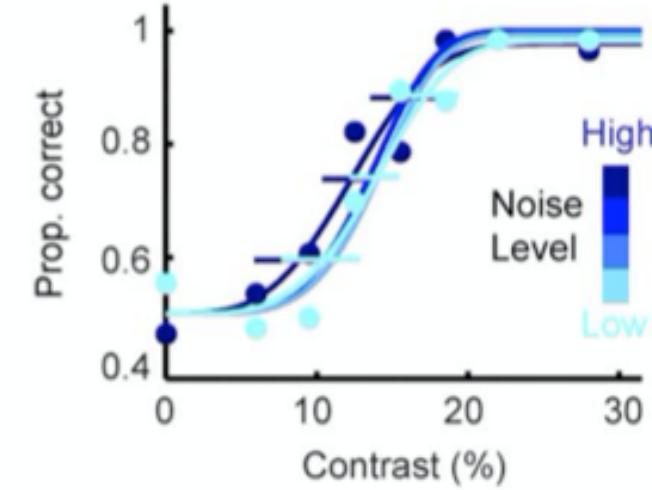
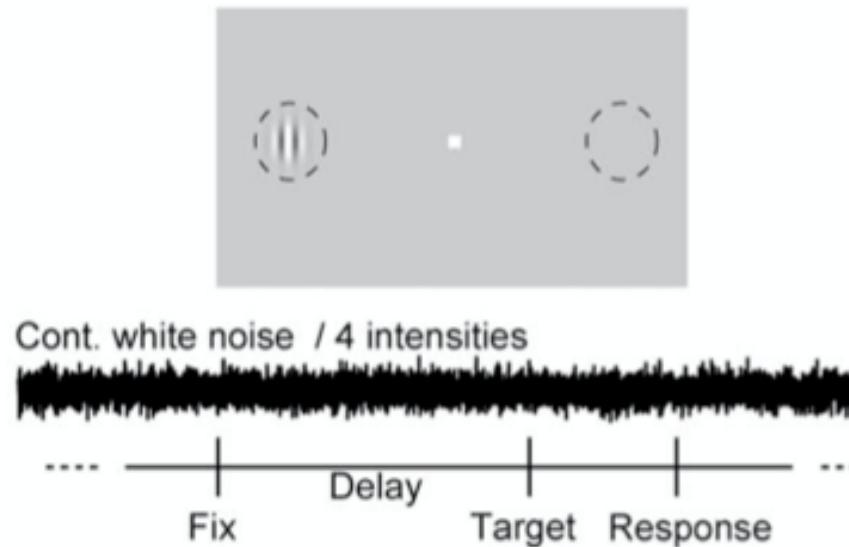
# Boosting arousal: White noise stimulation



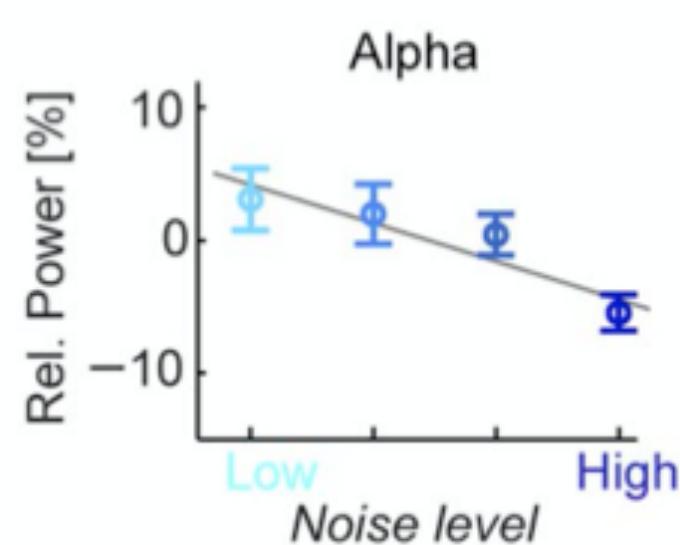
Stochastic resonance:  
Random information  
added to a stimulus  
can increase hit-rates



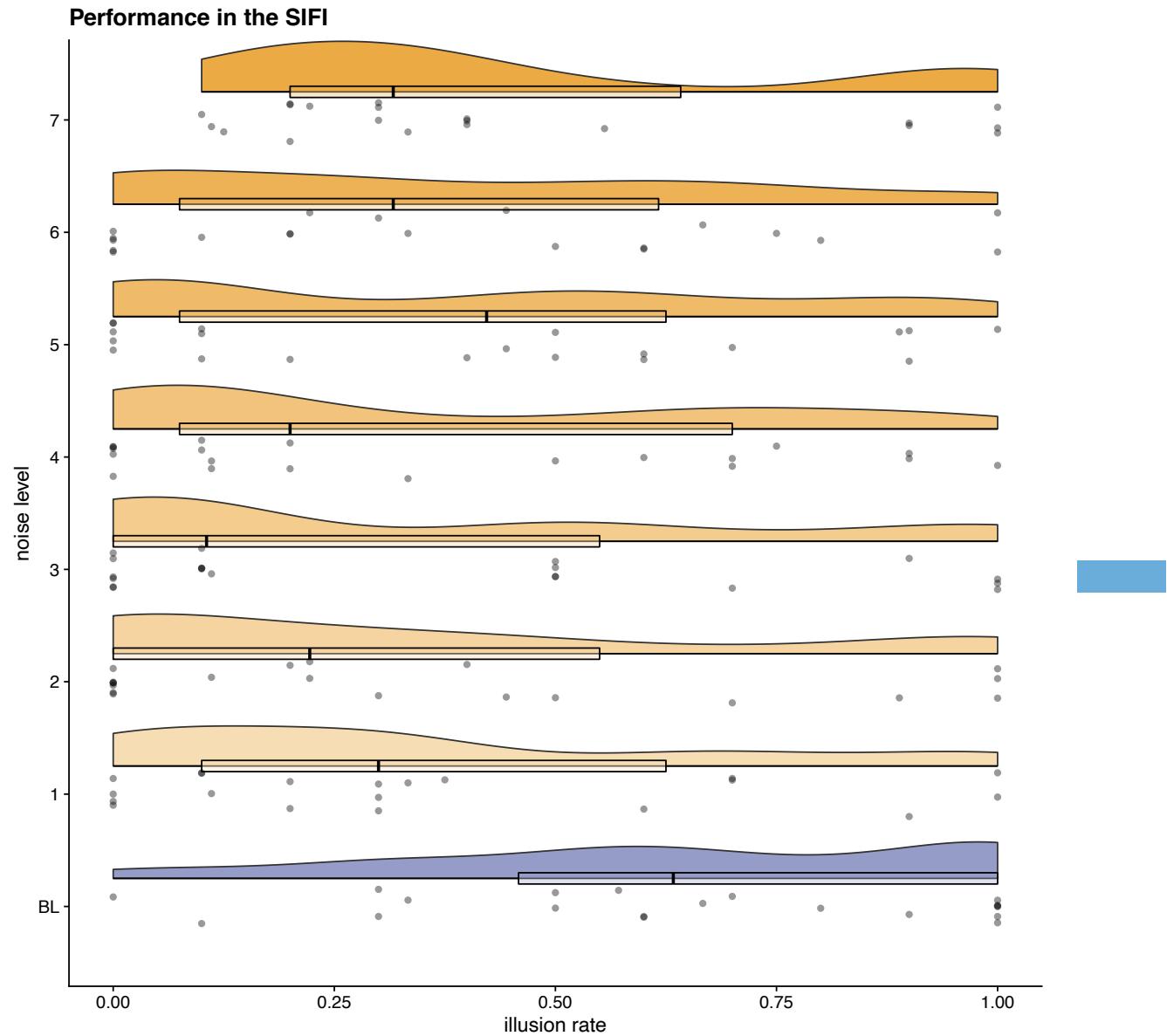
# Boosting arousal: White noise stimulation



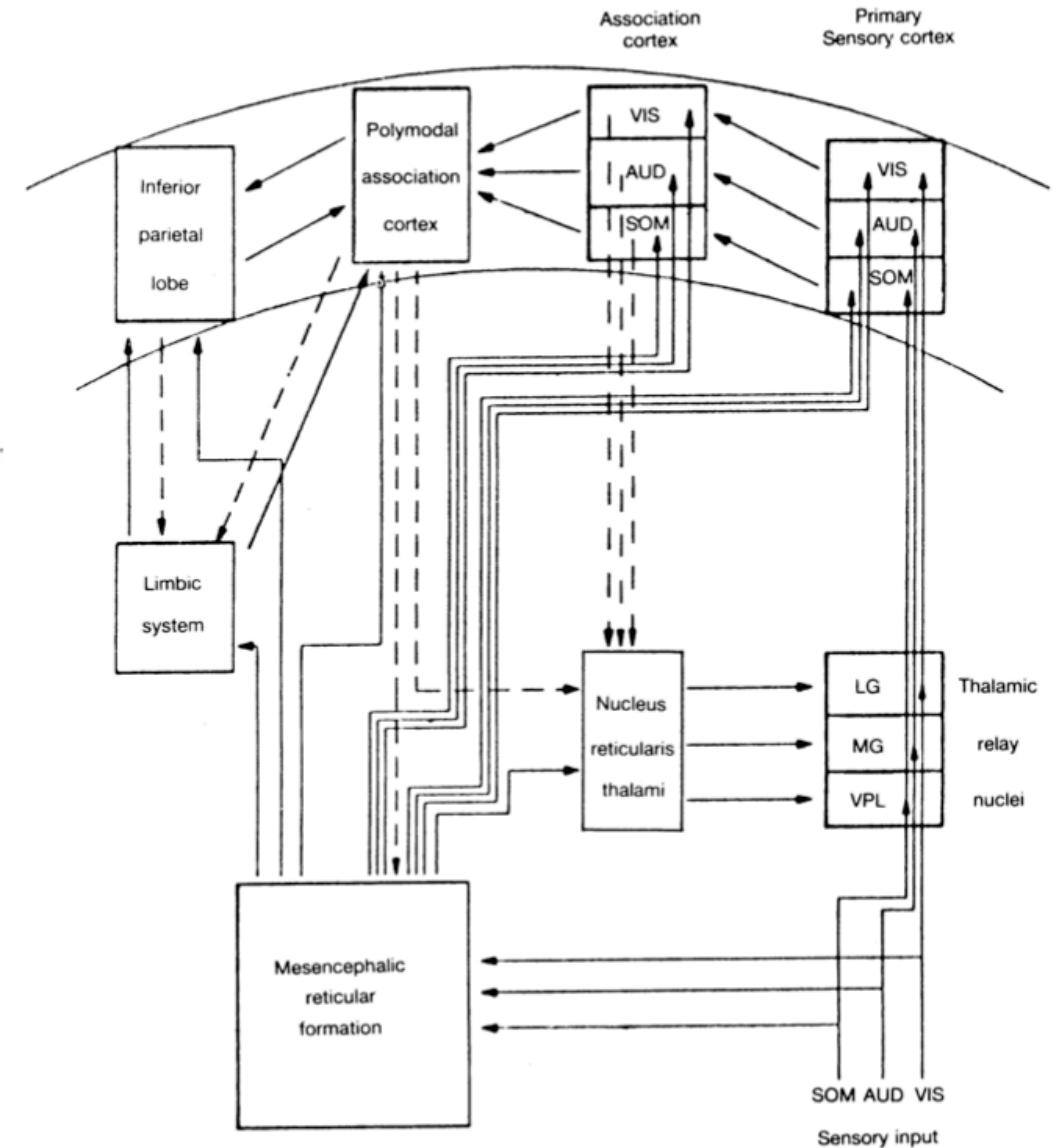
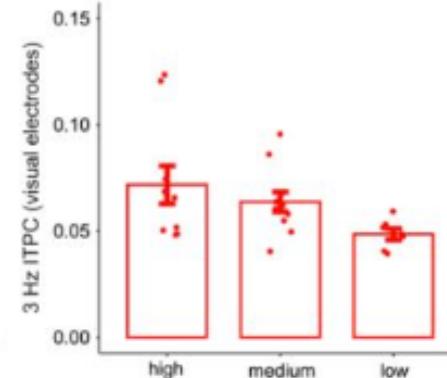
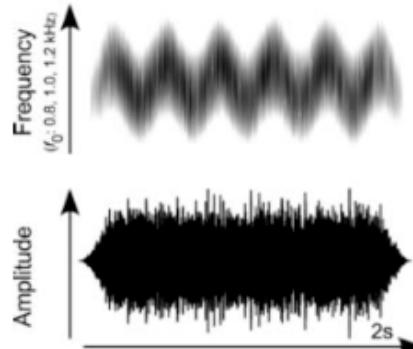
Auditory white noise increases hit-rates and reduces occipital alpha power



# Boosting arousal: White noise stimulation



# Possible mechanism?



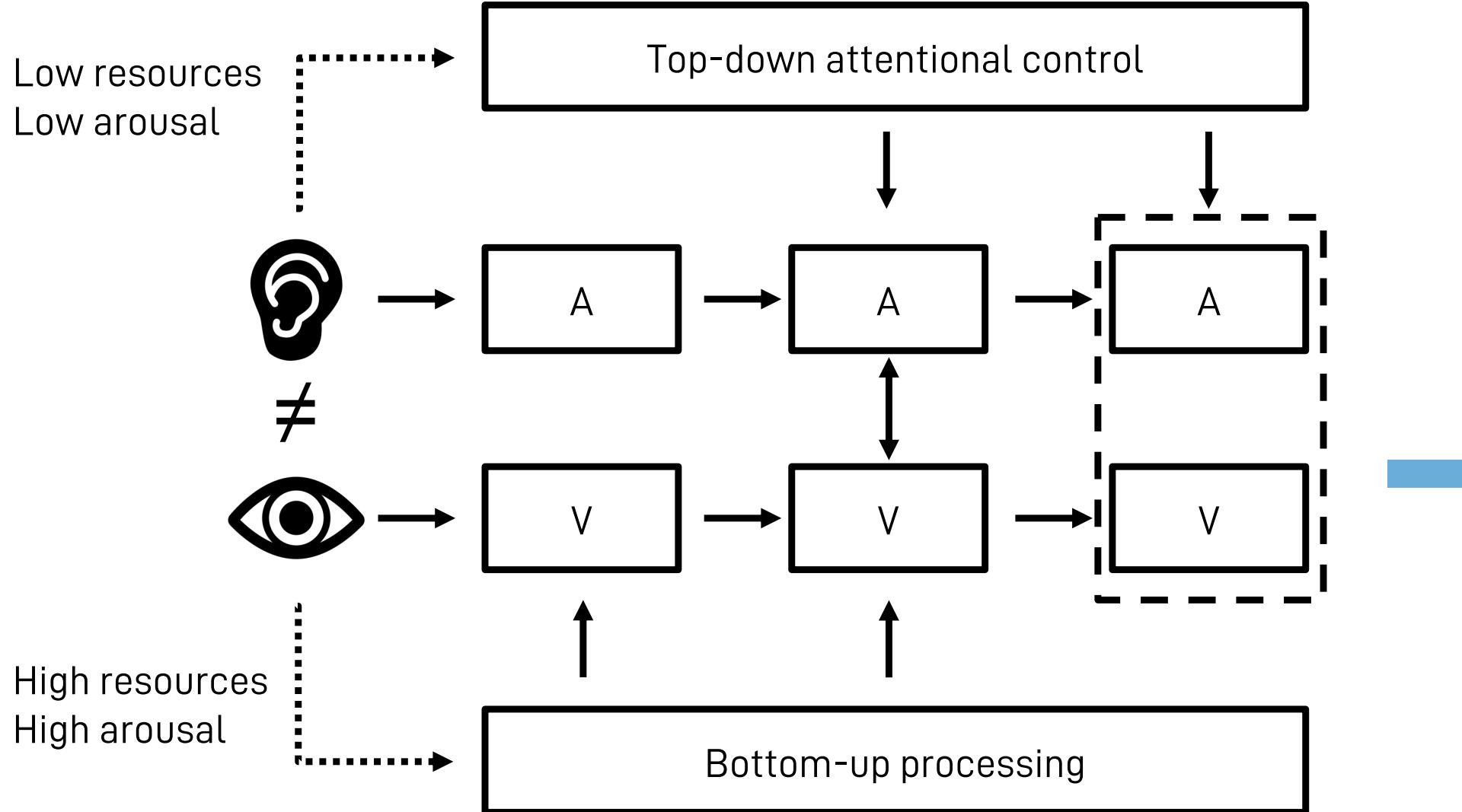
Direct cortico-cortical  
connectivity

vs.

Global modulation (e.g., via  
reticular formation)

Bauer et al., 2021; Flohr, 1991

# Summary



# Thank you!



Christian-Albrechts-Universität zu Kiel

Prof. Dr. Christian Kaernbach,  
Dr. Mira-Lynn Chavanon, Joshua  
Lorenzen, Ida Zimmermann, Madelaine-  
Rachel Dering, Merle Schuckart



Prof. Dr. Daniel Senkowski,  
Dr. James Moran, Dr. Mathis  
Kaiser, Georgios Michail



KE1828/2-1 (2014-2016)  
KE1828/4-1 (2016-2021)  
KE1828/5 (?)

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