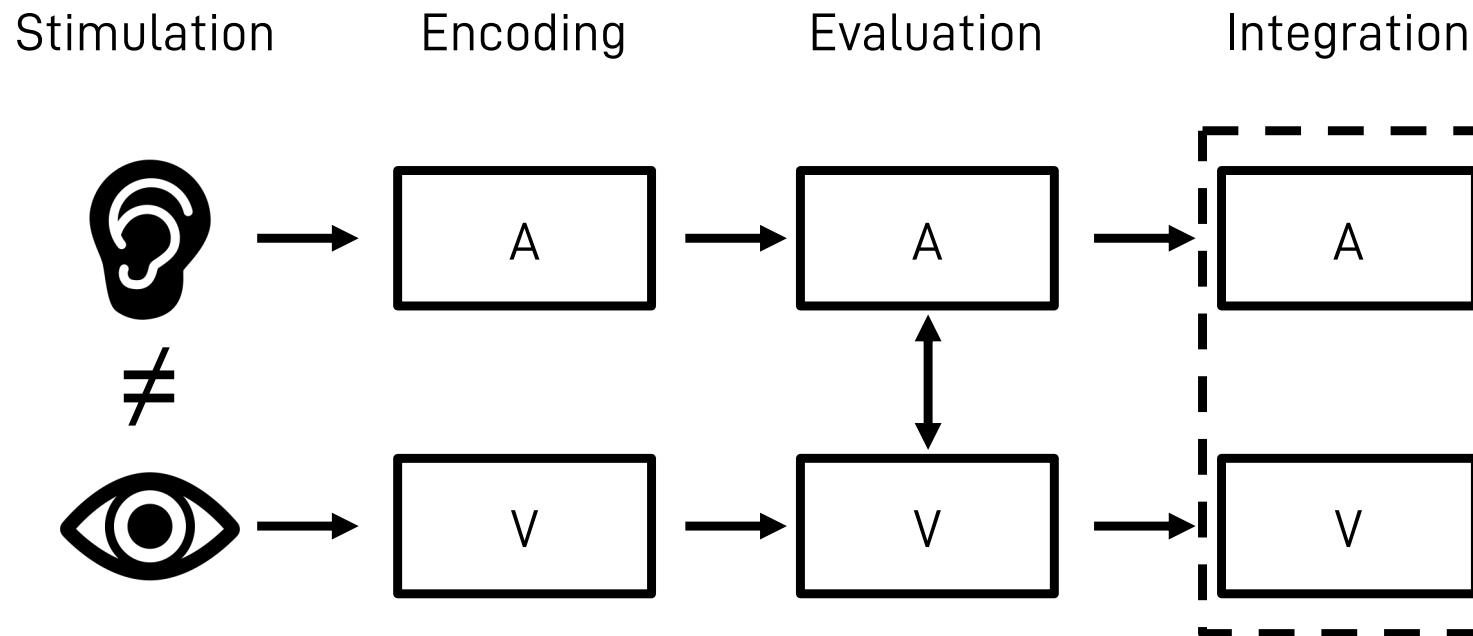


# The neural basis of the Sound-Induced Flash Illusion



Dr. Julian Keil

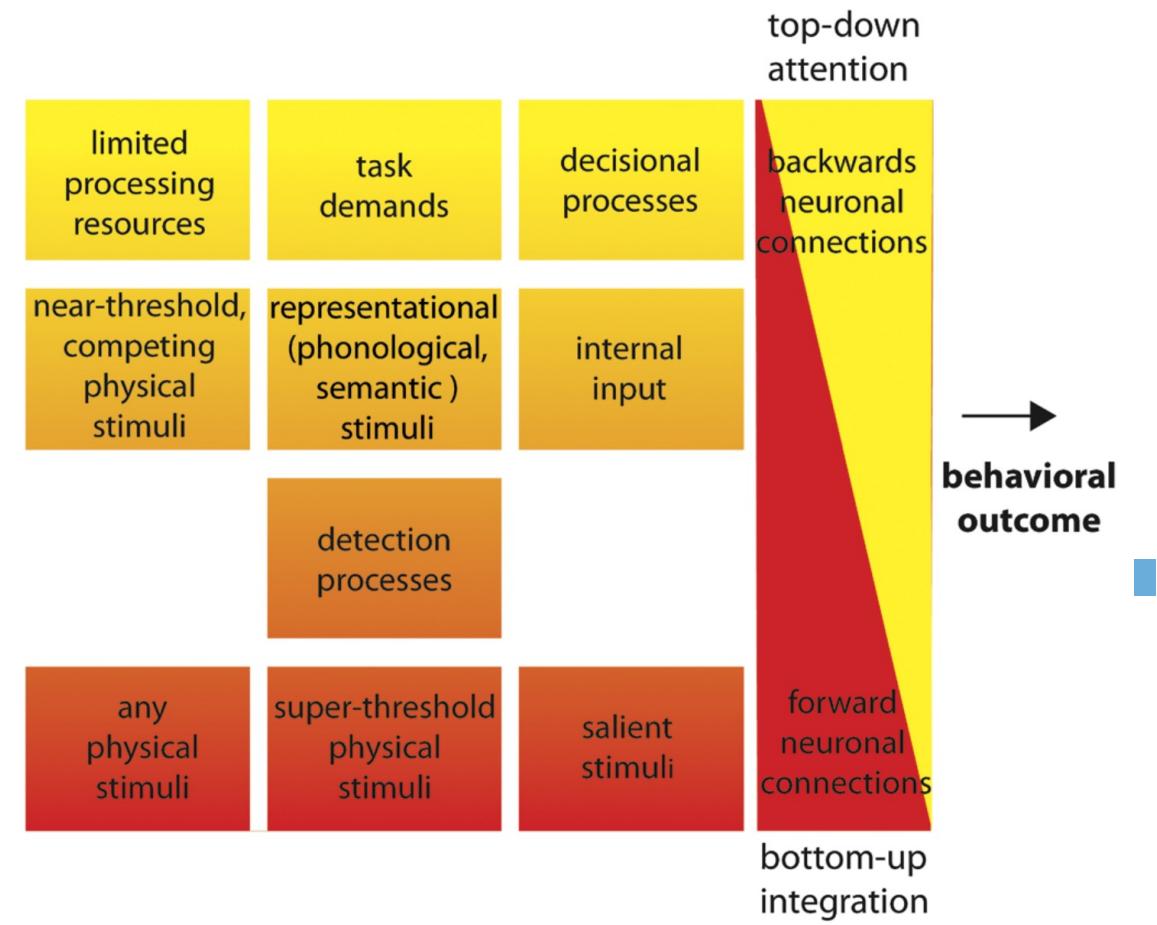
Biologische Psychologie

[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://tinyurl.com/Keil-IMRF-2022>

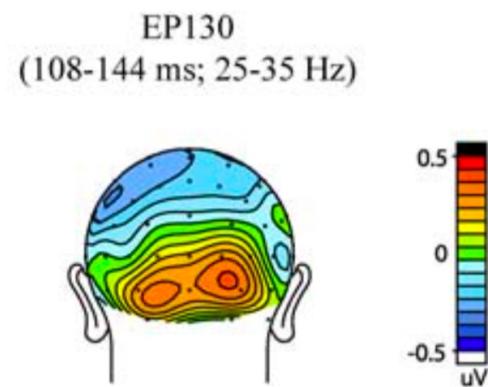
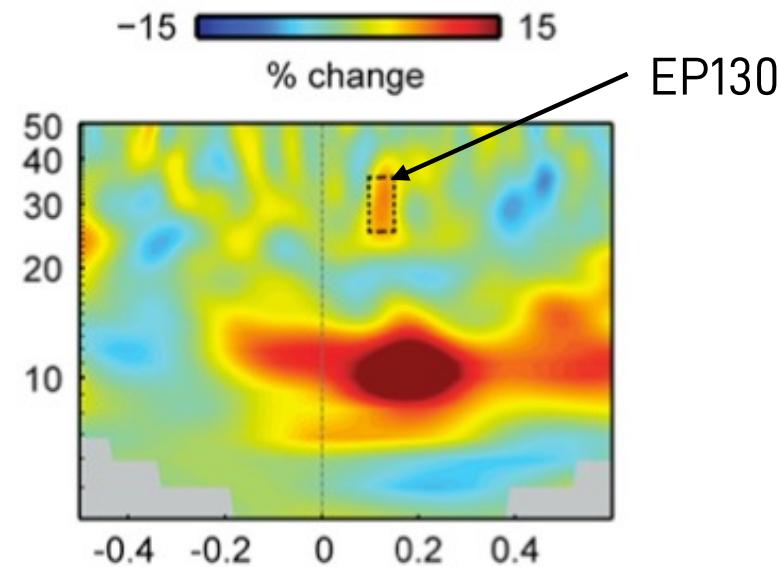
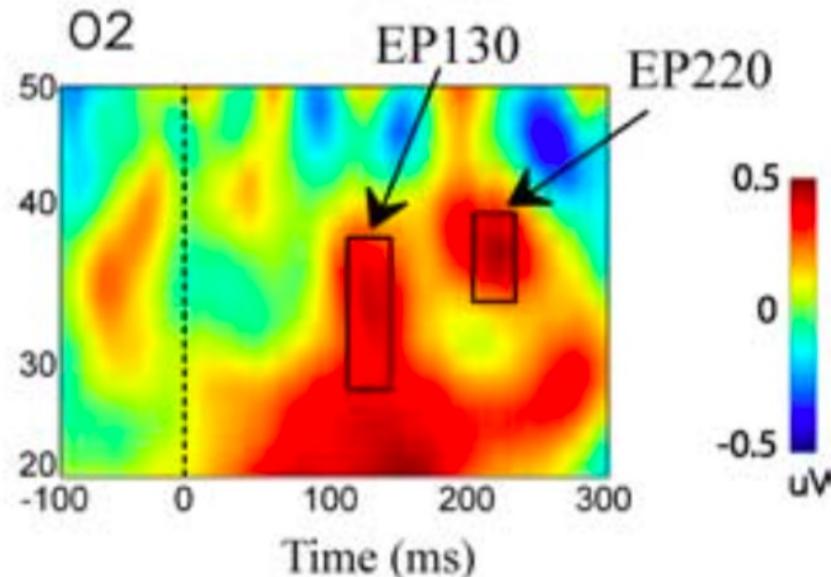
# Starting Point

- Multisensory perception involves multiple steps
- Neural activity reflects crossmodal interactions
- Brain state influences stimulus processing and perception



# Neural mechanisms: Stimulus processing

SEE - NO-SEE trial difference

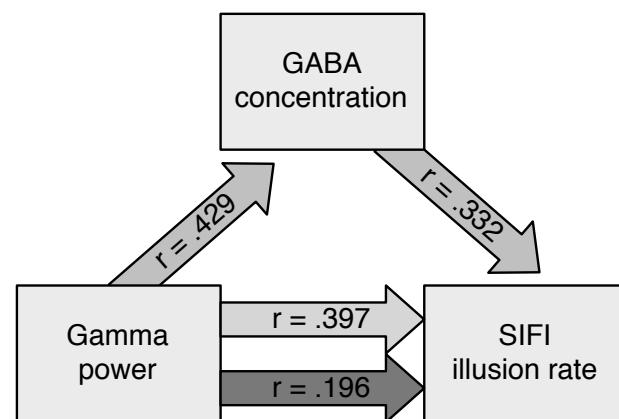
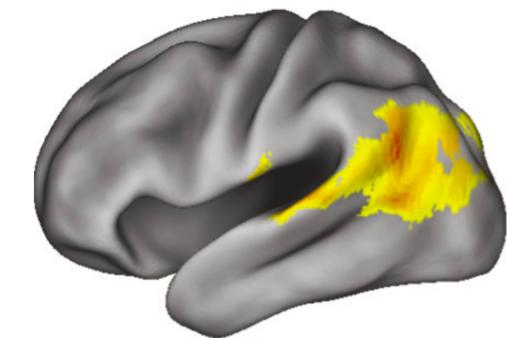
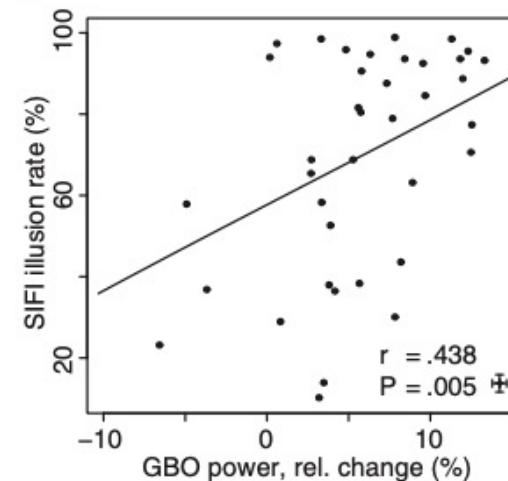
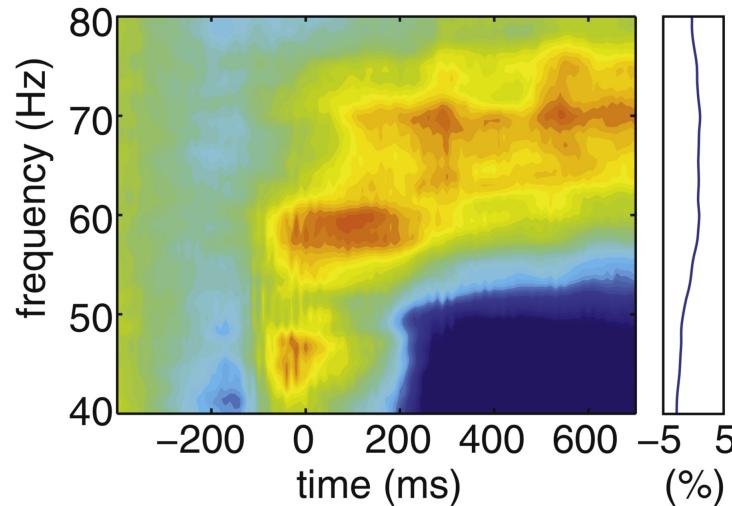


Integration of incongruent input: Illusion

- Higher gamma band power for illusion vs. no-illusion perception

Mishra et al., 2007; Balz et al., 2016b

# Neural mechanisms: Stimulus processing



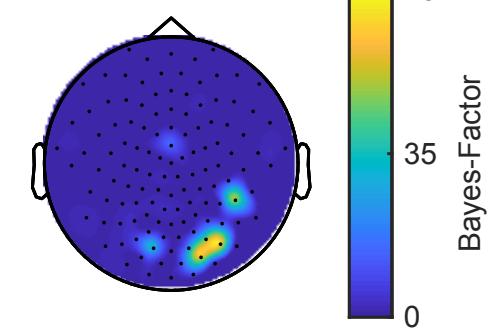
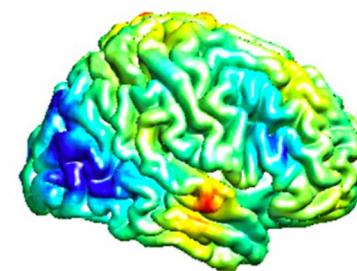
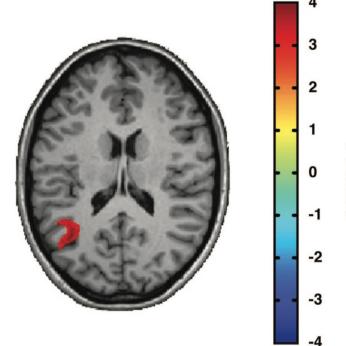
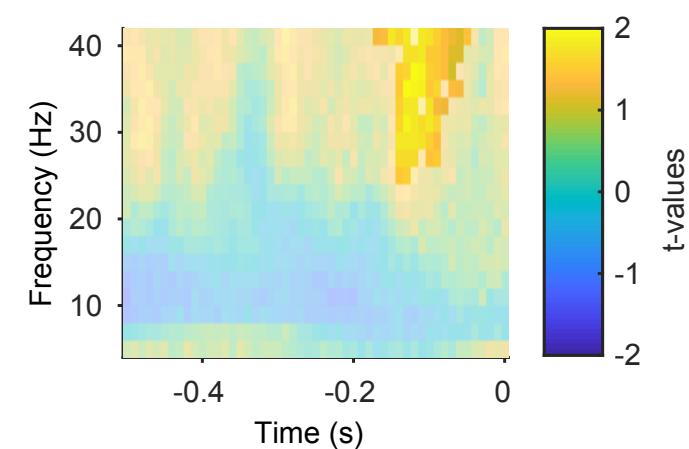
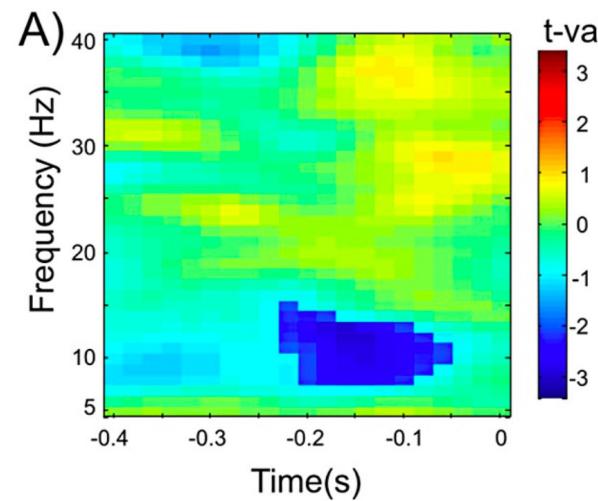
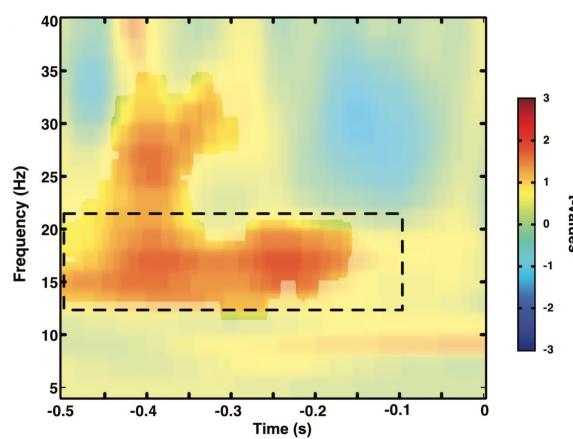
Integration of incongruent input: Illusion

- Higher gamma band power for illusion vs. no-illusion perception
- Increased gamma band power correlates with illusion rate, mediated by GABA

# Neural mechanisms: Local excitability

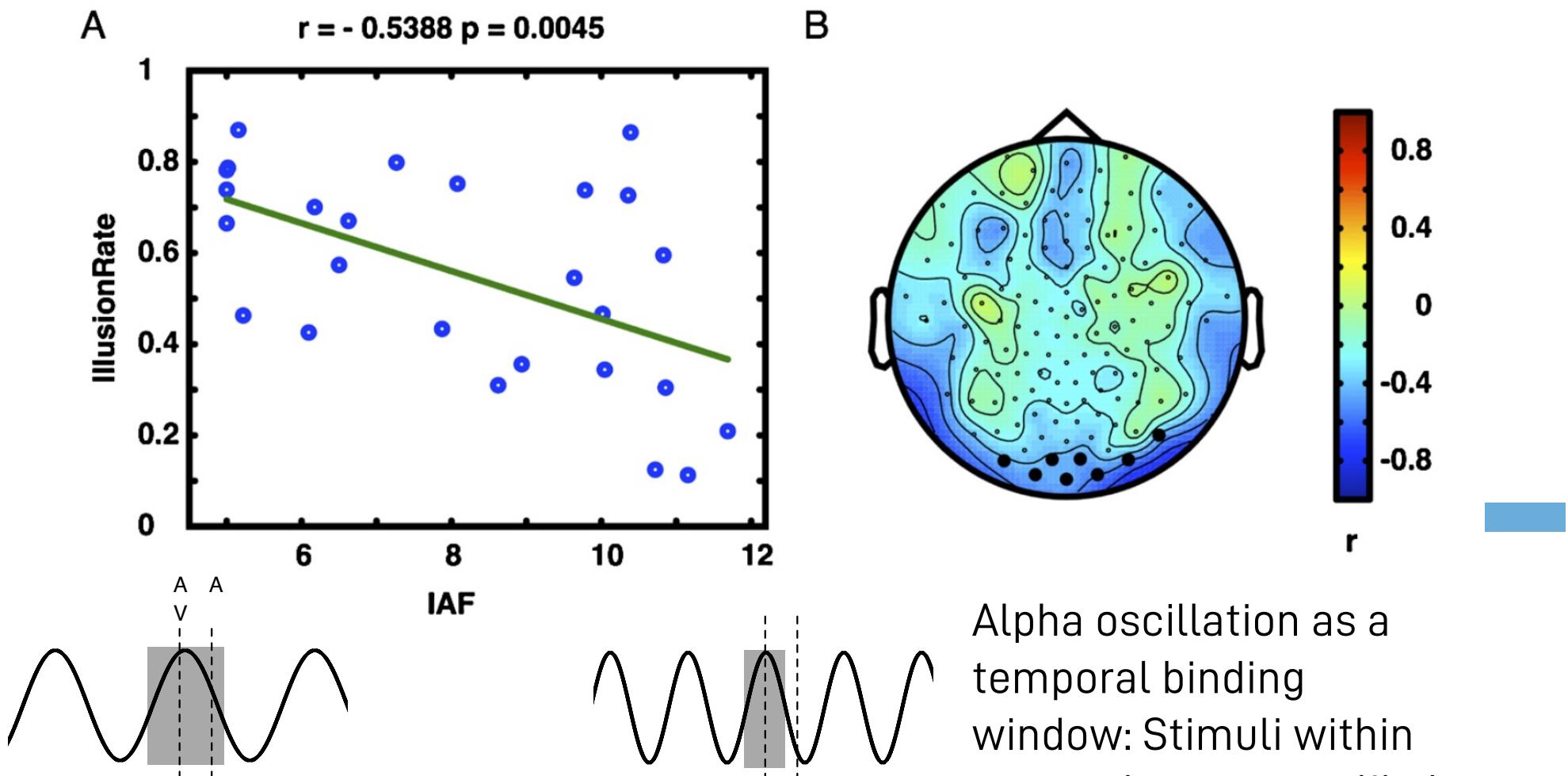
Brain state influences upcoming perception

- Low-frequency power in sensory and association areas

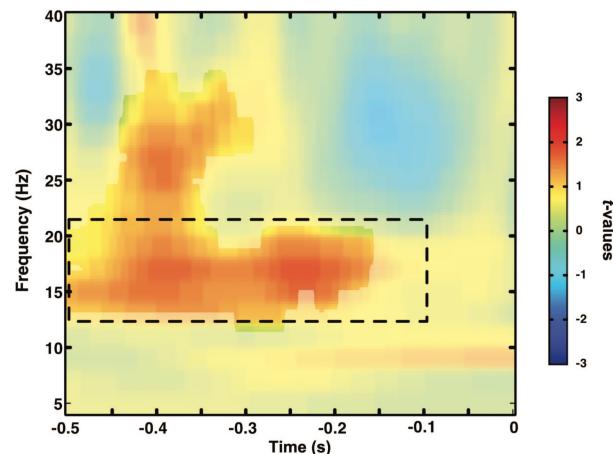


Keil et al., 2014; Lange et al., 2013; Kaiser et al., 2019

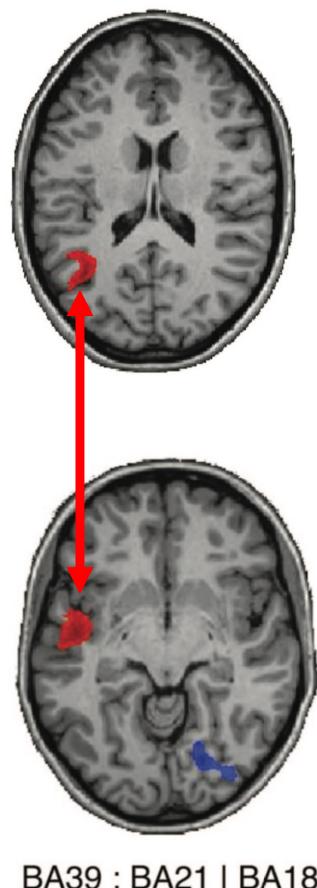
# Neural mechanisms: Temporal binding window



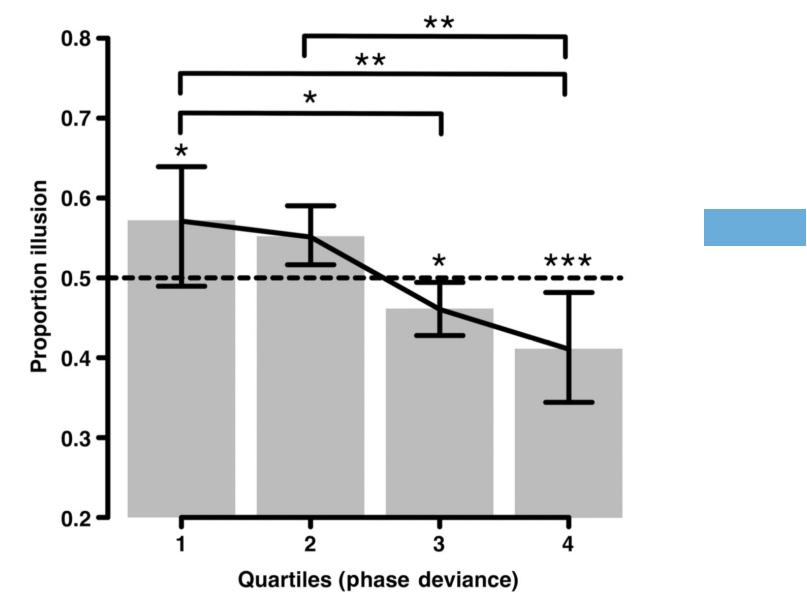
# Neural mechanisms: Functional connectivity



Beta connectivity  
reflects crossmodal  
influences: Similar  
phase angle supports  
integration

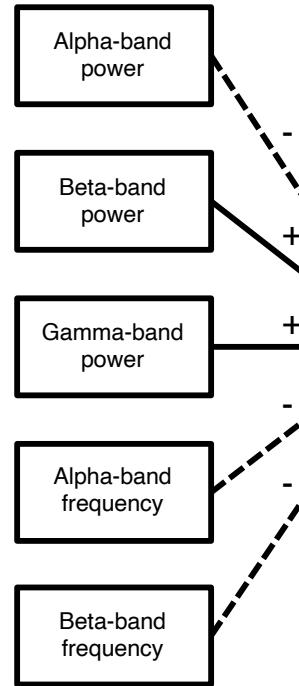


Beta power reflects  
state of integration  
areas: High power  
supports integration

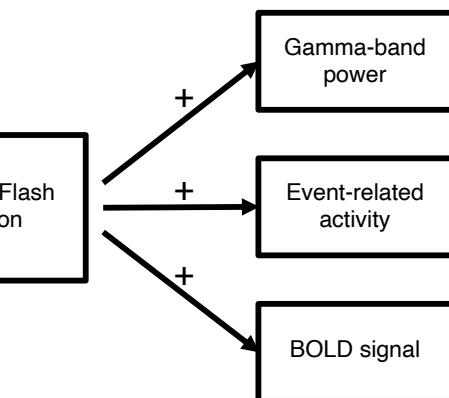


# Interim Summary

Brain state



Stimulus processing

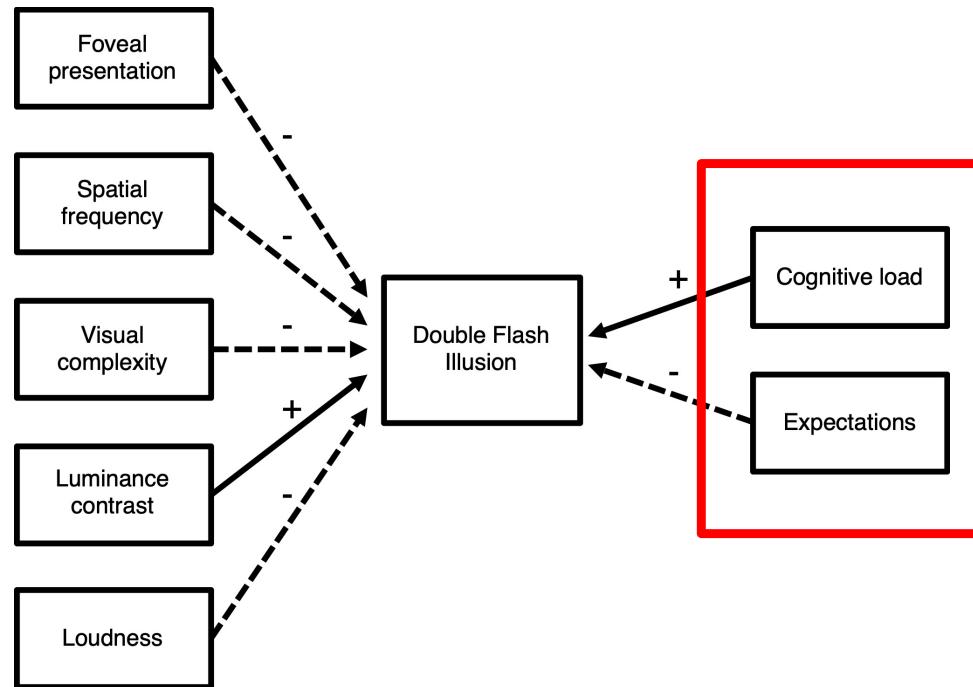


- Multisensory perception depends on the brain state
  - Bottom-up: Induced gamma-band power reflects integrated perception
  - Top-down: Ongoing alpha/beta-band oscillations influence sensory encoding and processing
- Can we change the brain state?



# Next step: Change the state

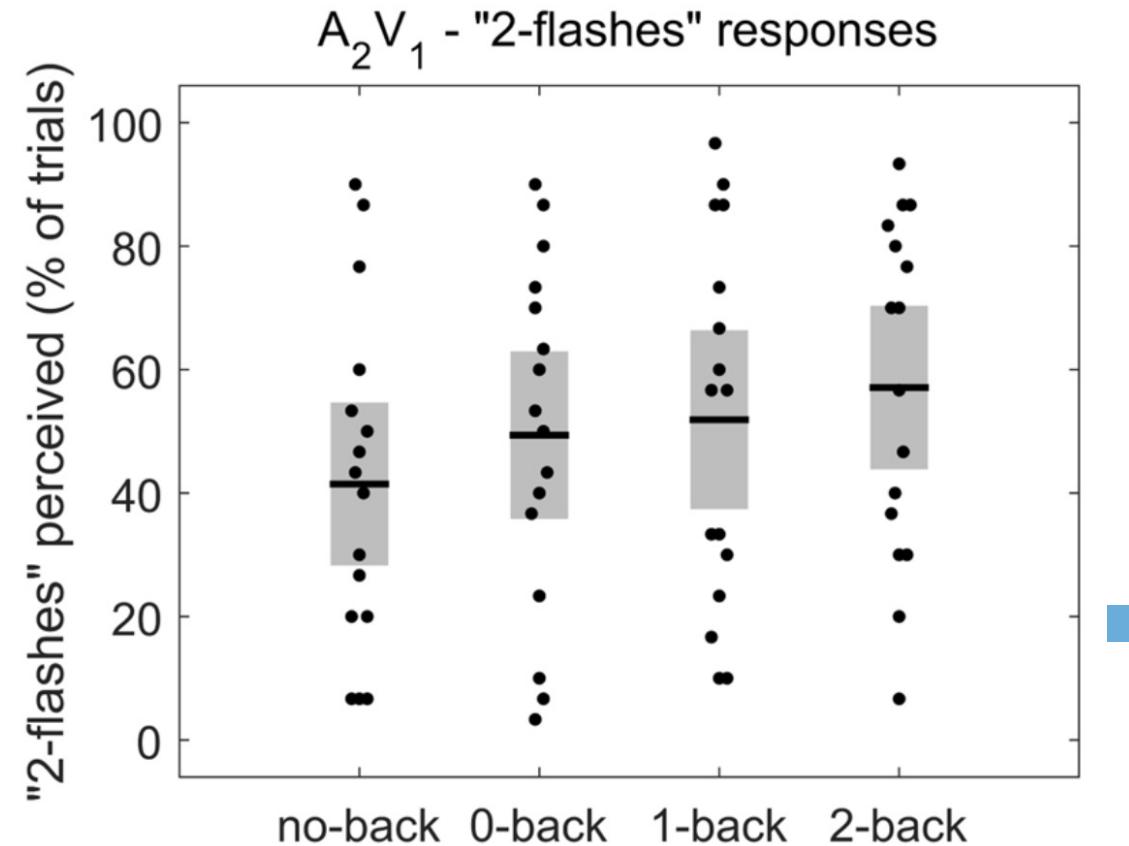
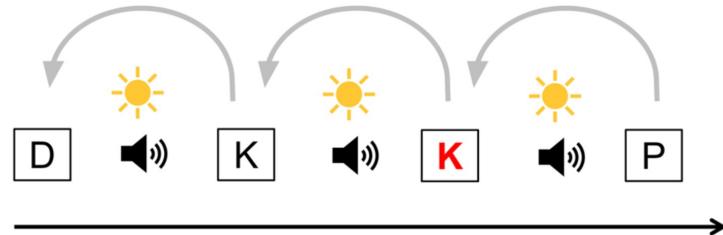
Stimulus properties      Cognitive Influences



Modulate cognitive processes to change the brain state



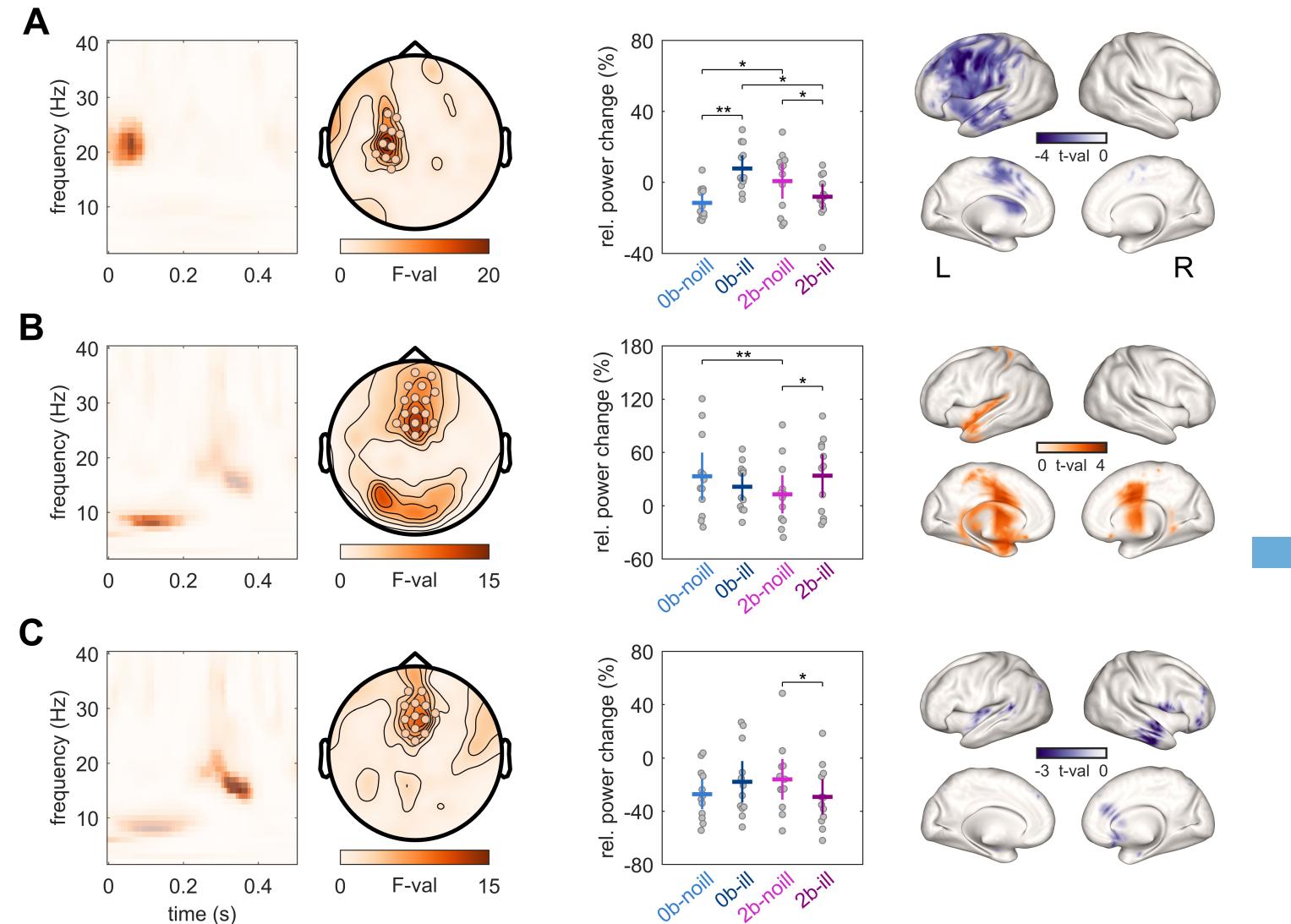
# Change the state: Cognitive Load



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

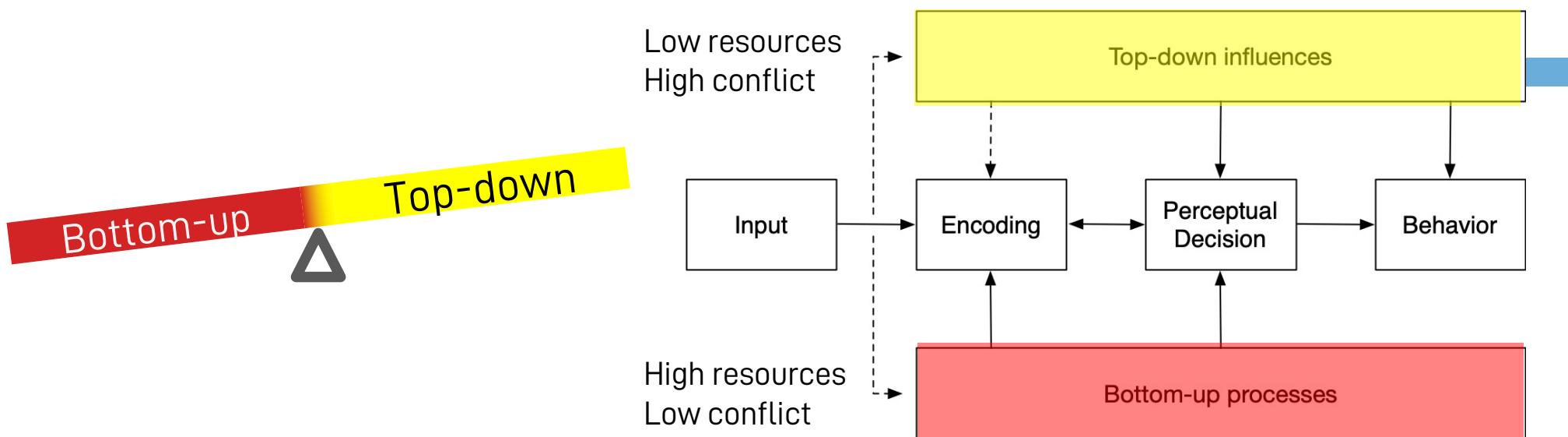
# Neural Mechanisms of Cognitive Load

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



# Summary

- Multisensory perception depends on the brain state
  - Neural oscillations reflect crossmodal interactions and influence stimulus processing
  - Changing the brain state influences integration, but not initial processing
  - Cognitive load changes the brain state: increased demand of (late) top-down resources to resolve intersensory conflict



# Thank you!



Christian-Albrechts-Universität zu Kiel

Prof. Dr. Christian Kaernbach,  
Joshua Lorenzen, Merle Schuckart and  
many others...



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



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

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