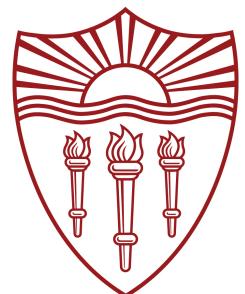
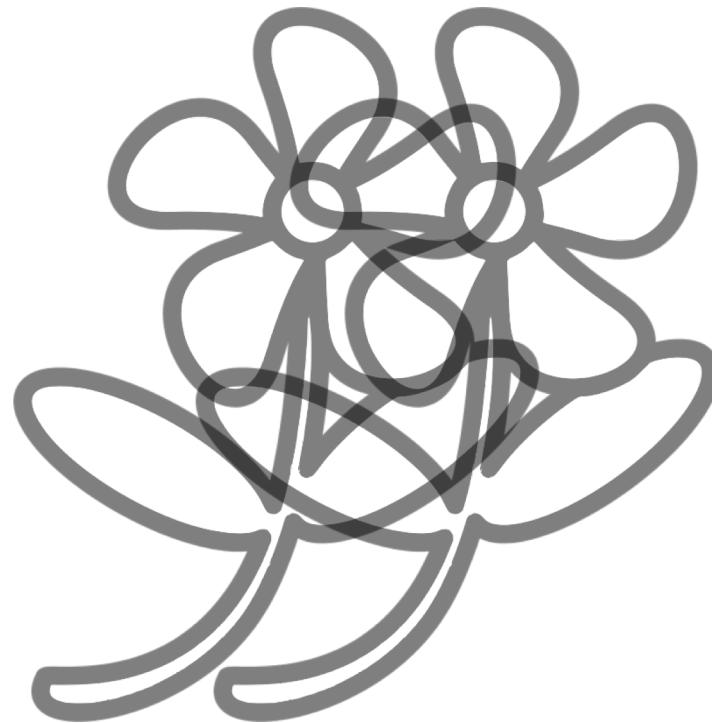


Auditory object formation from background noise improves speech perception

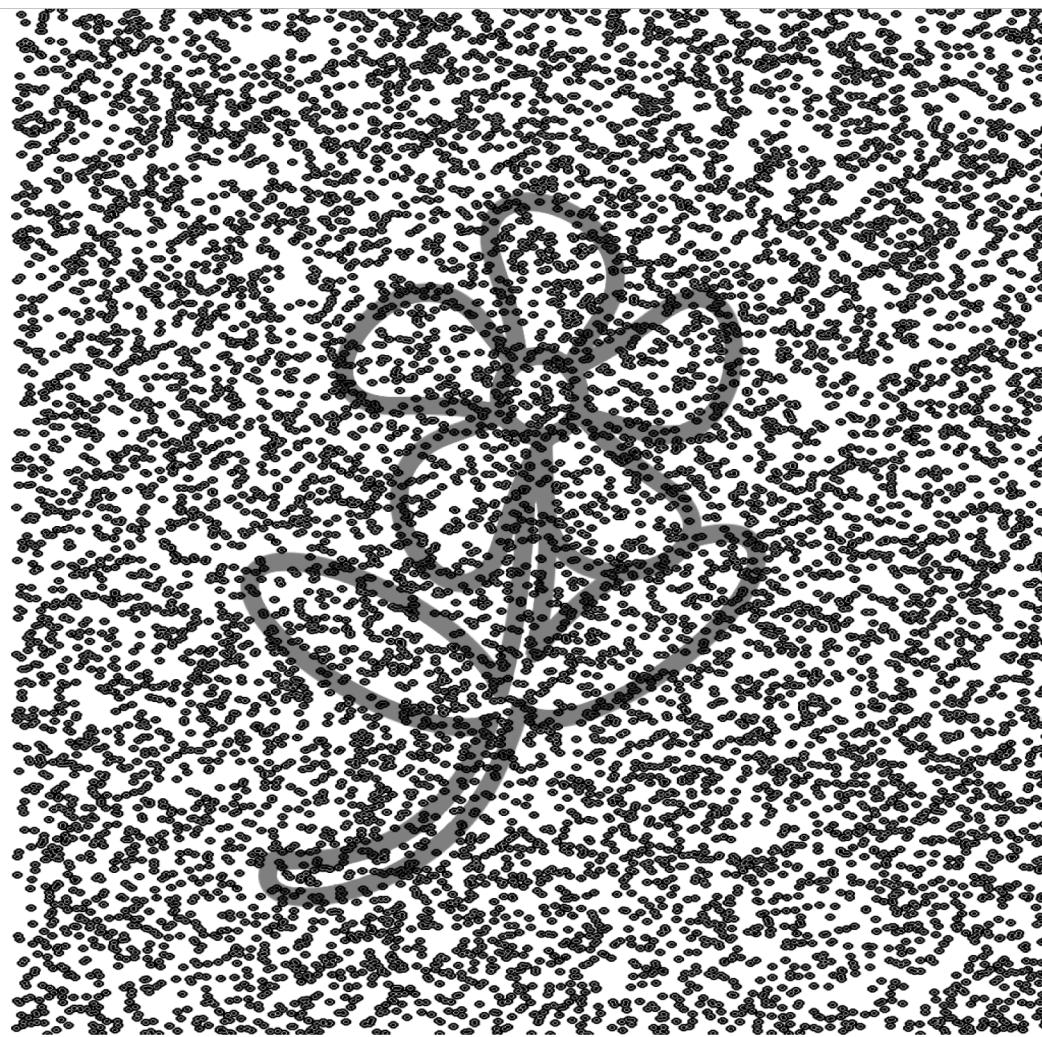
MAURY LANDER-PORTNOY & JASON ZEVIN
UNIVERSITY OF SOUTHERN CALIFORNIA



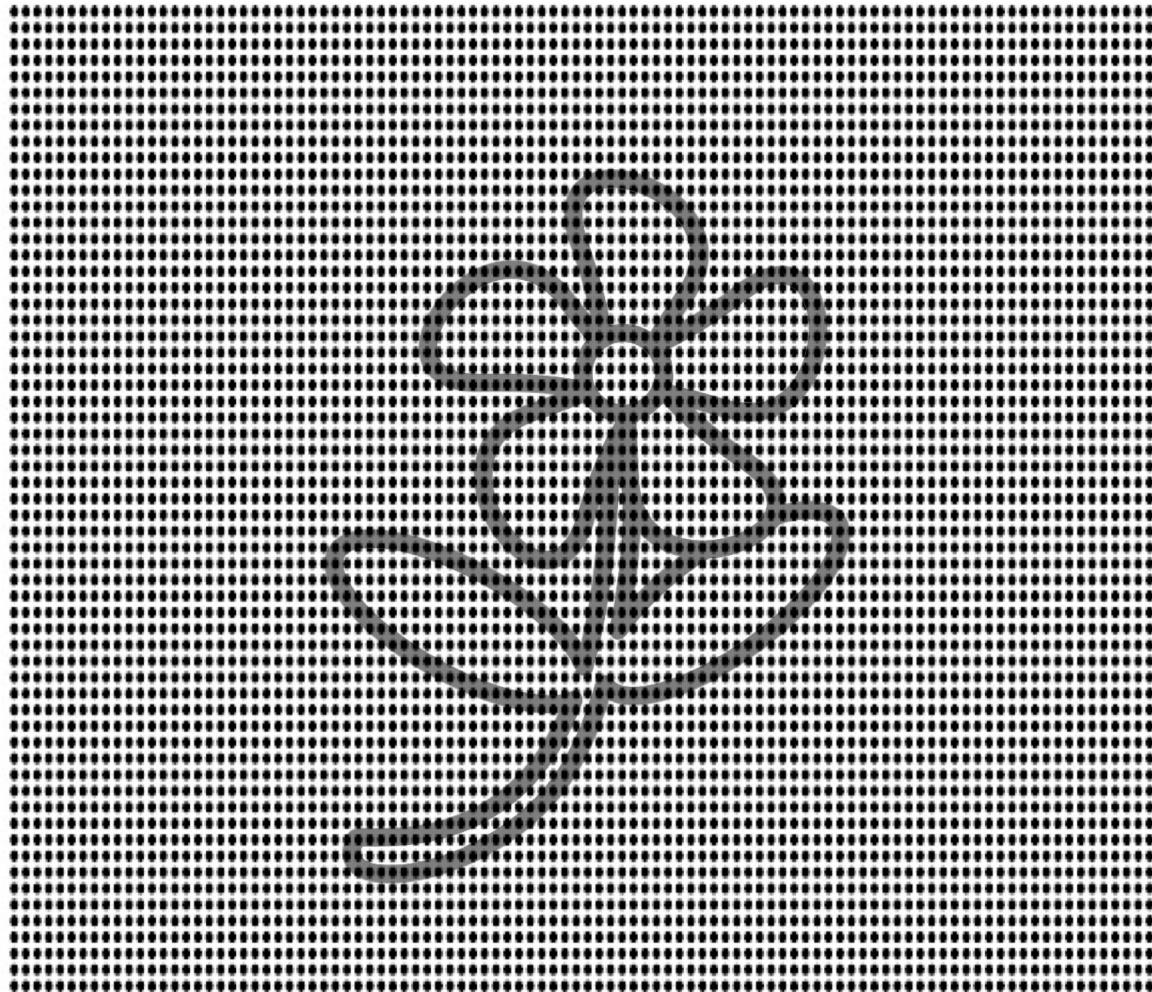
Informational Masking



Energetic Masking



Regular Energetic Masking



Behavioral Studies

Background

Initial Exploratory
Experiment

Follow-up Clarification
Experiment

Question:

What role does temporal prediction play in speech perception in noise?

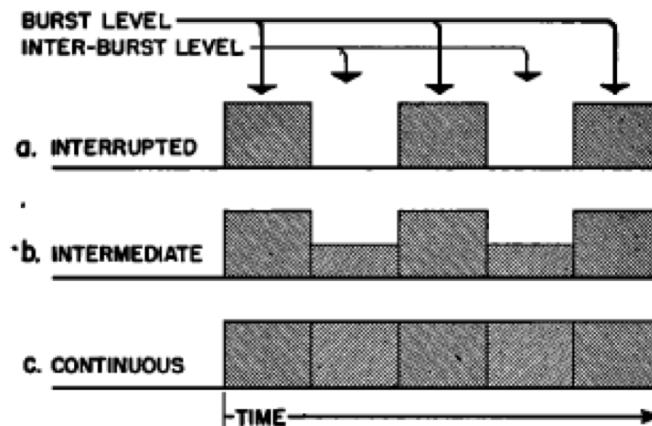


Previous Energetic Masking Work

- Steady-state masker
- Periodic maskers, simple and variable noise power
- Complex structure, but no repeating rhythm



(Festen & Plomp, 1990)



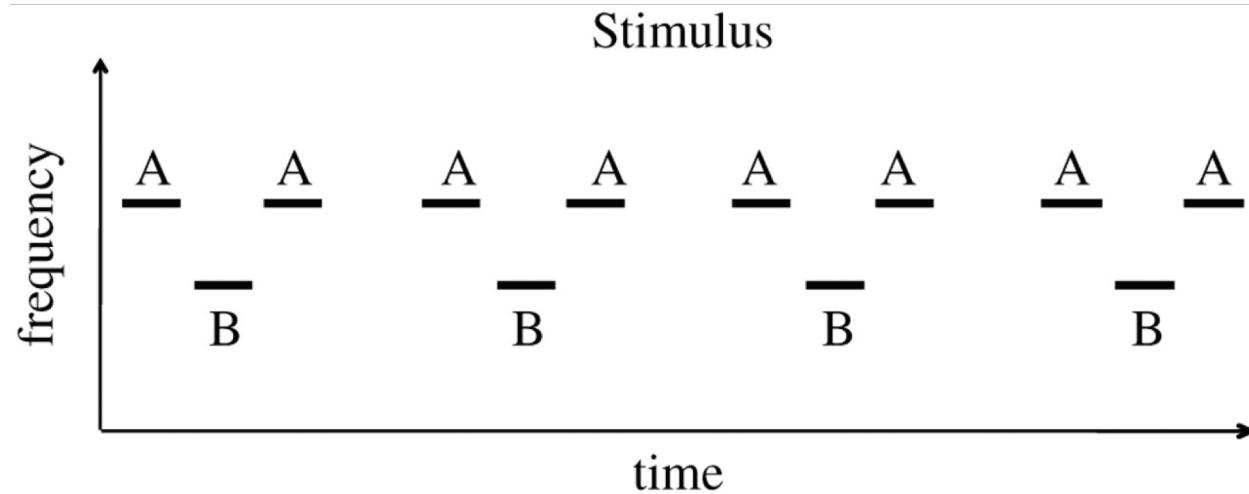
(Pollack, 1955)



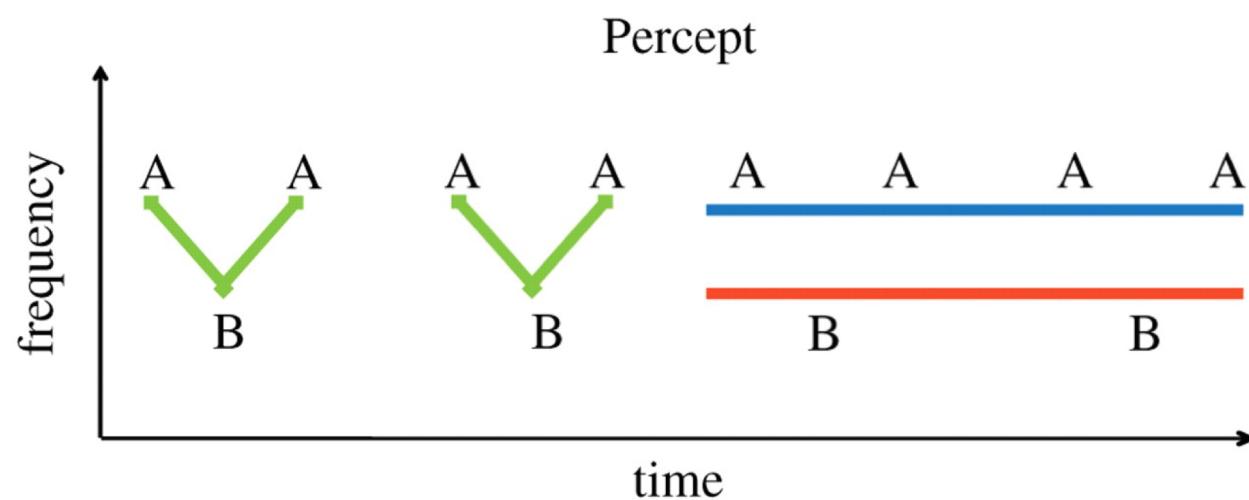
(Festen & Plomp, 1990)



Auditory scene analysis



Construct perceptual stream



Segregate streams

Attend to desired stream



Motivation for the experiments

- Noise causes decreased intelligibility
- Auditory object formation allows separation of auditory stimuli
- **Hypothesis: increased online rhythmic information will ease speech perception in noise**

Spoiler: It does



Behavioral Studies

Background

Initial Exploratory
Experiment

Follow-up Clarification
Experiment

Question:

How do you create information from random noise?



Spectral profile of noise vs. speech

LTAS



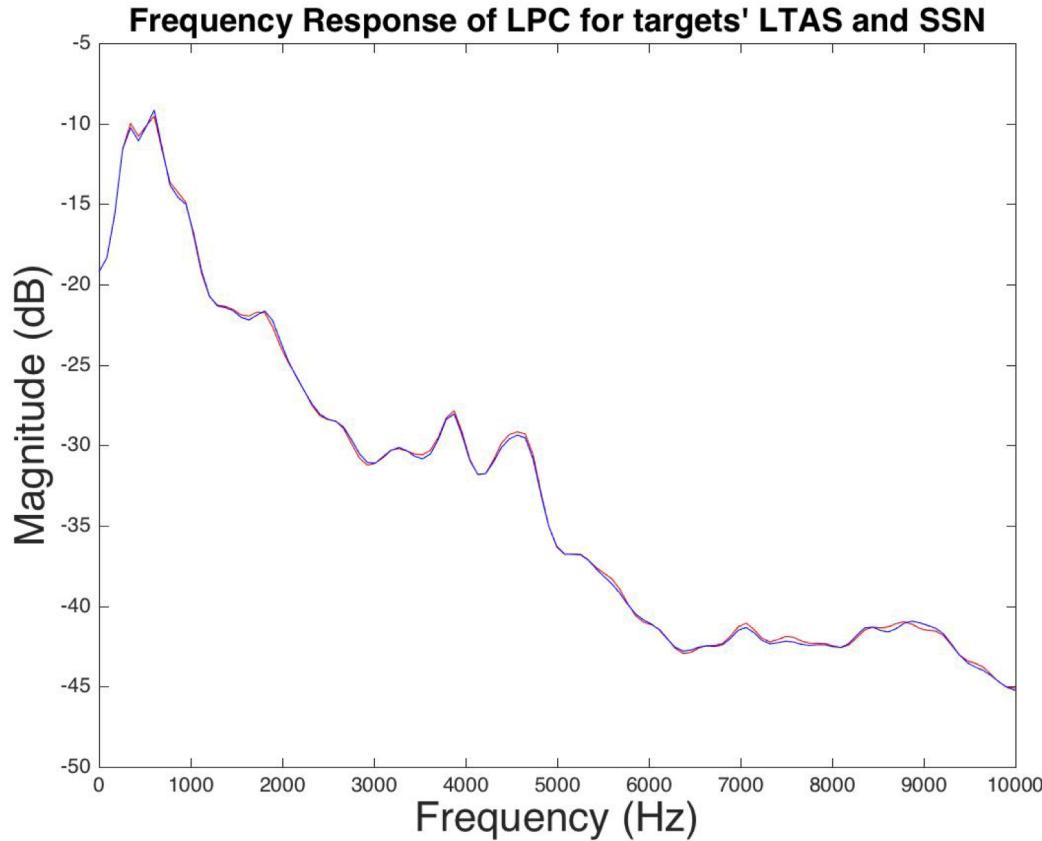
Glimpses



Patterns



Trials

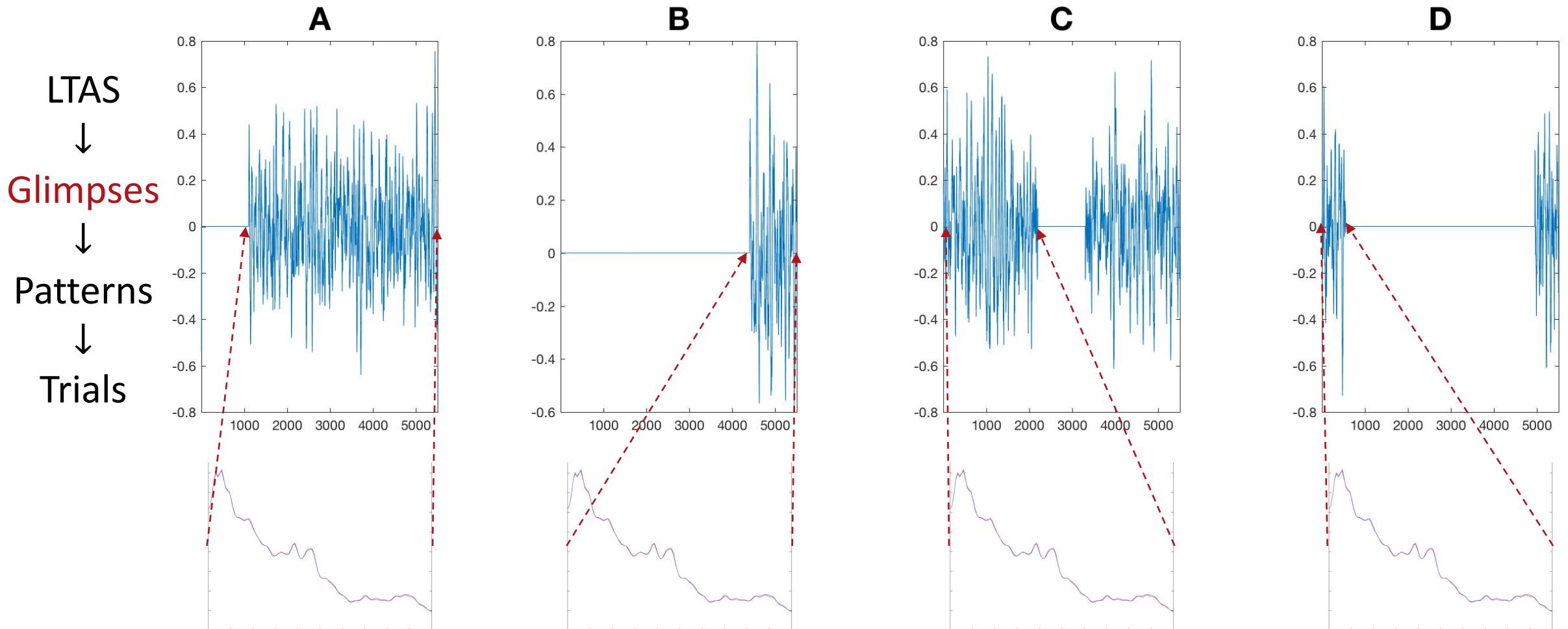


Noises' long-term average spectrum correlated to speech



Noise Patterns

8Hz (125ms) windows containing noise and silence



Provide temporal regularity in noise

LTAS



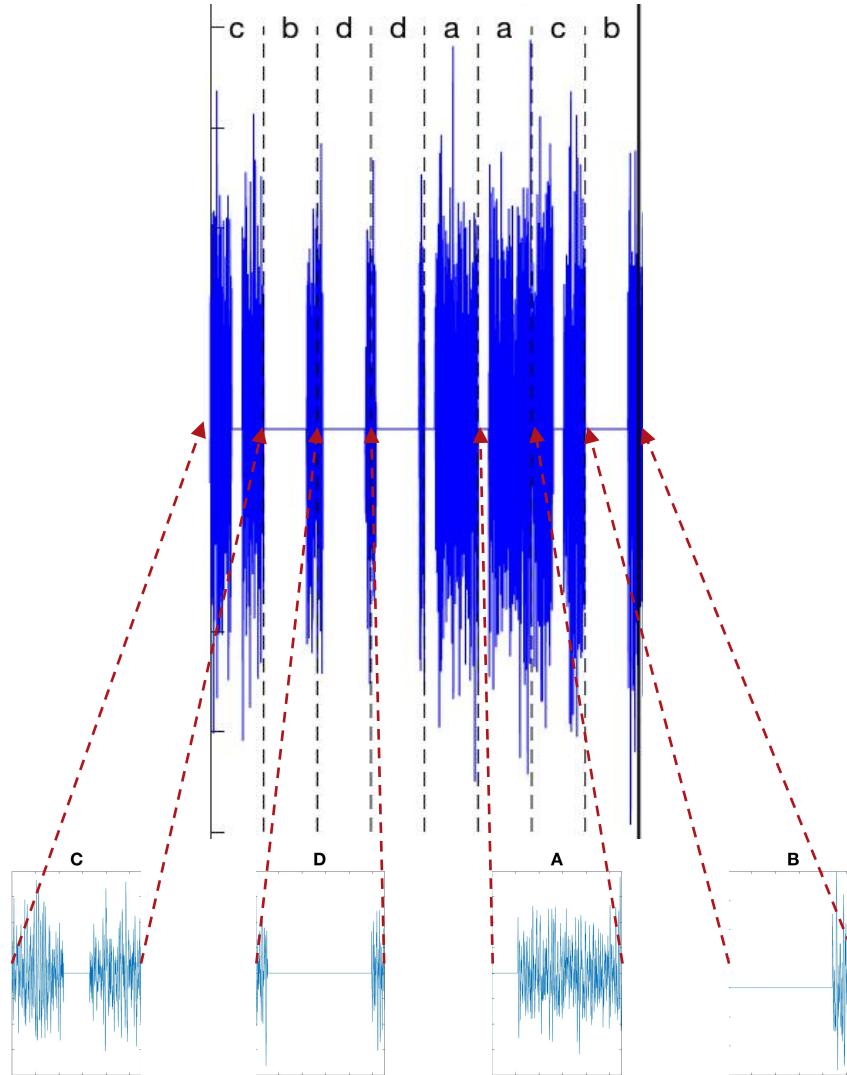
Glimpses



Patterns

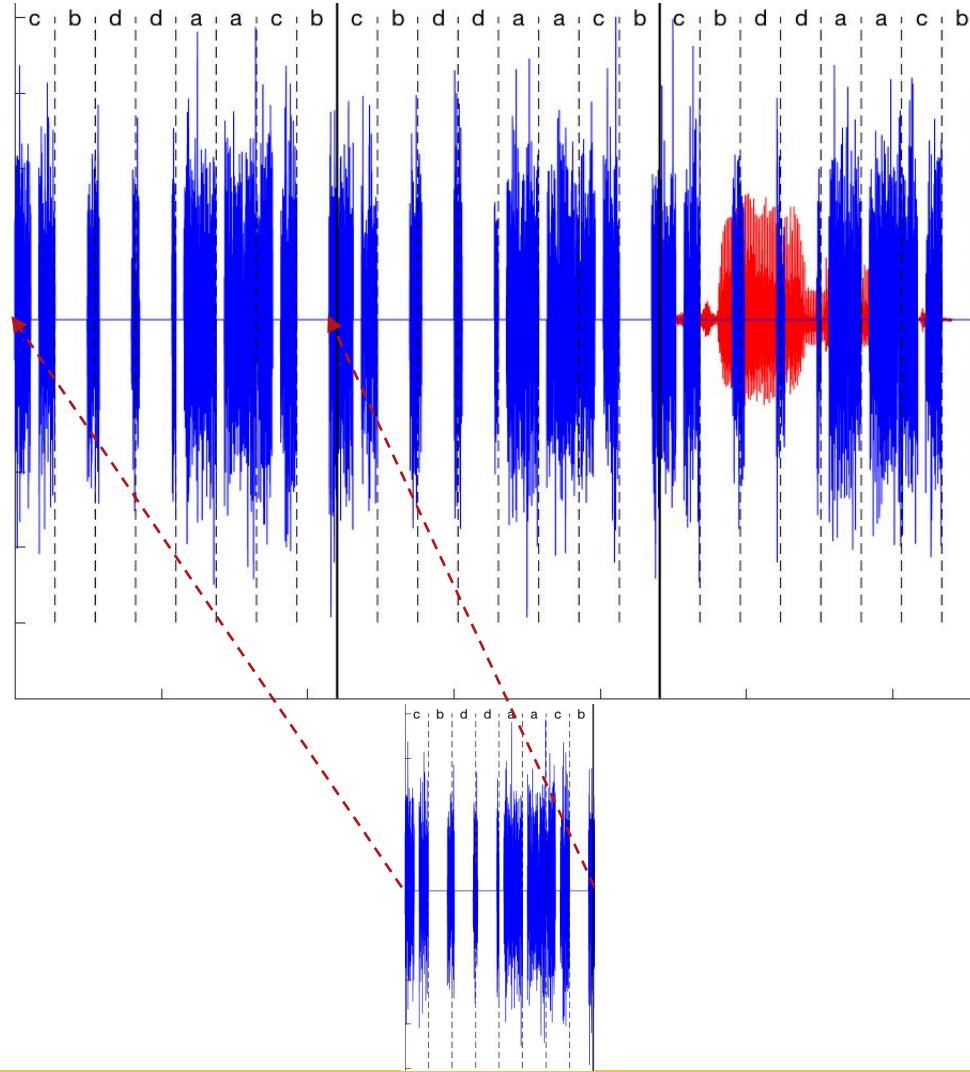


Trials



Provide temporal regularity in noise

LTAS
↓
Glimpses
↓
Patterns
↓
Trials

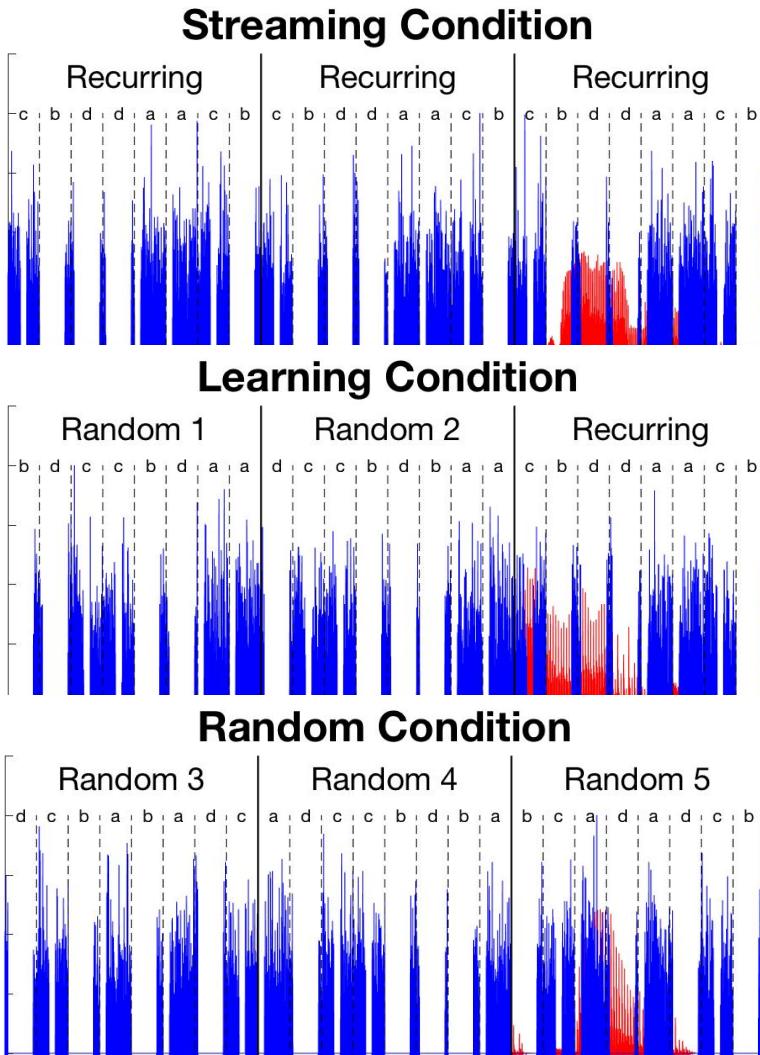


Conditions

Repetitive information available for streaming

Control for SNR, glimpsing, and learning

Control for SNR, baseline task performance

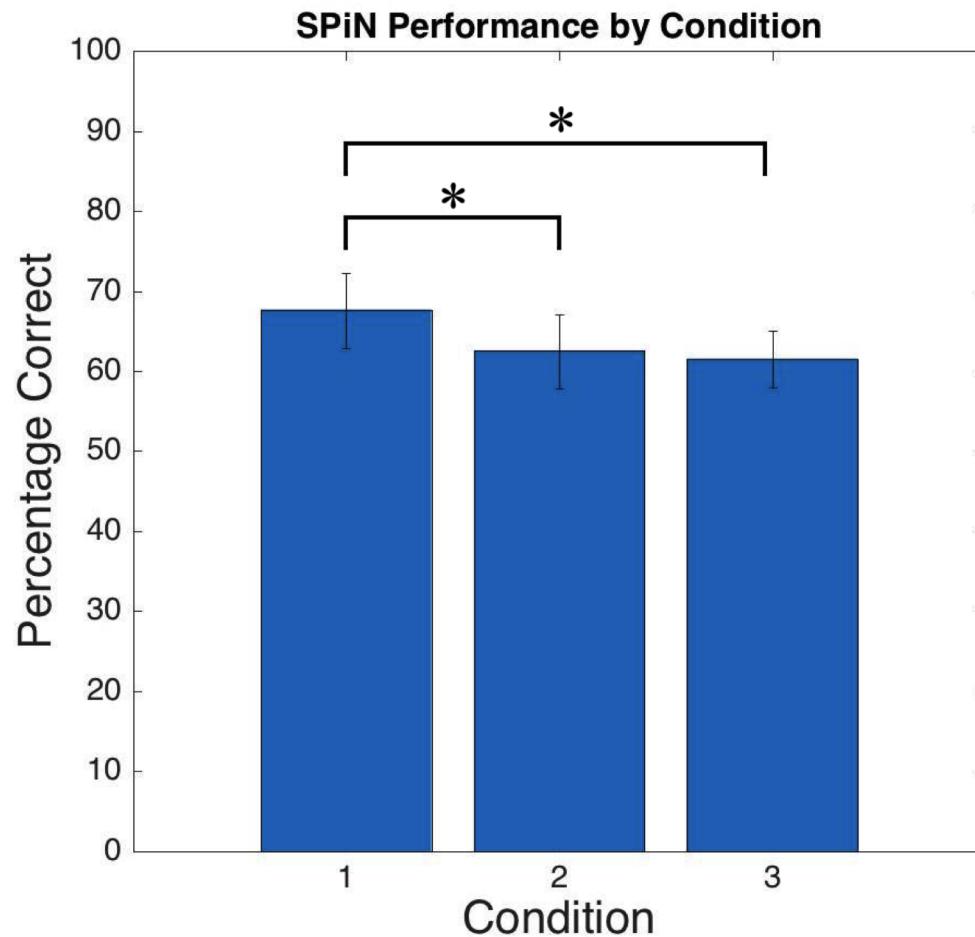


Experiment Format

- Open-set word-recognition task
- Used 108 multisyllabic words as targets
- 60 Undergraduates at USC (n = 60)
- Executive function and working memory tasks followed



Temporal regularity significantly better



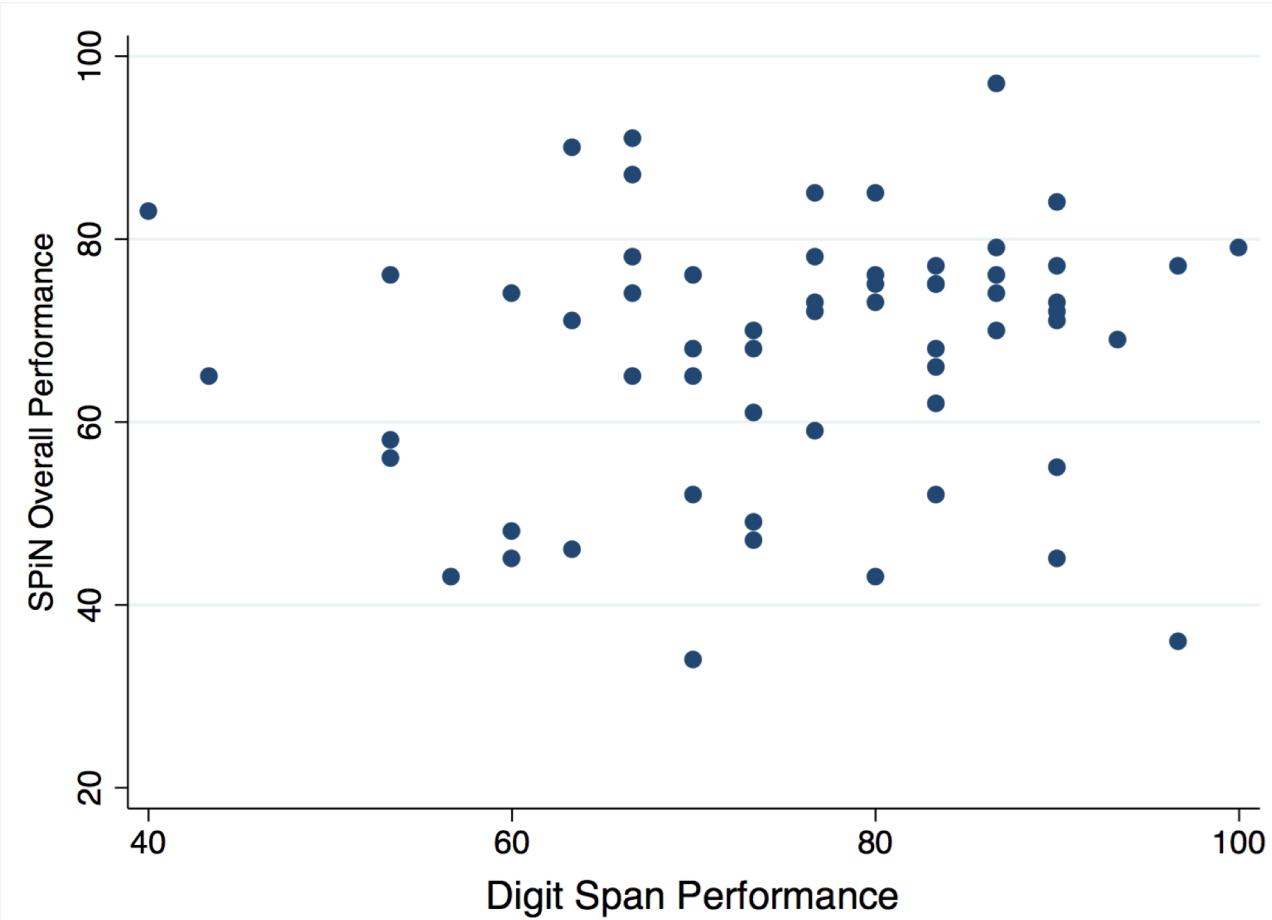
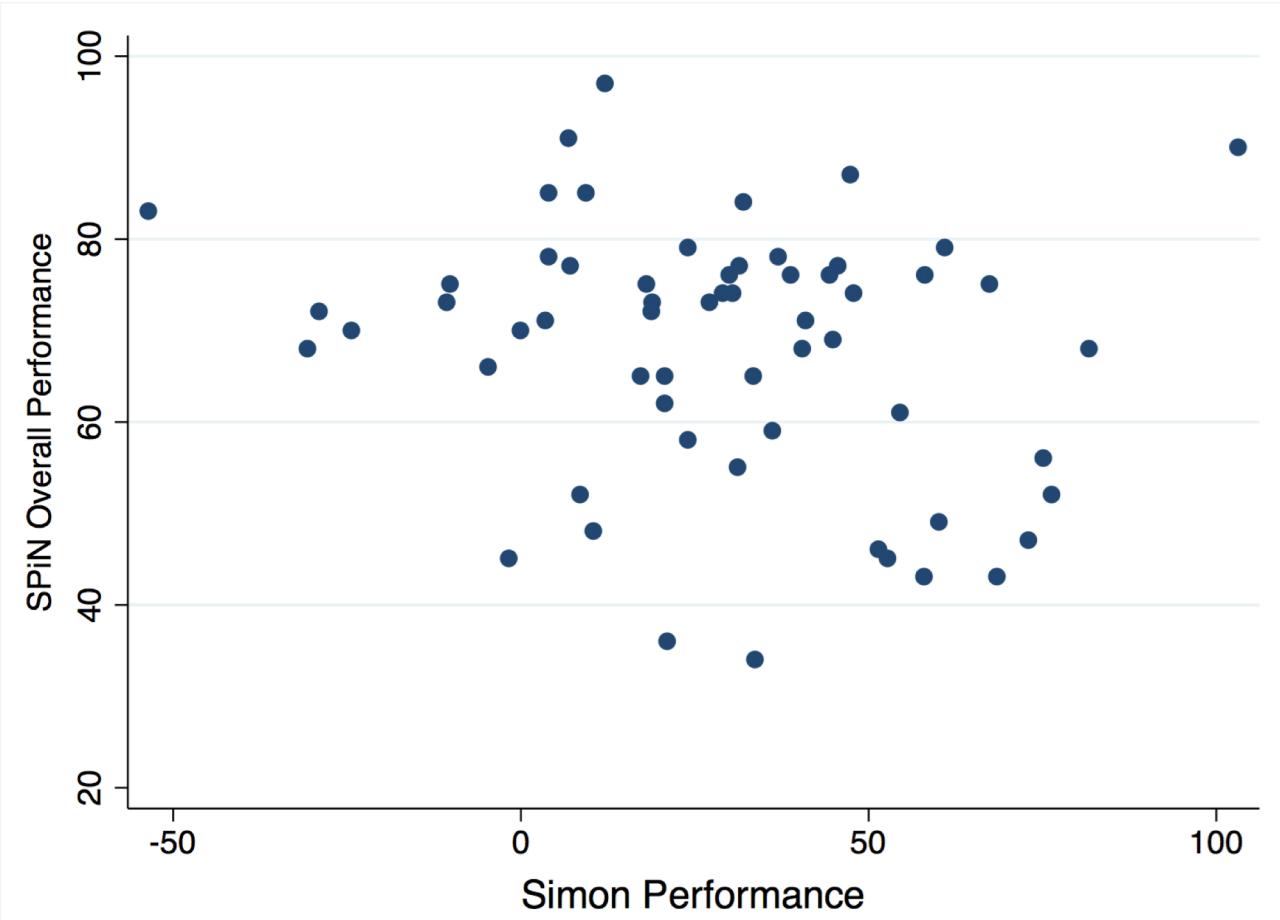
N = 60

Mean: 66% vs. 61% vs. 61%

P-value: both $\leq .001$



Executive Function & Working Memory tasks



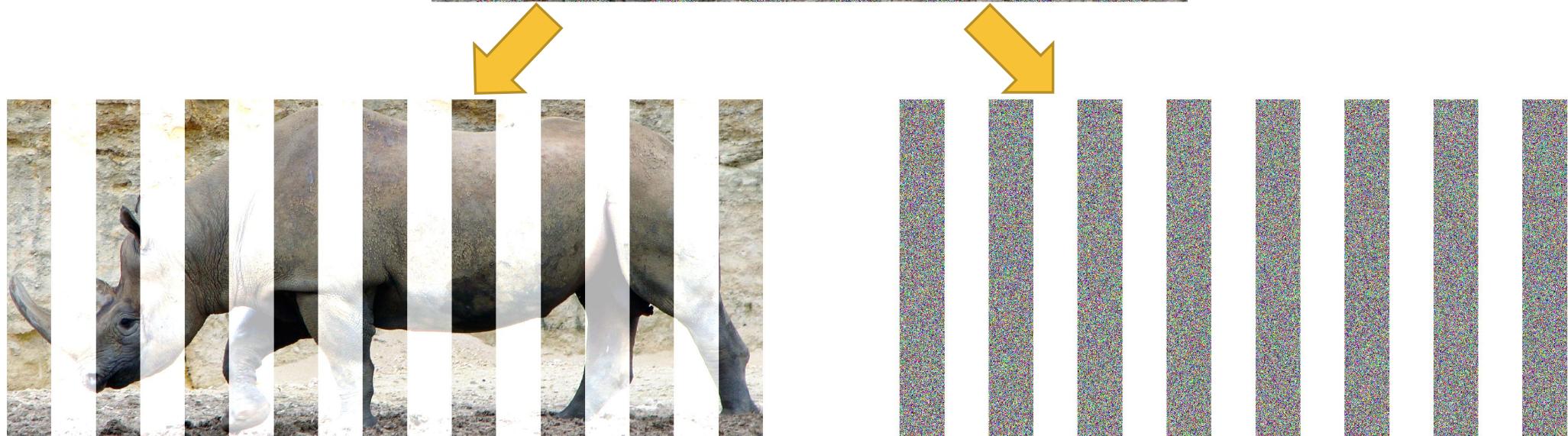
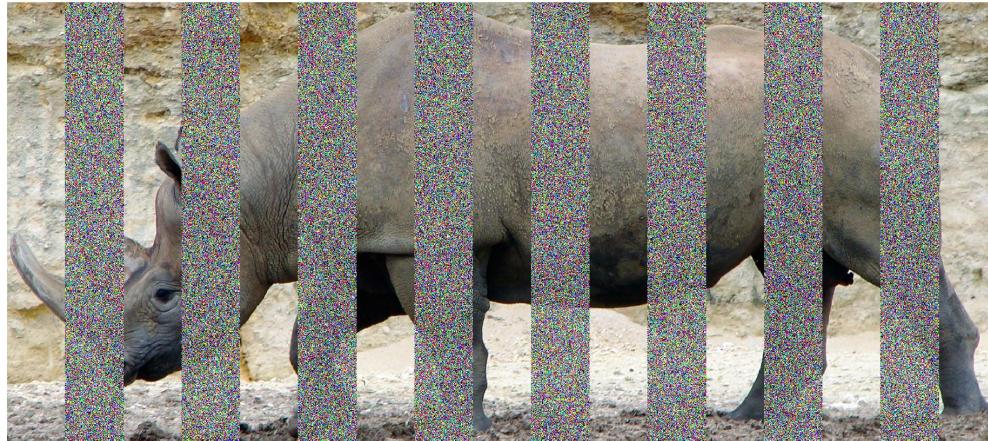
Behavioral Studies

Background

Initial Exploratory
Experiment

Follow-up Clarification
Experiment

Is this caused by streaming?



Is this caused by pure temporal prediction?



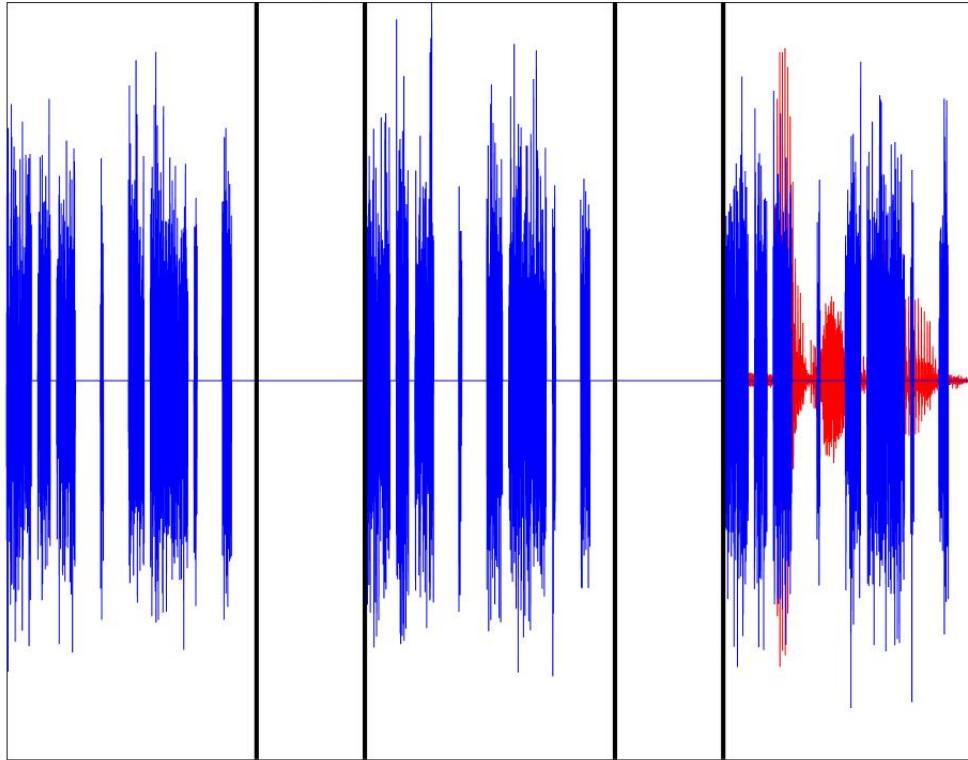
Experiment Format

- Open-set word-recognition task
- Used 108 multisyllabic words as targets
- 60 Undergraduates at USC (n = 60)
- Musical Experience Questionnaire Followed



Insert silences to defeat streaming

Noise Regularities with Silences



Bregman showed
streaming “builds up”

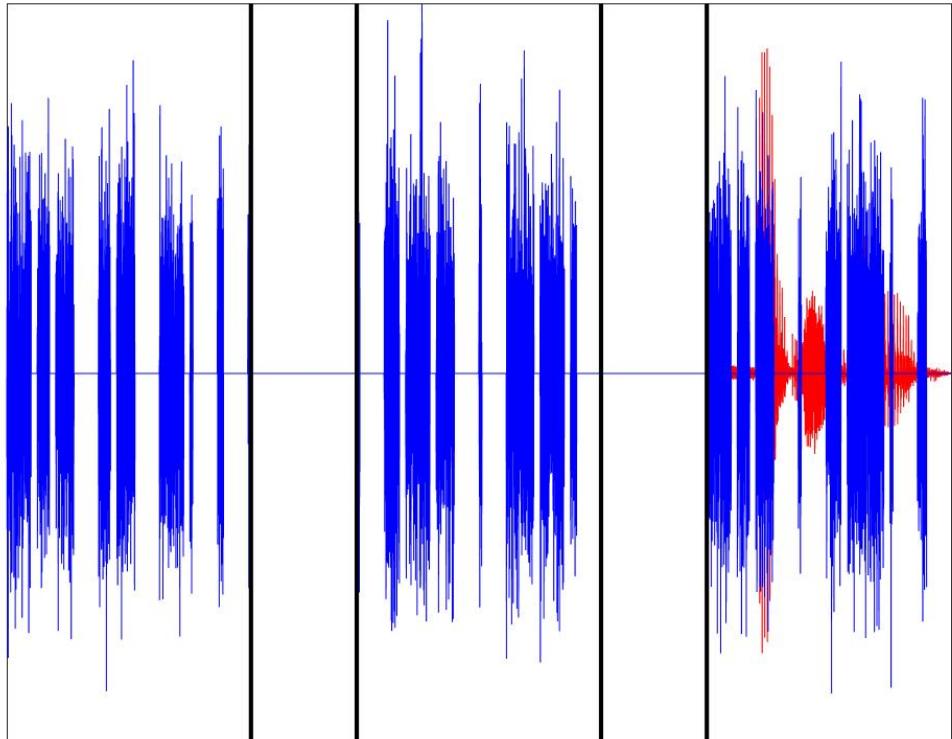


We inserted silences
between patterns

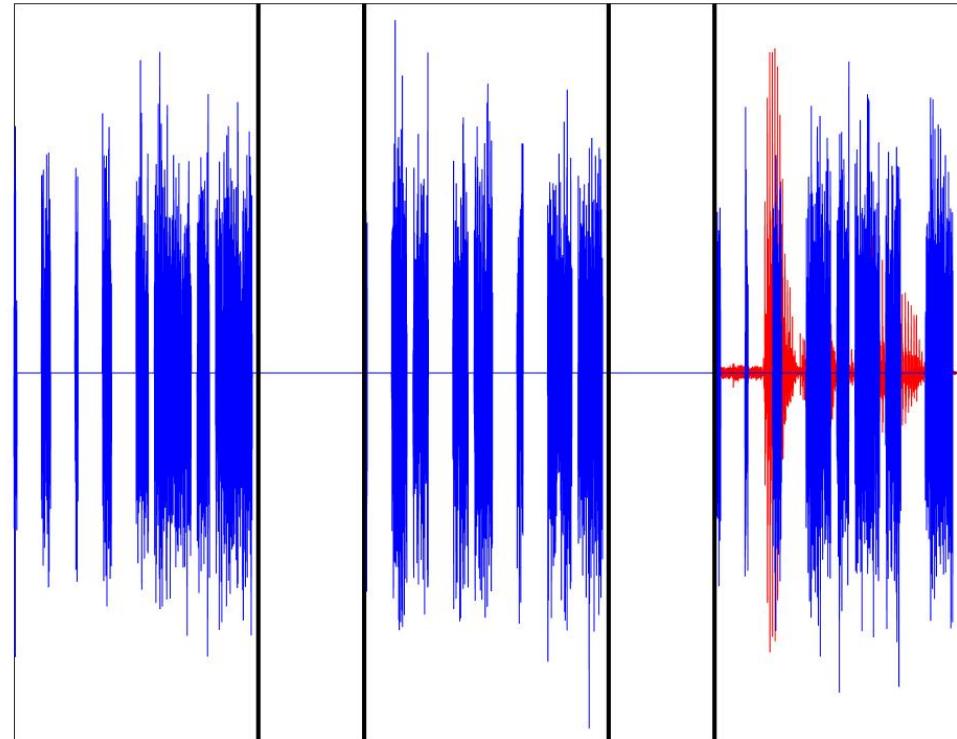


Again compared with control and baseline

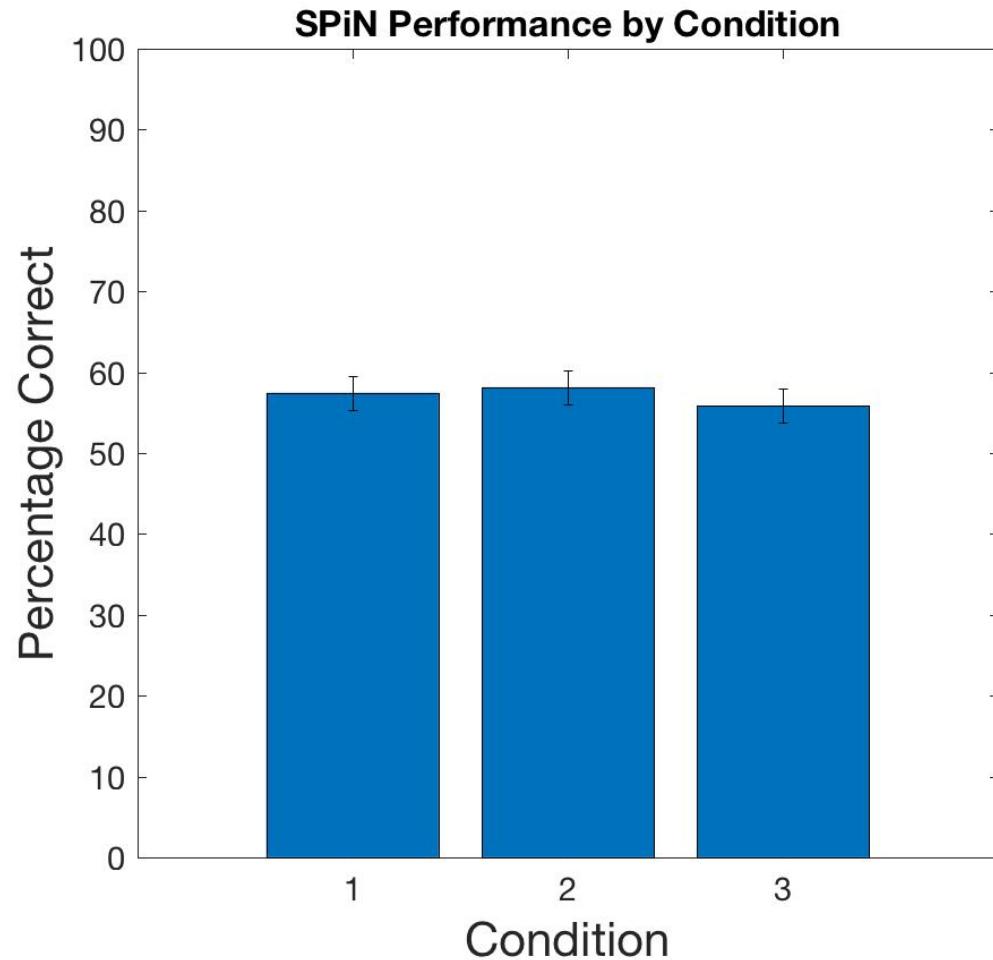
Control with Silences



Random Baseline with Silences



No significant difference



N=60

Mean: 57.4% vs. 58.1% vs. 55.8%

P-value: .681, .269, and .129



We have evidence for streaming, now what?

Frequency manipulations

- Constructing noise “melody”

Manipulation of auditory attention

- Streaming highly dependent on attention

Testing of pattern learning vs. streaming

- Streaming patterns AAA, AAA, AAA vs. XXX, YYY, ZZZ



THANK YOU!

THANK YOU TO THE ZEVINLAB RAS AND THE PARTICIPANTS WHOSE
DATA MADE THIS WORK POSSIBLE

