

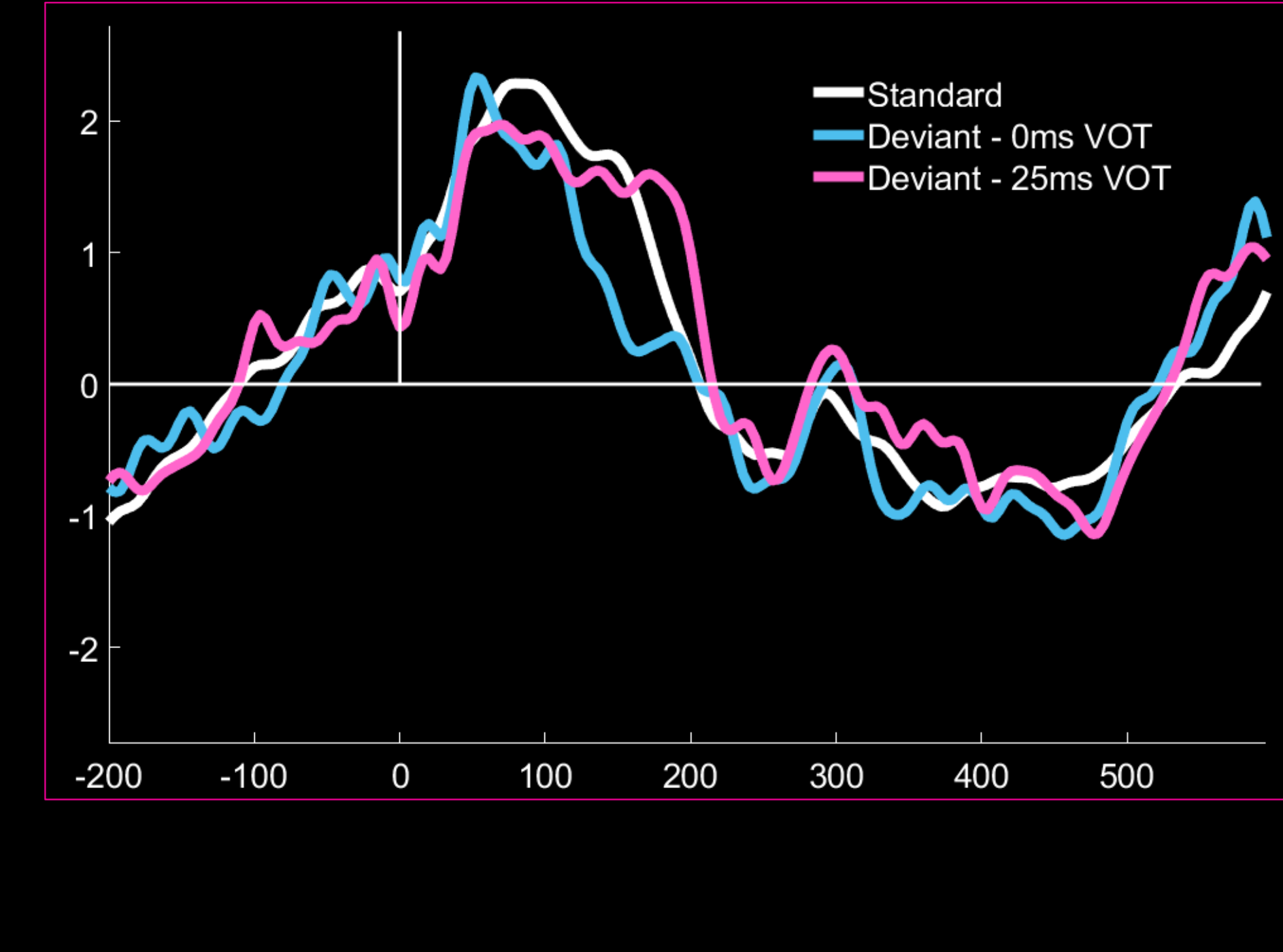
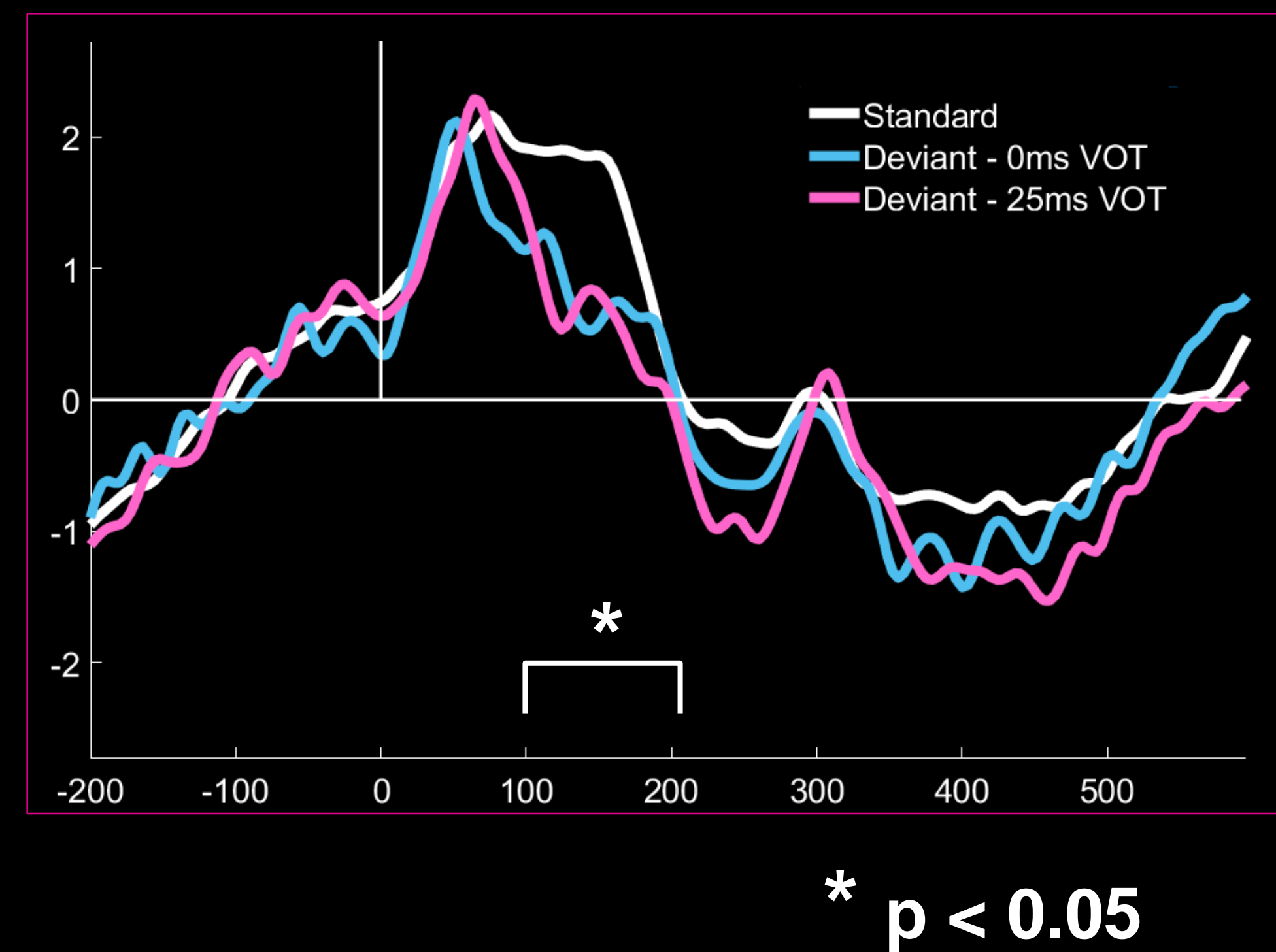
Summary

What's the point? Speech is a mess! How does the brain make generalizations about phonetically-varying speech sounds in the acoustic environment?

We measure the brain's prediction error response – a reflection of the brain's internal model of its acoustic environment.

Results – when sounds are varying, the brain only predicts the category of the sound: *is this a /t/ or a /d/?*

Results



Predictive Coding

The brain is a prediction engine. A mental model of the world is used to make sensory predictions.¹

- ▶ Predictions are encoded neuronally.
- ▶ Different information is encoded at different hierarchical levels.²

Goal of the system: *reduce prediction error.*

High Condition

Phonemic t t t d t t t d
 Phonetic 80 100 90 25 90 100 80 0



Low Condition

Phonemic t t t d t t t d
 Phonetic 55 75 65 25 65 75 55 0

Control Condition

Phonemic t t ? d ? ? t d
 Phonetic 50 75 44^o 25 48^o 36^o 100 0
Hz

Brain Measure

Mismatch Negativity (MMN) – using EEG, we can measure the brain's prediction error response.³ We use a *varying standards* oddball paradigm – phonetically-varying input contrasts with an across-category deviant.⁴

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Discussion

Of 4 contrasts – only 2 showed a significant MMN.
 High Condition – 0ms VOT
 High Condition – 25ms VOT

There were no significant differences between the 0ms and 25ms VOT deviants, and no significant differences between High and Low conditions.

This suggests that phonetic detail is not present in prediction – **only phoneme categories.**

Standards	Deviants
80, 90, 100ms VOT	25ms VOT*
	0ms VOT*
55, 65, 75ms VOT	25ms VOT
	0ms VOT

References

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- ²Heilbron, M., & Chait, M. (2018). Great Expectations: Is there Evidence for Predictive Coding in Auditory Cortex? *Neuroscience*, 389, 54–73.
- ³Näätänen, R., Paavilainen, P., Rinne, T., & Alho, K. (2007). The mismatch negativity (MMN) in basic research of central auditory processing: A review. *Clinical Neurophysiology*, 118, 2544–2590.
- ⁴Rhodes, R., Han, C., & Hestvik, A. (2019). Phonological memory traces do not contain phonetic information. *Attention, Perception, & Psychophysics*, 81(4), 897–911.