



Top-down Neural Synchronization during Imagined Acoustic Rhythm

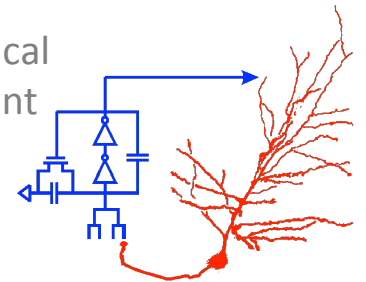
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ARO Annual MidWinter Meeting

Auditory Cortex: Human Studies podium session

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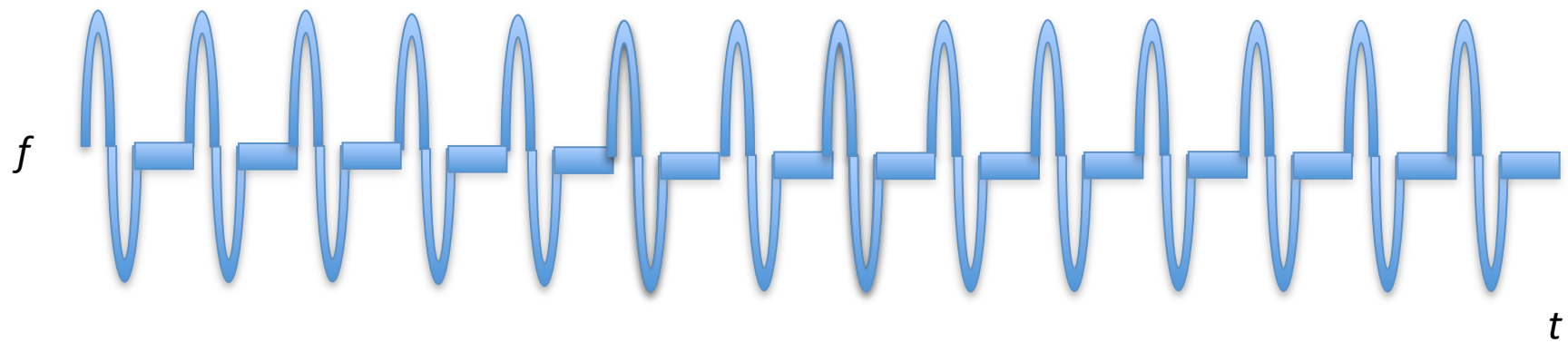


The Computational Sensorimotor Systems Laboratory

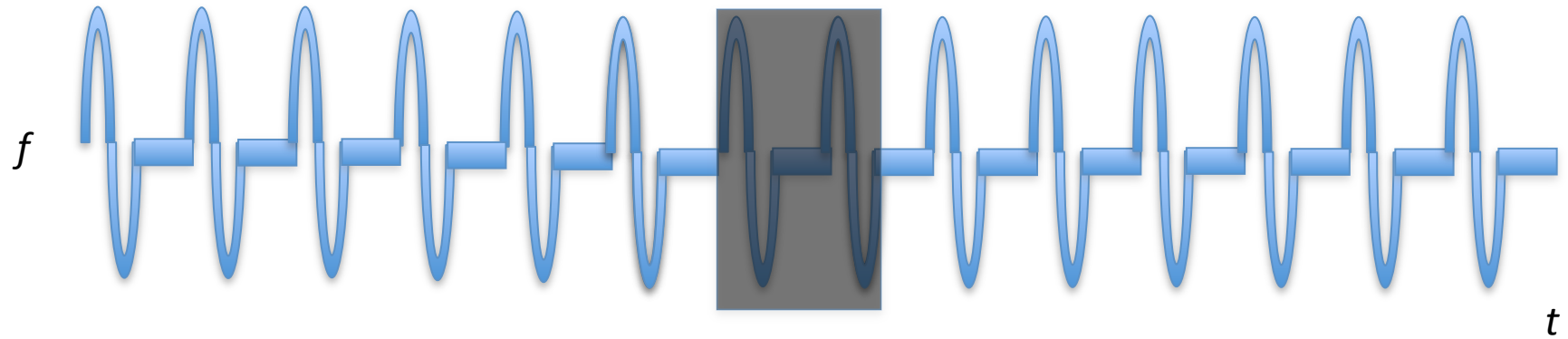
Summary

- Continuity illusion / perceptual fill-in
 - critical for cocktail-party
- Neural representation (MEG) of acoustic feature:
 - when feature is present but not perceived
 - when feature is absent but nevertheless perceived
- Result: Neural representation reflects *perception* of feature

Acoustic feature: a masked rhythm

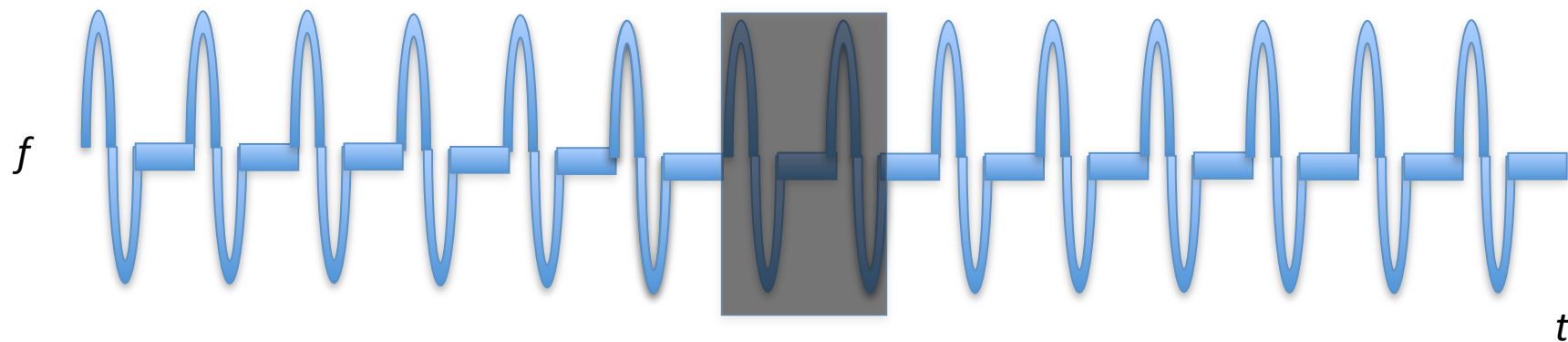


Acoustic feature: a masked rhythm



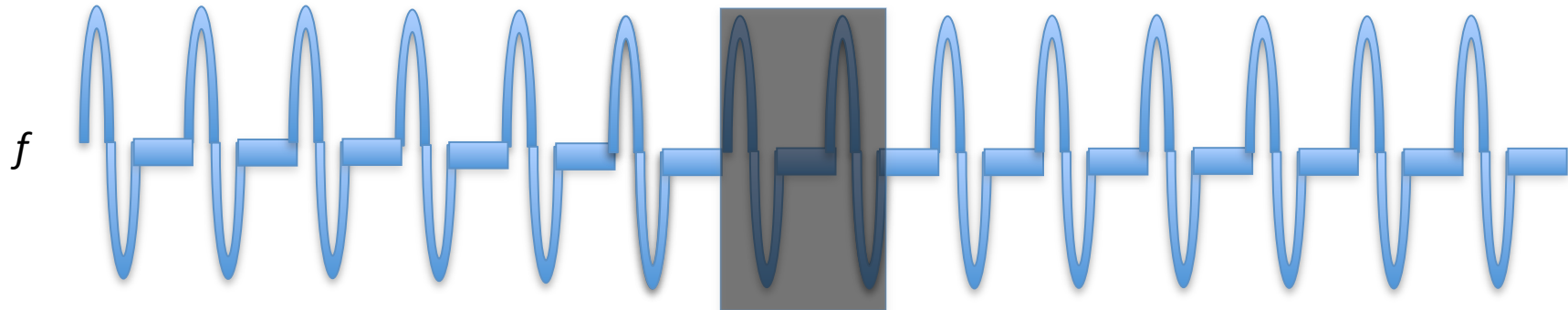
Acoustic feature: a masked rhythm

Rhythm present

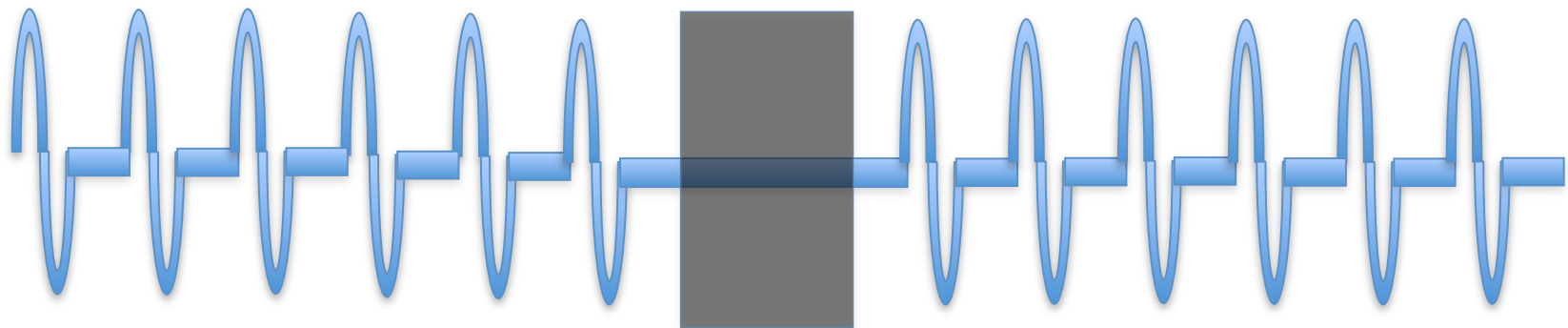


Acoustic feature: a masked rhythm

Rhythm present



Rhythm absent



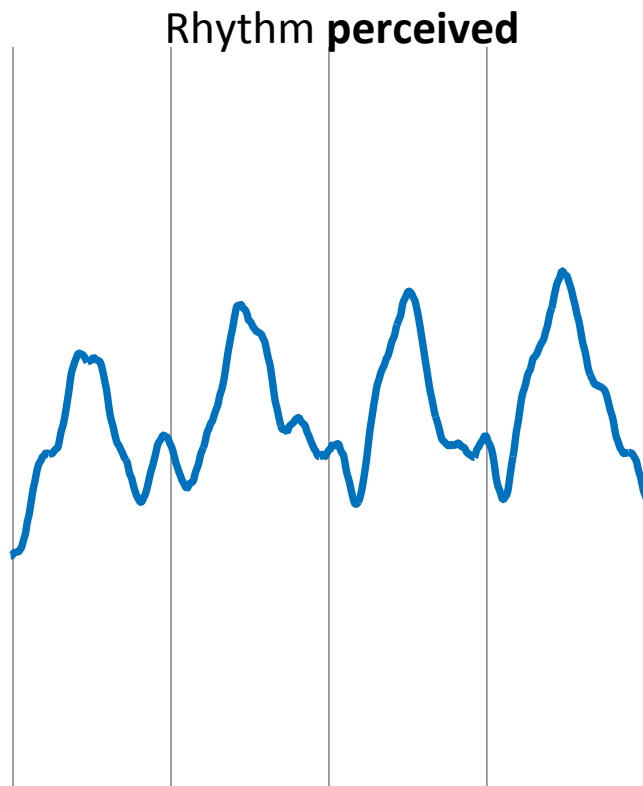
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cf. Riecke et al. (2009); Millman et al. (2010)

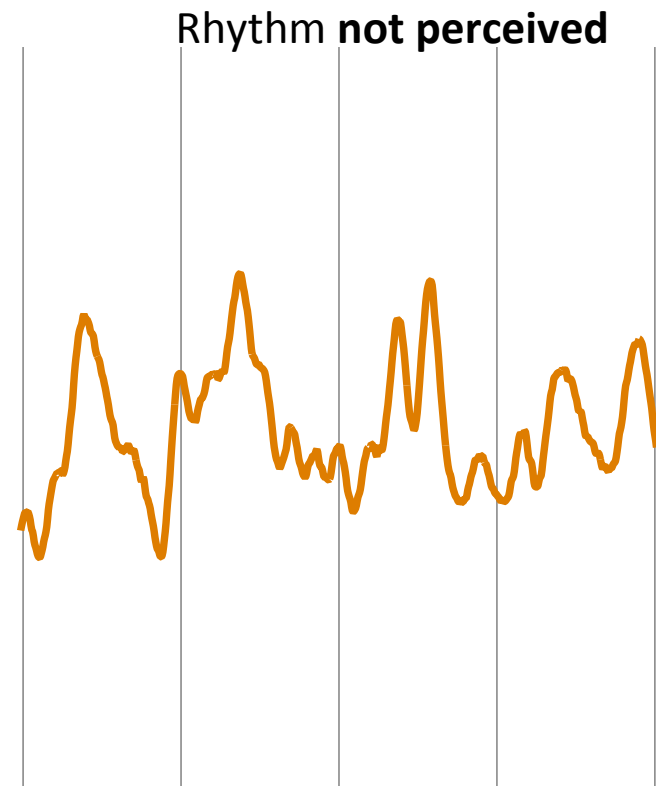
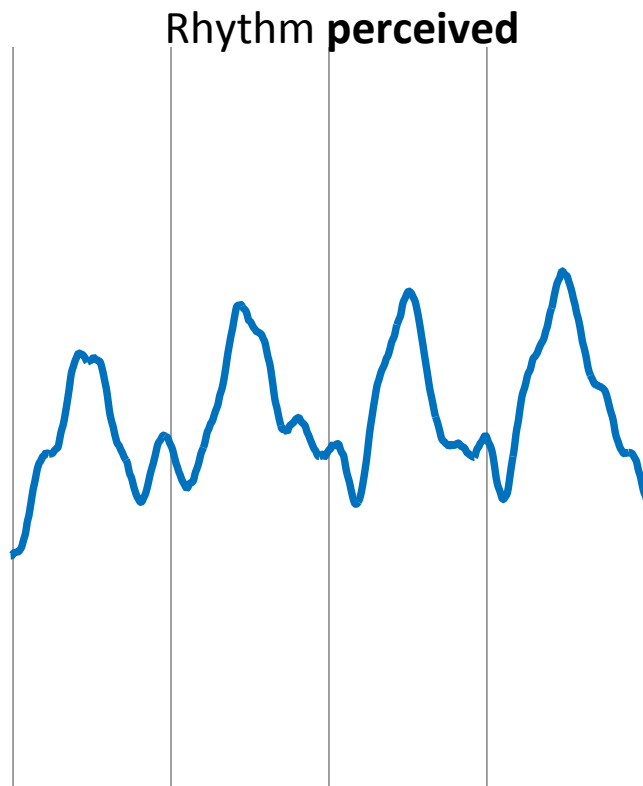
Experimental methods

- 5 Hz rhythm with irregular noise maskers (1.2 s each), 1 hour total
- During masker, rhythm is acoustically ***present*** or ***absent***
- After masker, rhythm reported ***perceived*** or ***not perceived*** (button press)
- Masker SNR matched to listener (moderate difficulty)
- Whole-head magnetoencephalography (MEG)
- Neural data analysis using 5 Hz Morlet wavelet
 - Power and phase locking
 - Responses sorted by reported percept
- $N = 35$ subjects

Neural* representations of an ***acoustically-present rhythm**



Neural representations of an **acoustically-present** rhythm



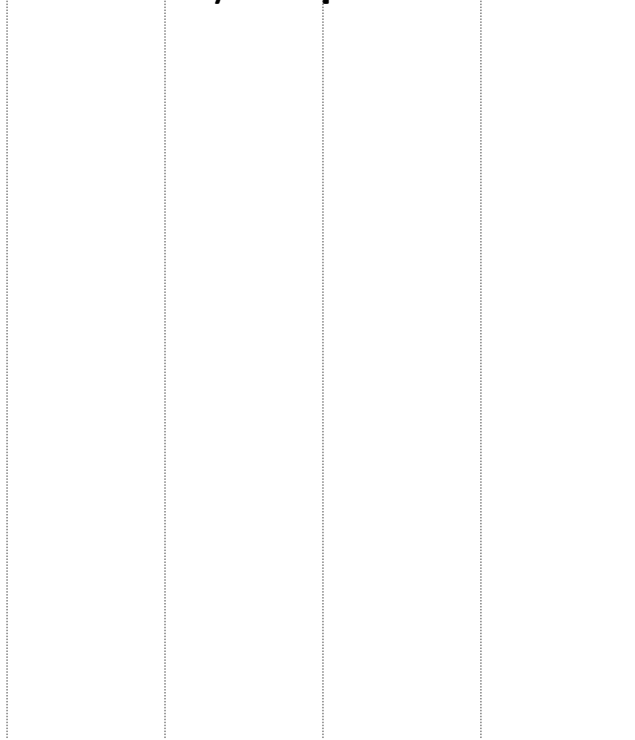
Neural representations of an **acoustically-present** rhythm

Rhythm **perceived**

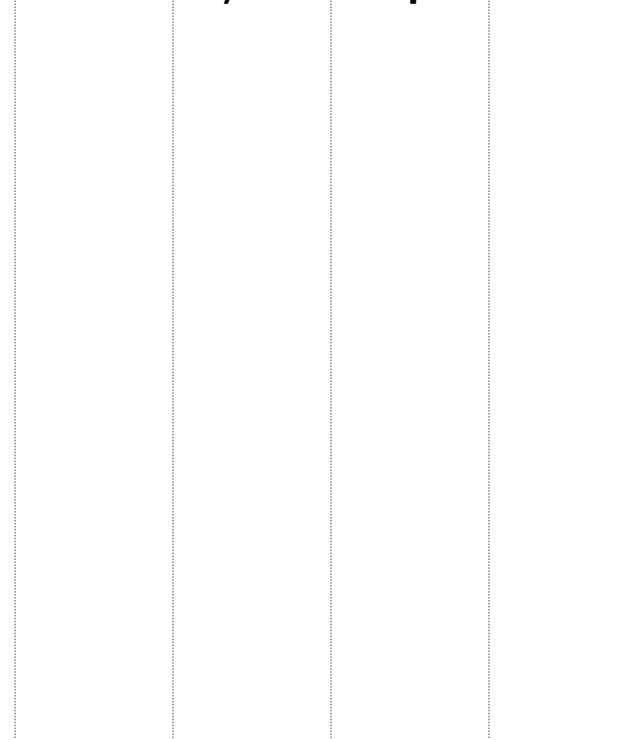
Rhythm **not perceived**

*Neural representations of an acoustically **absent** rhythm*

Rhythm **perceived**

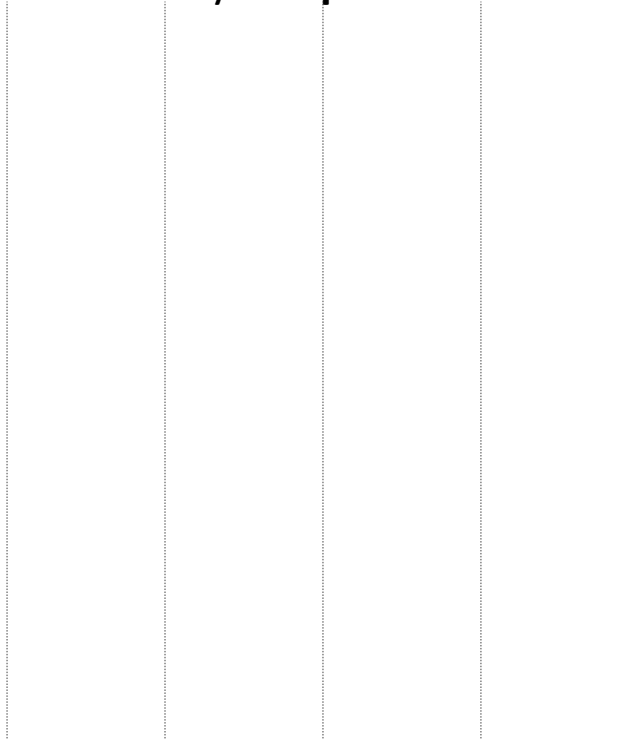


Rhythm **not perceived**

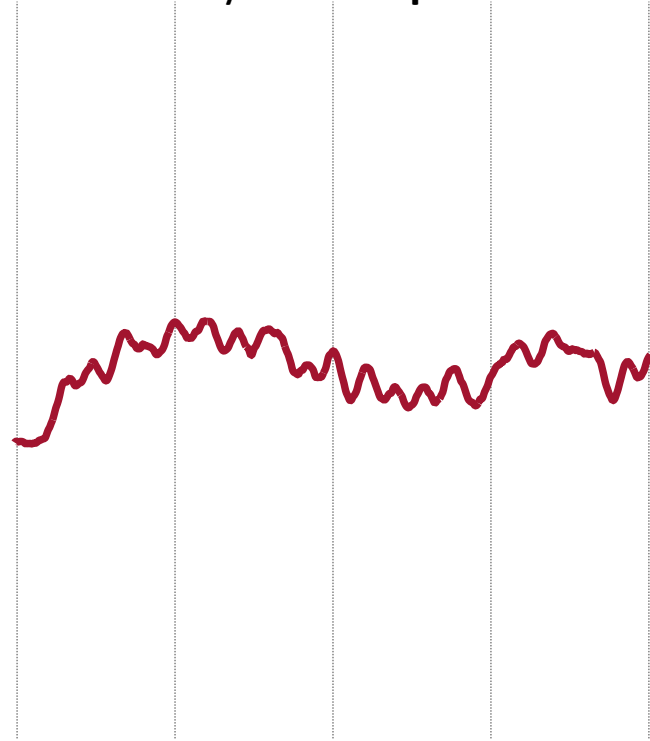


*Neural representations of an acoustically-**absent** rhythm*

Rhythm **perceived**

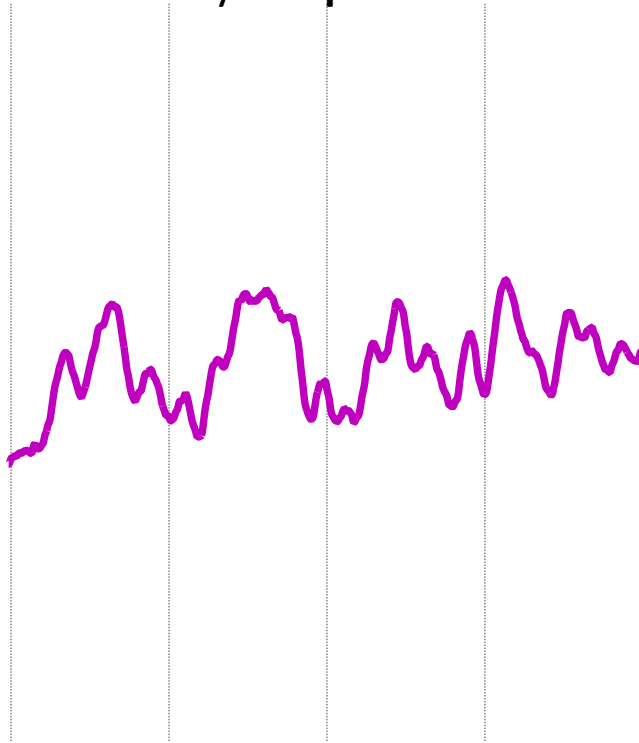


Rhythm **not perceived**

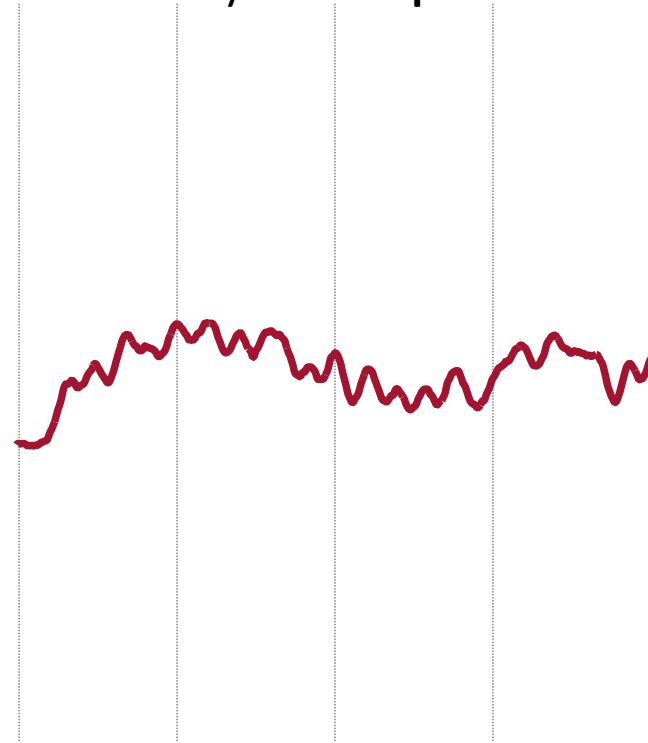


*Neural representations of an acoustically-**absent** rhythm*

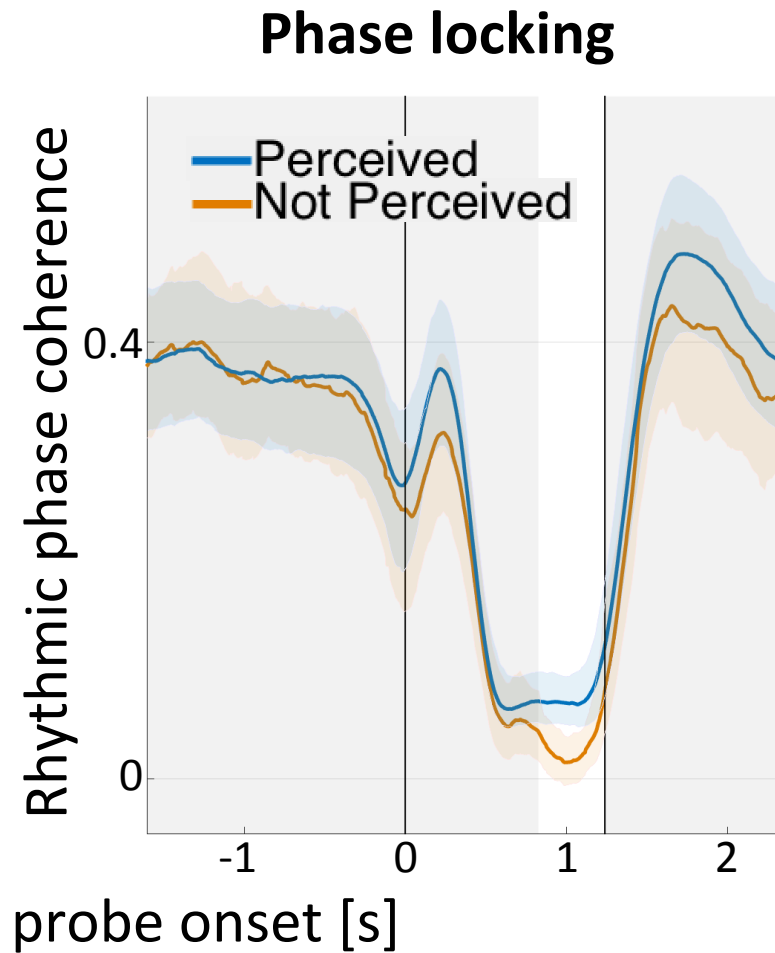
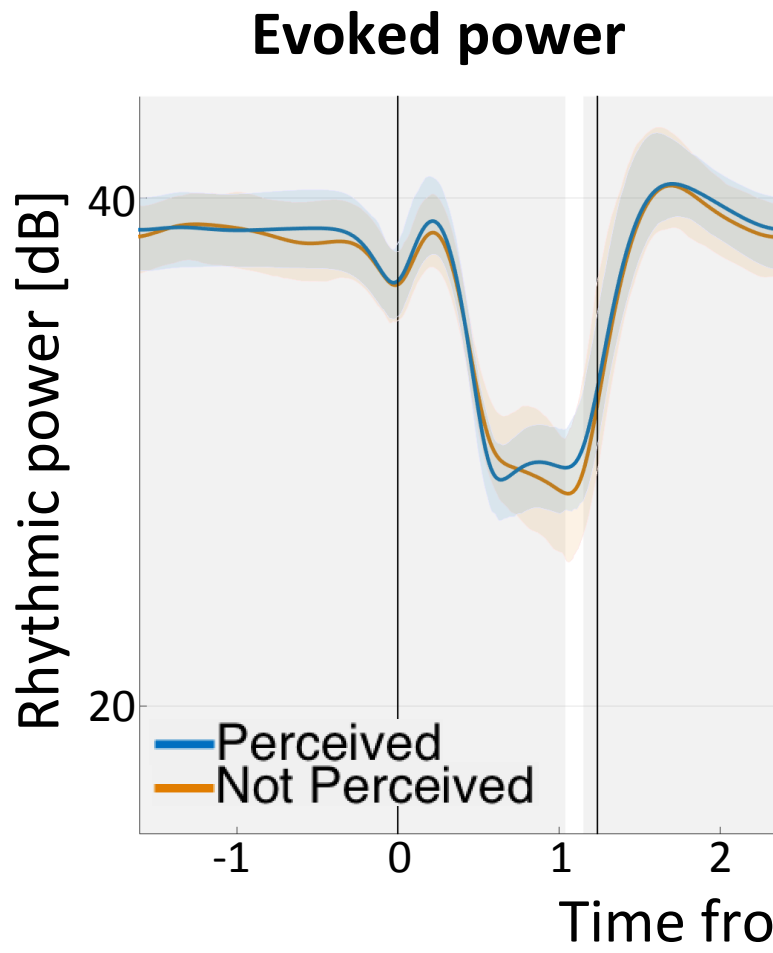
Rhythm **perceived**



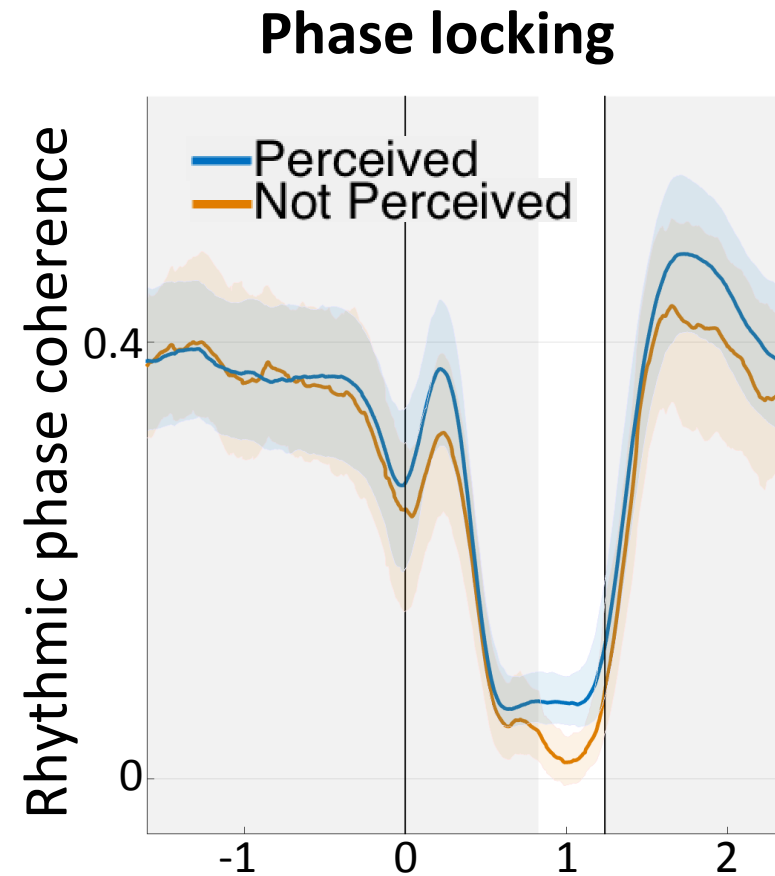
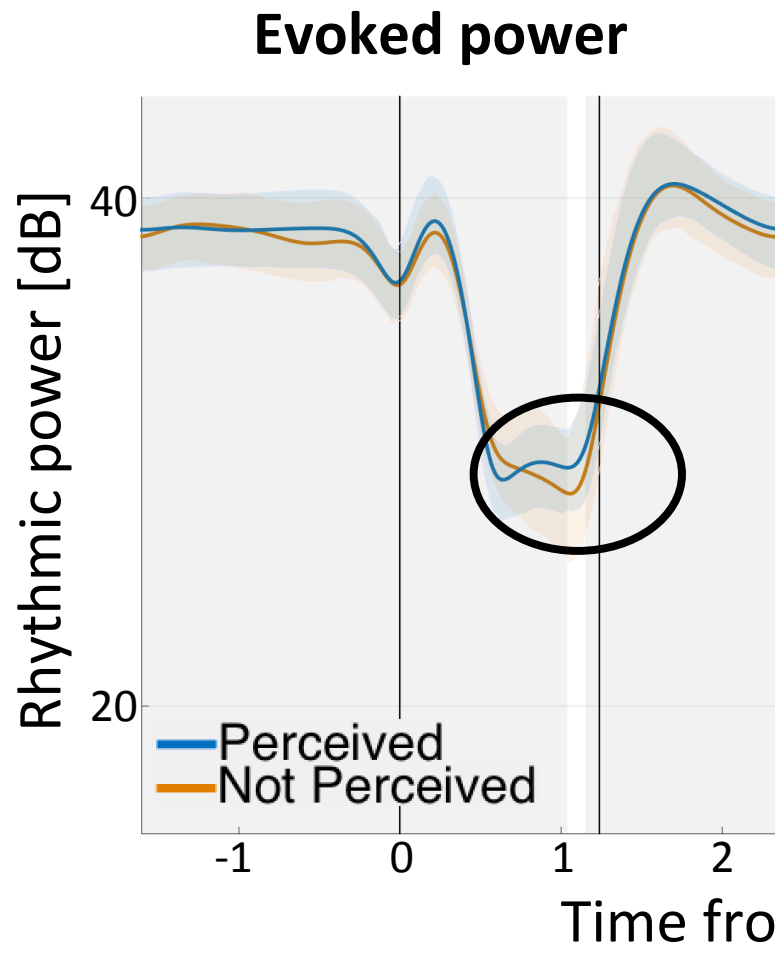
Rhythm **not perceived**



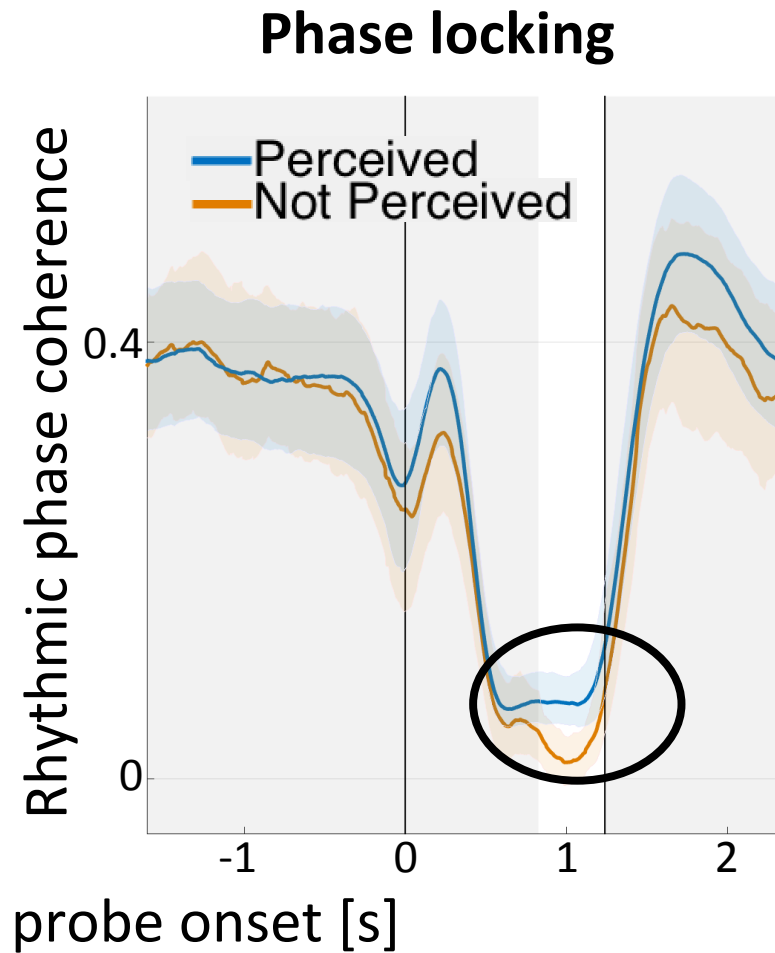
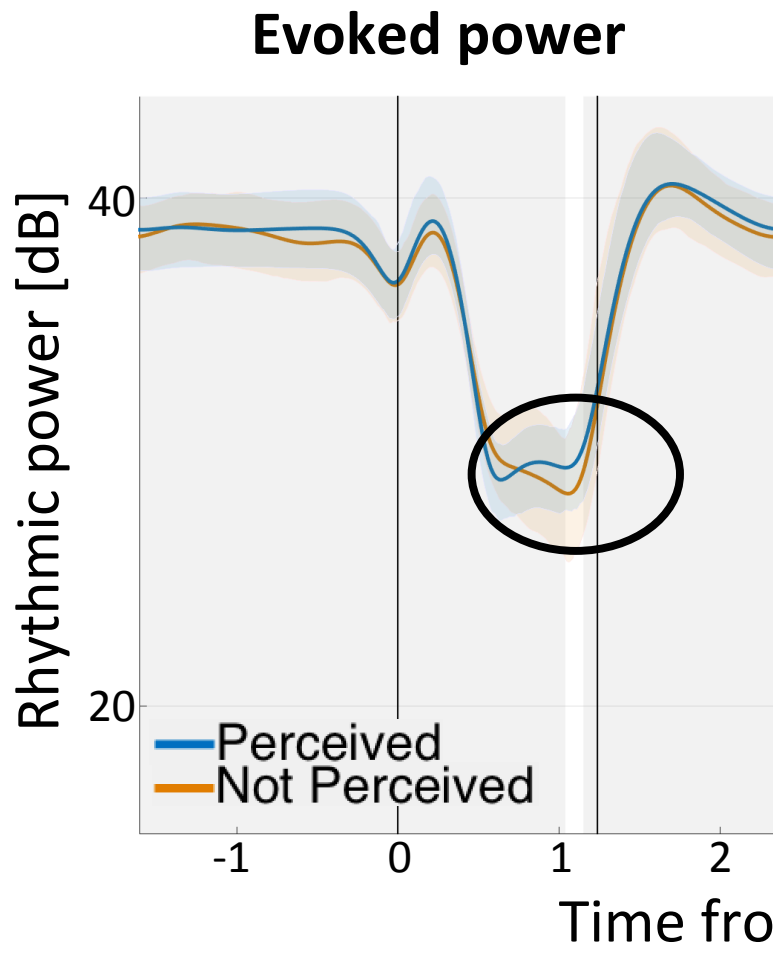
*Neural responses when rhythm **present***



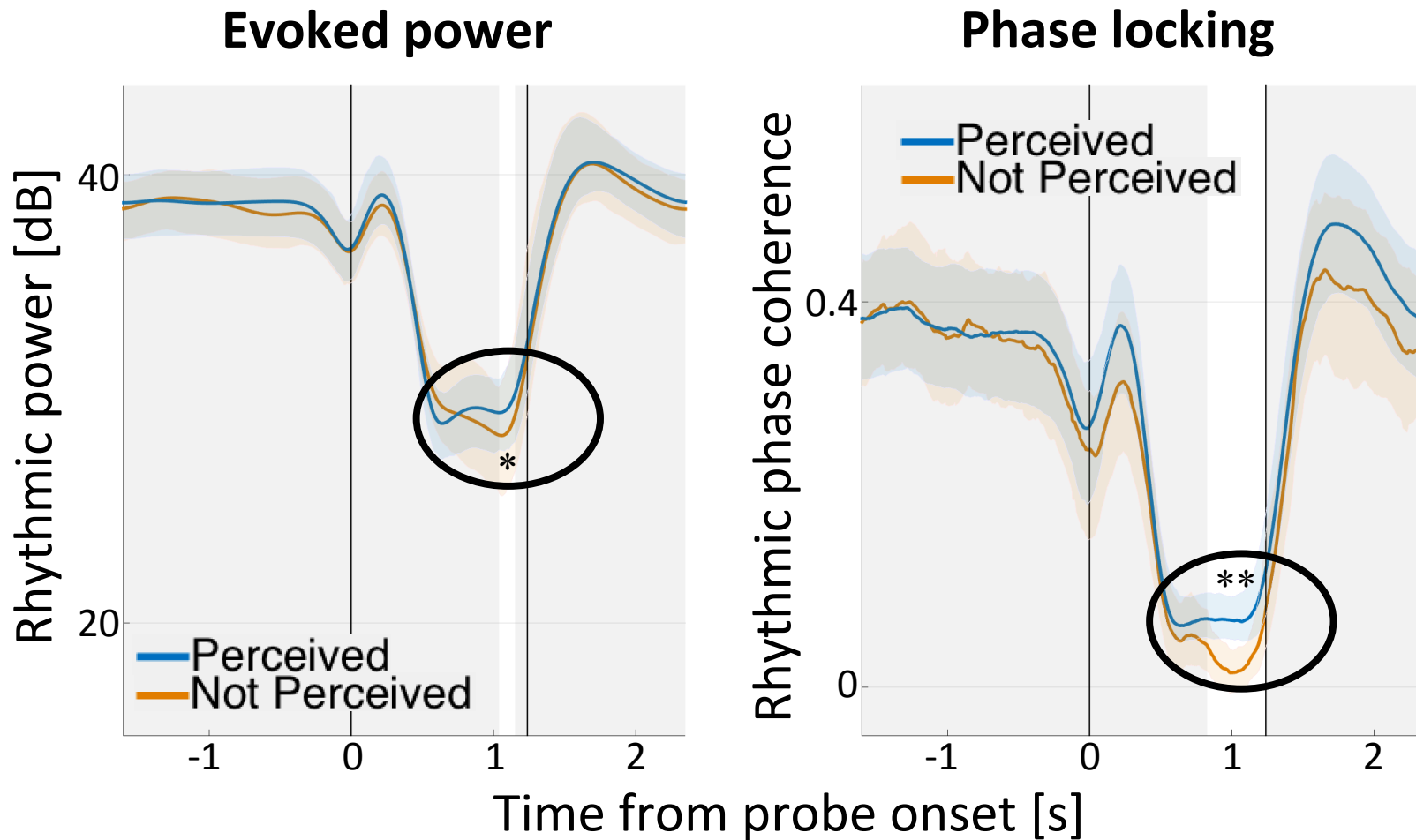
*Neural responses when rhythm **present***



Neural responses when rhythm **present**



Neural responses when rhythm *present*



Neural power DOWN Neural phase coherence DOWN
when rhythm *present* but *not perceived*

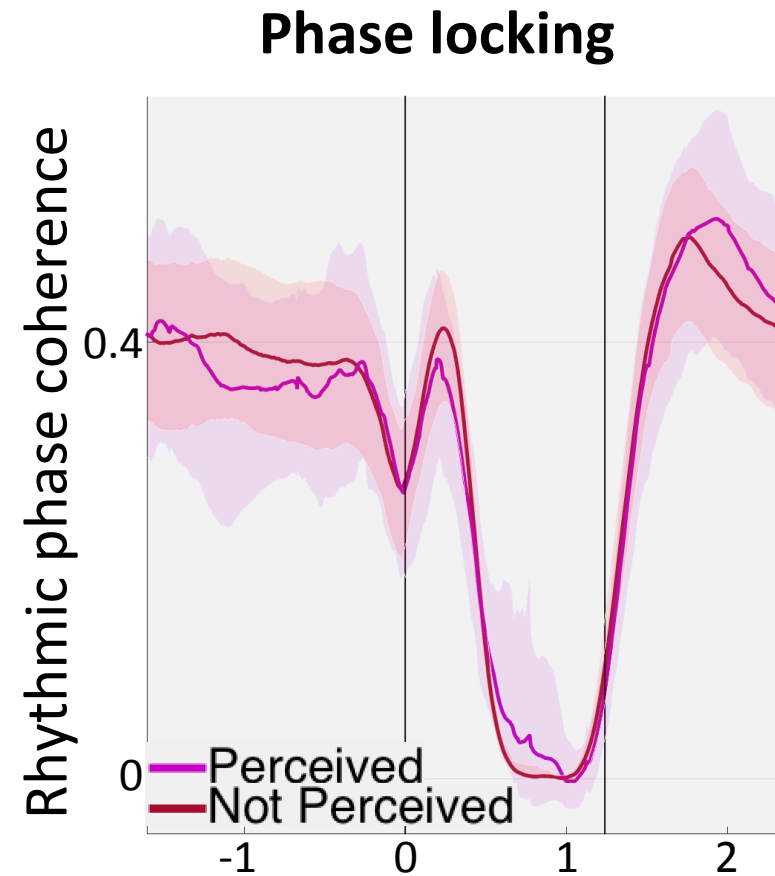
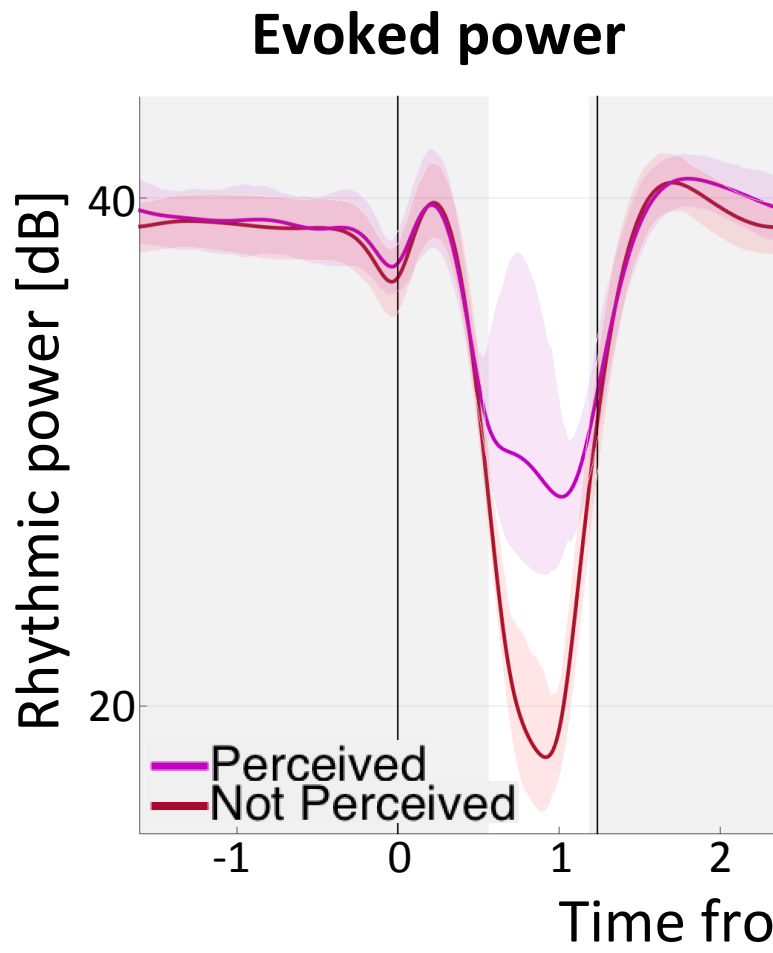
** $p < 0.001$ * $p < 0.05$

Neural responses when rhythm **absent**

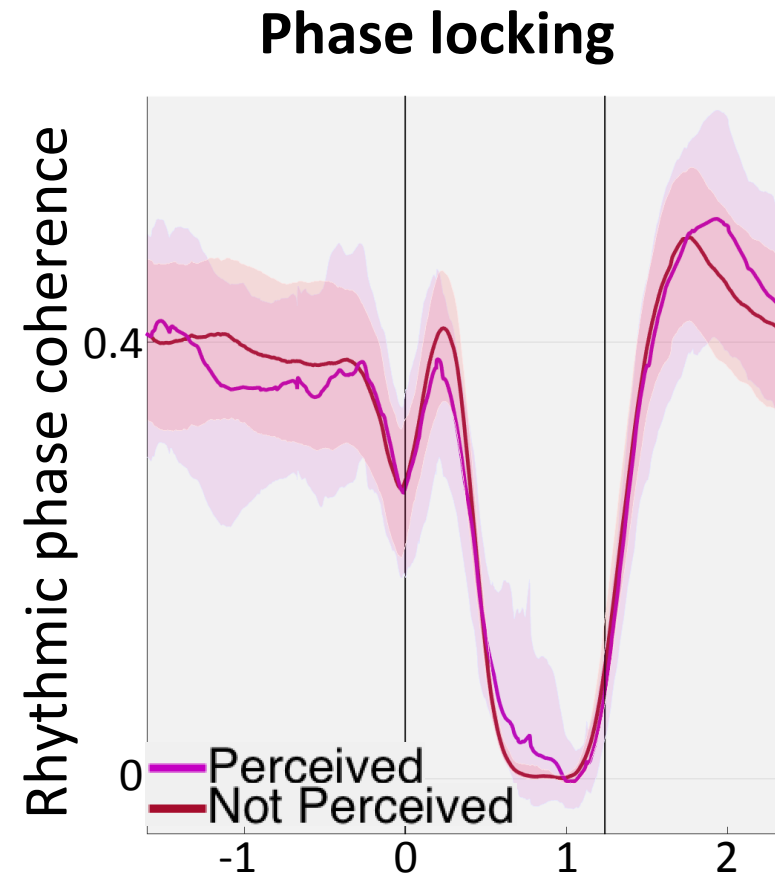
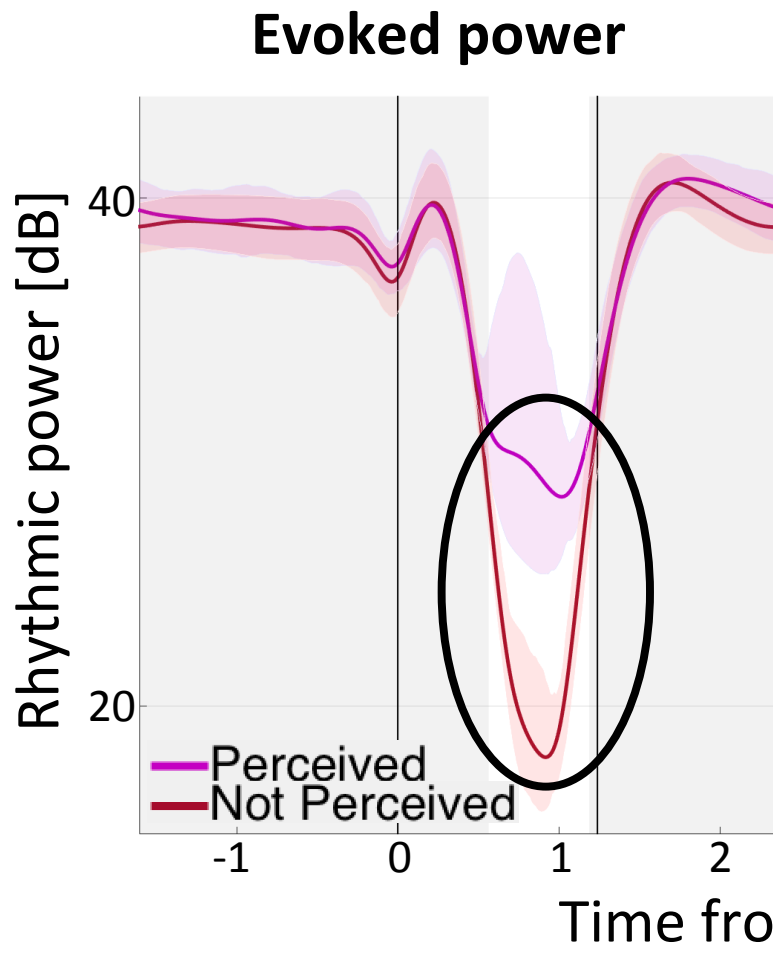
Evoked power

Phase locking

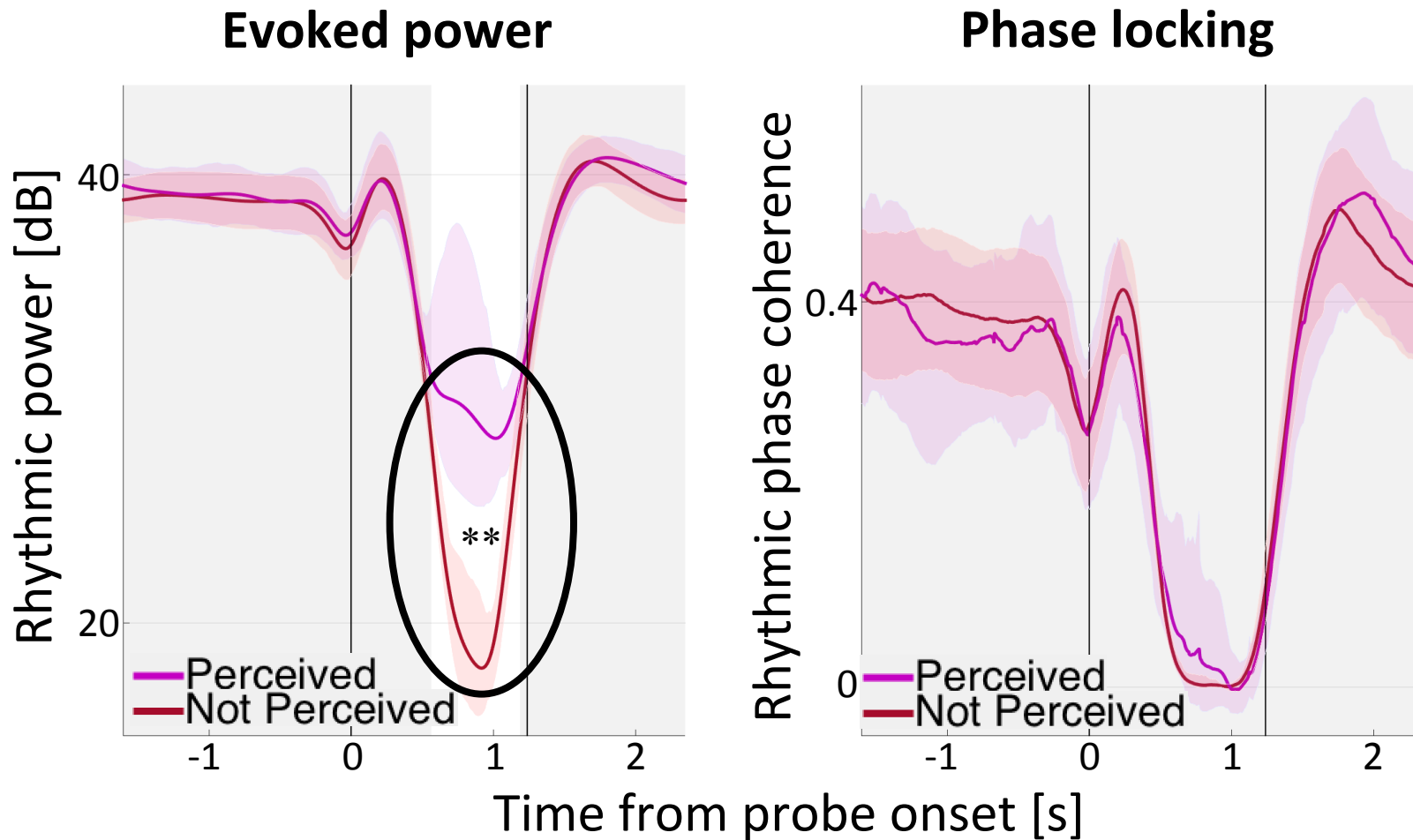
Neural responses when rhythm **absent**



Neural responses when rhythm **absent**



Neural responses when rhythm **absent**



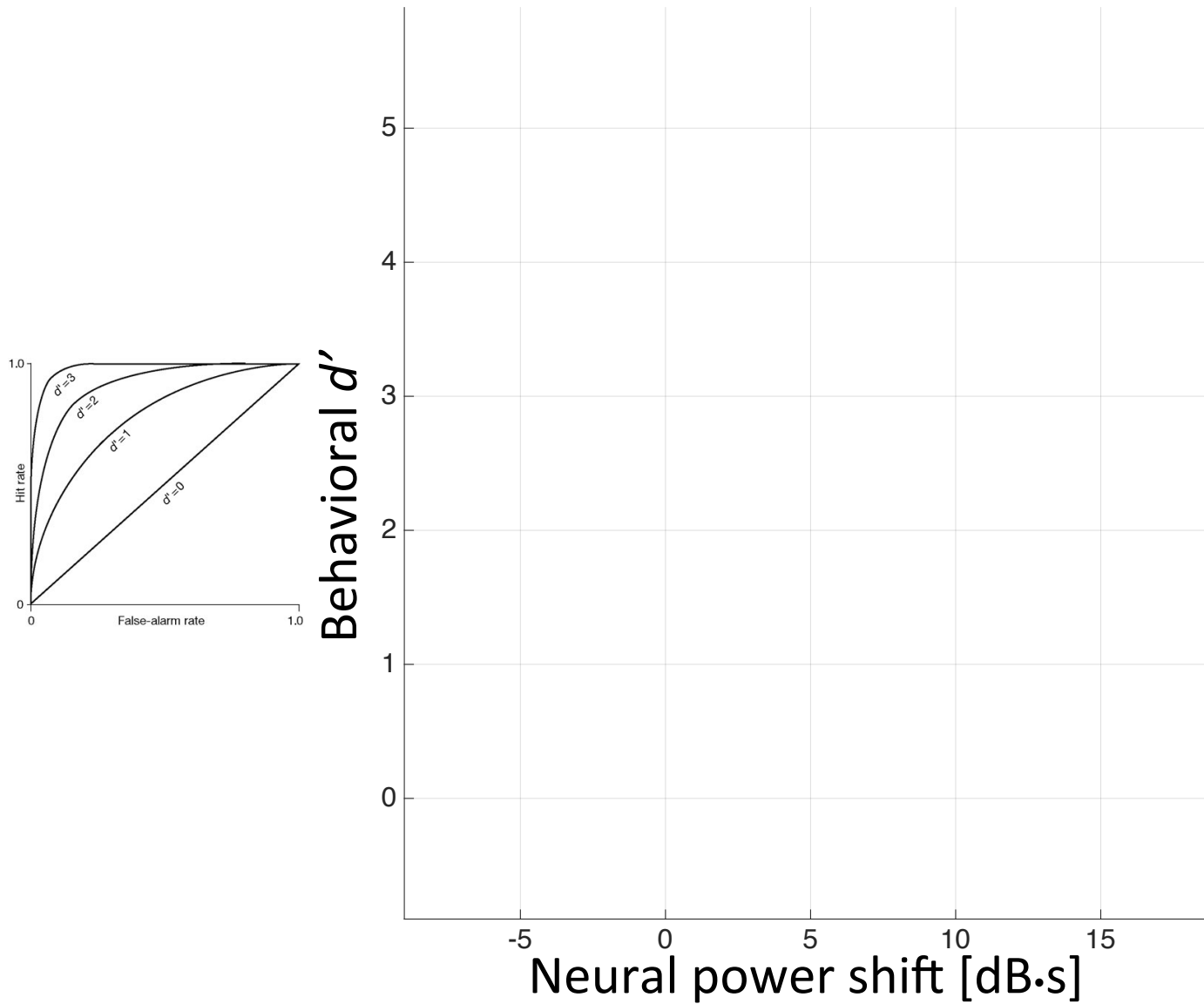
Neural power UP
when rhythm *absent* but *perceived*

****** $p < 0.001$

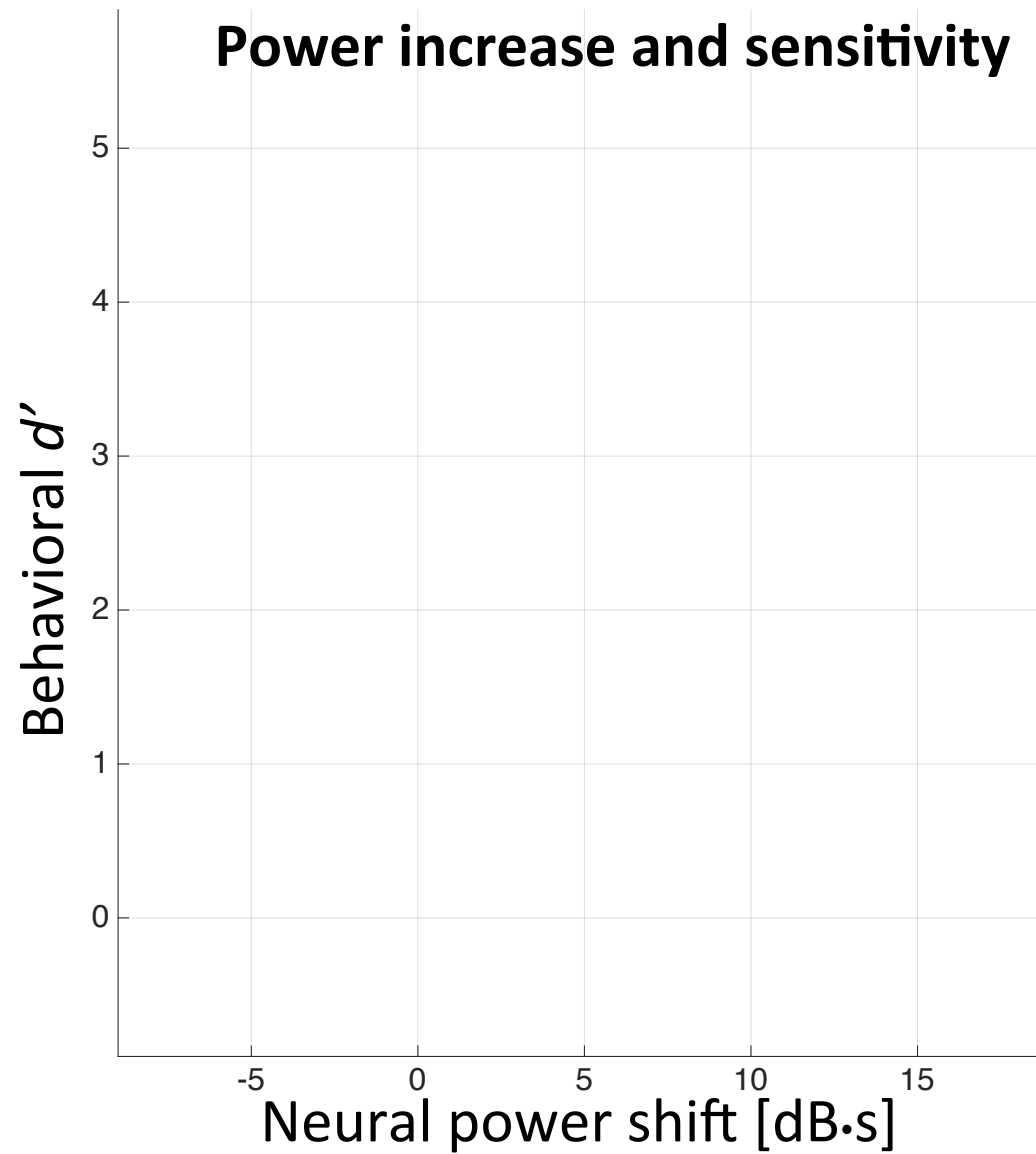
Perceptual sensitivity versus neural power



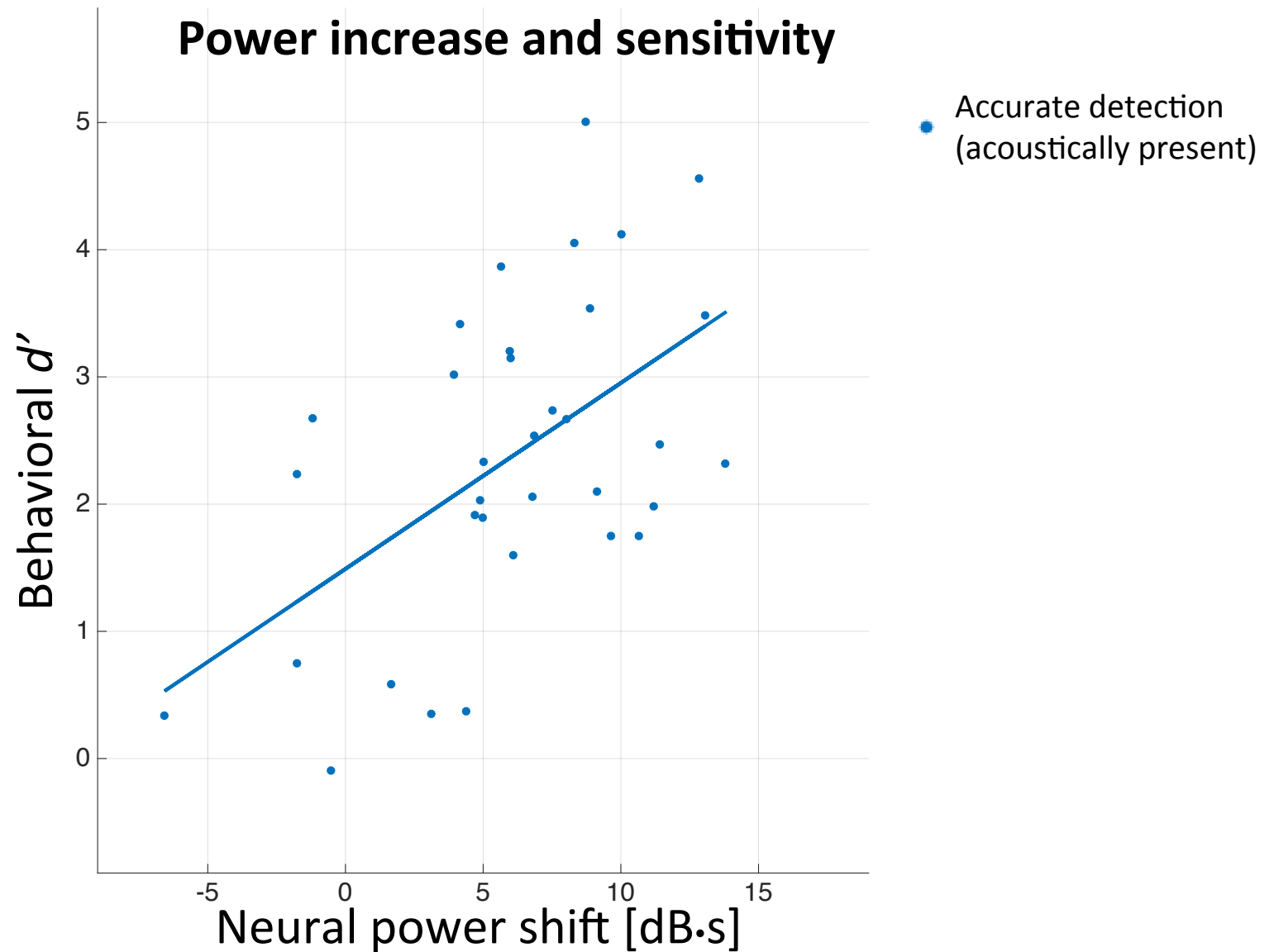
Perceptual sensitivity versus neural power



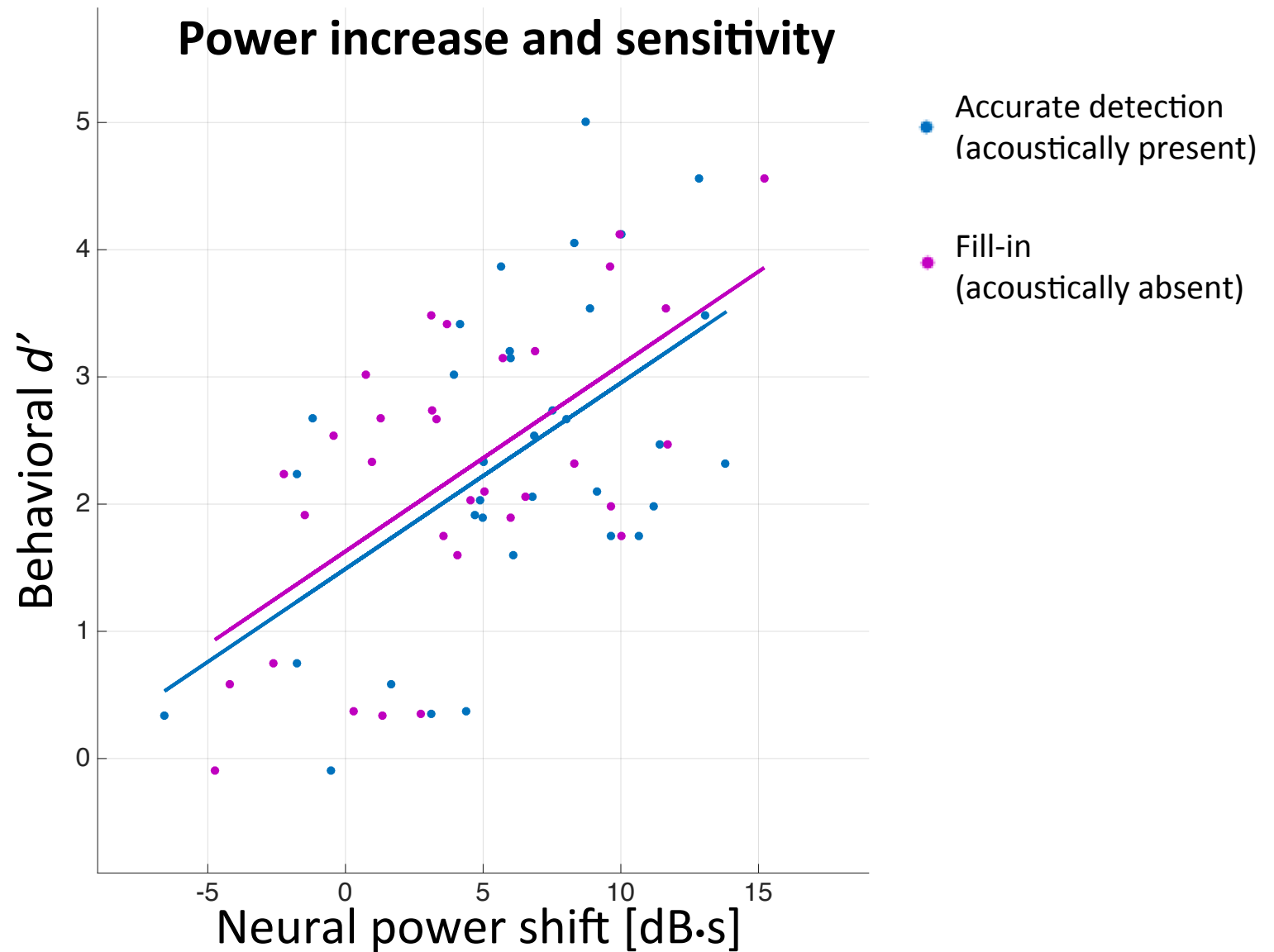
Perceptual sensitivity versus neural power



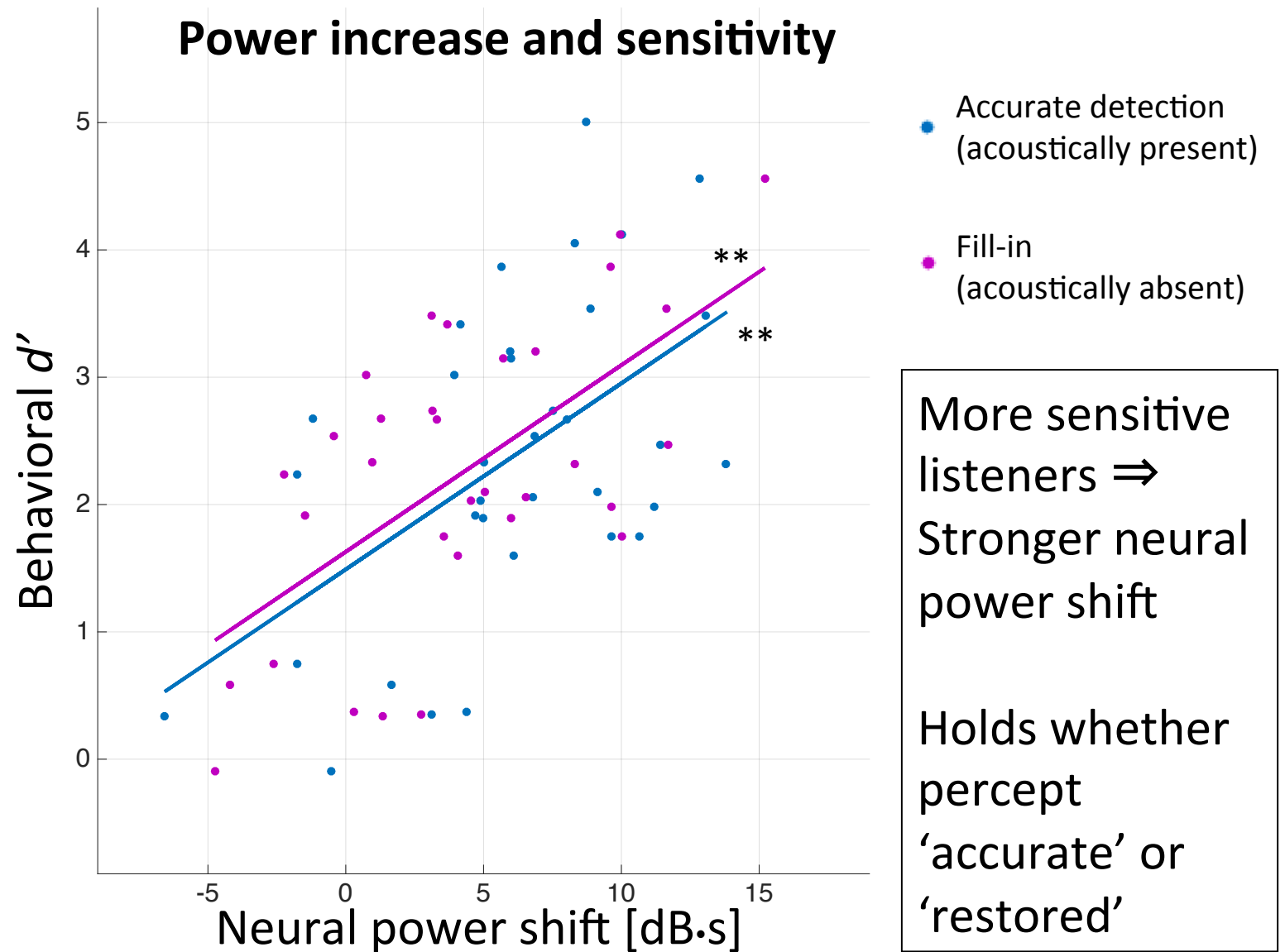
Perceptual sensitivity versus neural power



Perceptual sensitivity versus neural power



Perceptual sensitivity versus neural power

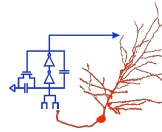


****** $p < 0.001$

Discussion

- Neural representation of rhythm reflects listener's perception :
 - when responses lose temporal coherence, and rhythmic strength, then no rhythm is perceived
 - when responses remain rhythmically strong, then rhythm is perceived
- Synchronization to imagined rhythm stronger for individuals more sensitive to acoustics
 - Neural marker of perceptual restoration

Acknowledgments



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