

# Language Shifts the Representation of Sounds in Time:

## From Auditory Individuals to Auditory Ensembles

Julia Ongchoco<sup>1</sup>, Tyler Knowlton<sup>1</sup>, Anna Papafragou<sup>1, 2</sup>  
<sup>1</sup>MindCORE <sup>2</sup>Department of Linguistics | University of Pennsylvania

### Individuating/grouping events in time

#### "What did you do last week?"

Can you individuate days or were they all a blur?

"I went to this amazing concert"

"I had the best date"

#### "individuals"

(e.g. Zacks et al., 2009; Newton, 1979)

"a ton of meetings"

"it was a tough week in general"

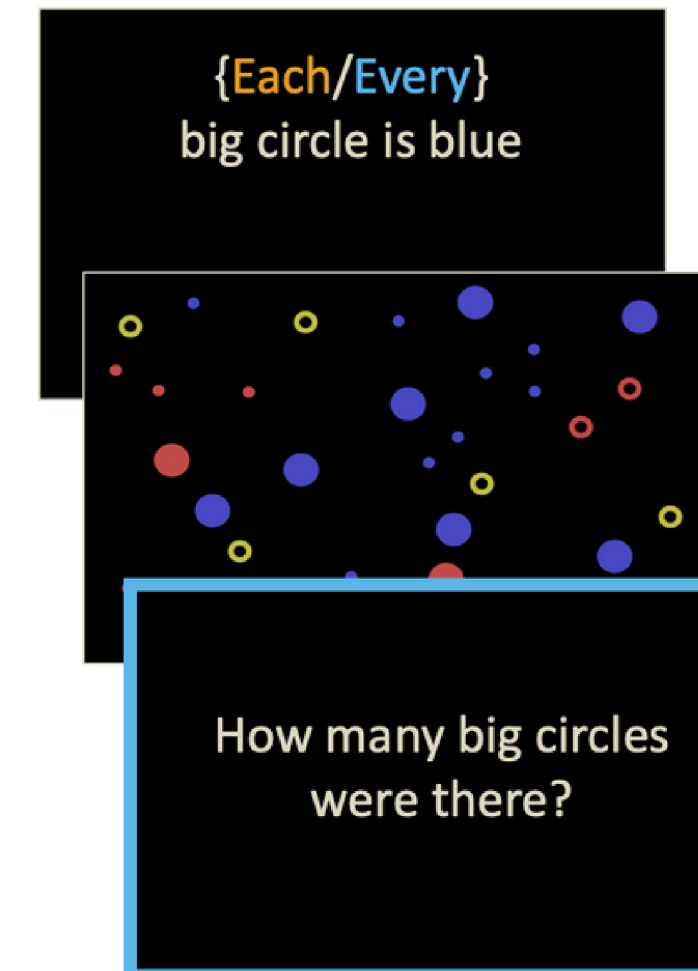
#### "ensembles"

(e.g. Piazza et al., 2013; Albrecht & Scholl, 2012)

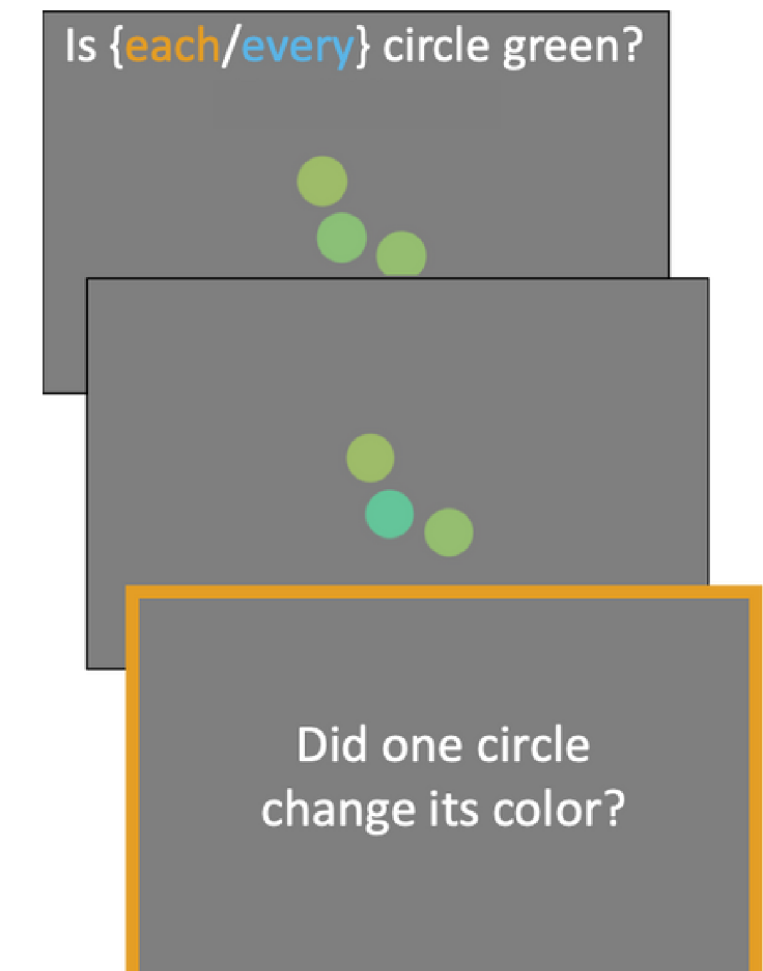
We experience the world as **events unfolding over time** -- but we do not represent events in equal resolution. Some events might be individuated, while others are just represented as gists.

**What determines whether we individuate events in time or not?**

### The power of a single word?



Ensemble Performance:  
**every > each**



Individuation Performance:  
**each > every**

The meaning of "**Each**" invites **individuating** the things under discussion, whereas the meaning of "**Every**" invites treating those things as **members of a group**

**Could processing each/every impact representation of sounds in time?**

### Expt. 1: Does "every" lead to false memories of hearing the "average" tone?

**Group 1**

**Each** tone is pleasant.

A = Yes L = No

**Group 2**

**Every** tone is pleasant.

A = Yes L = No

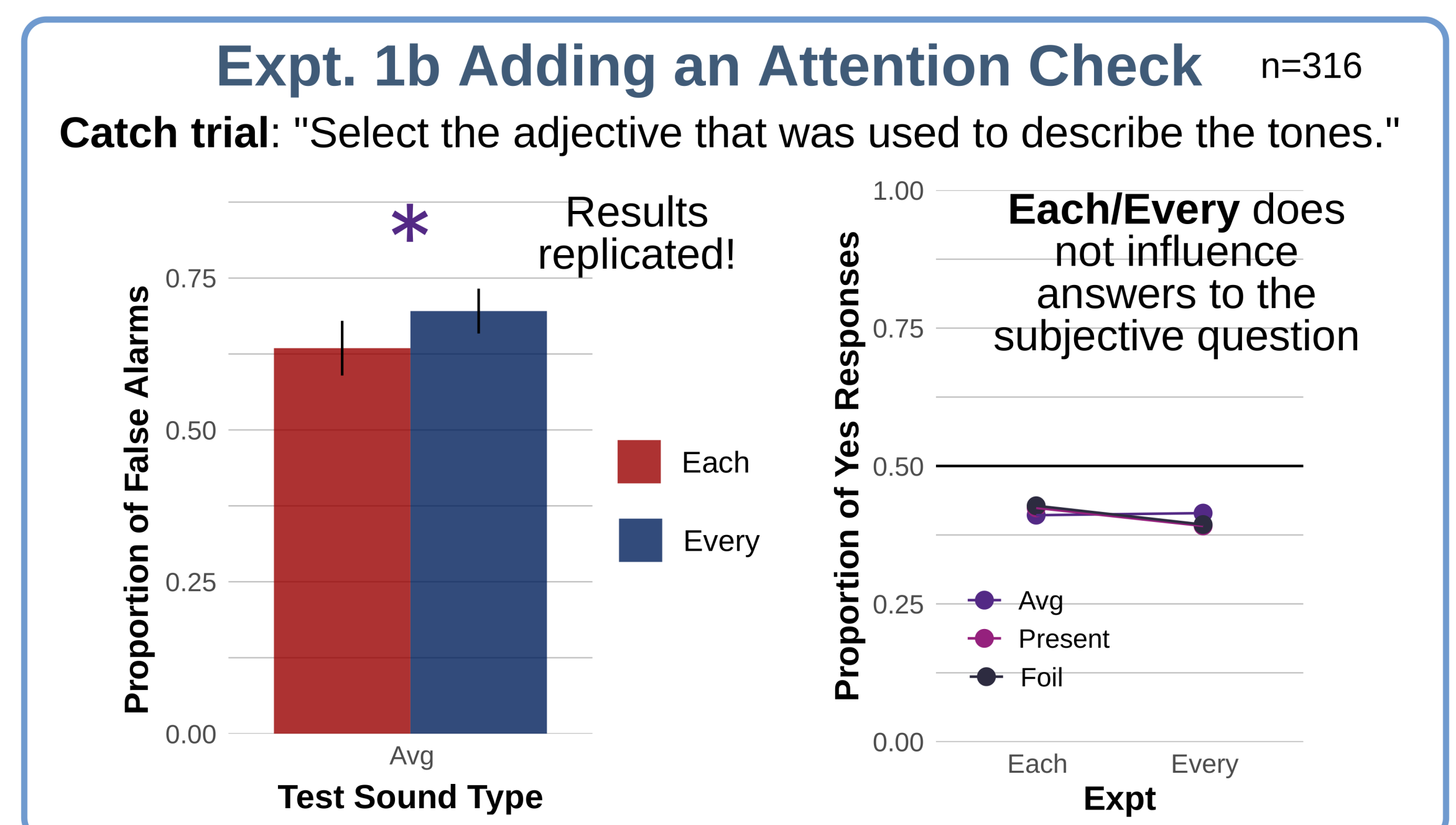
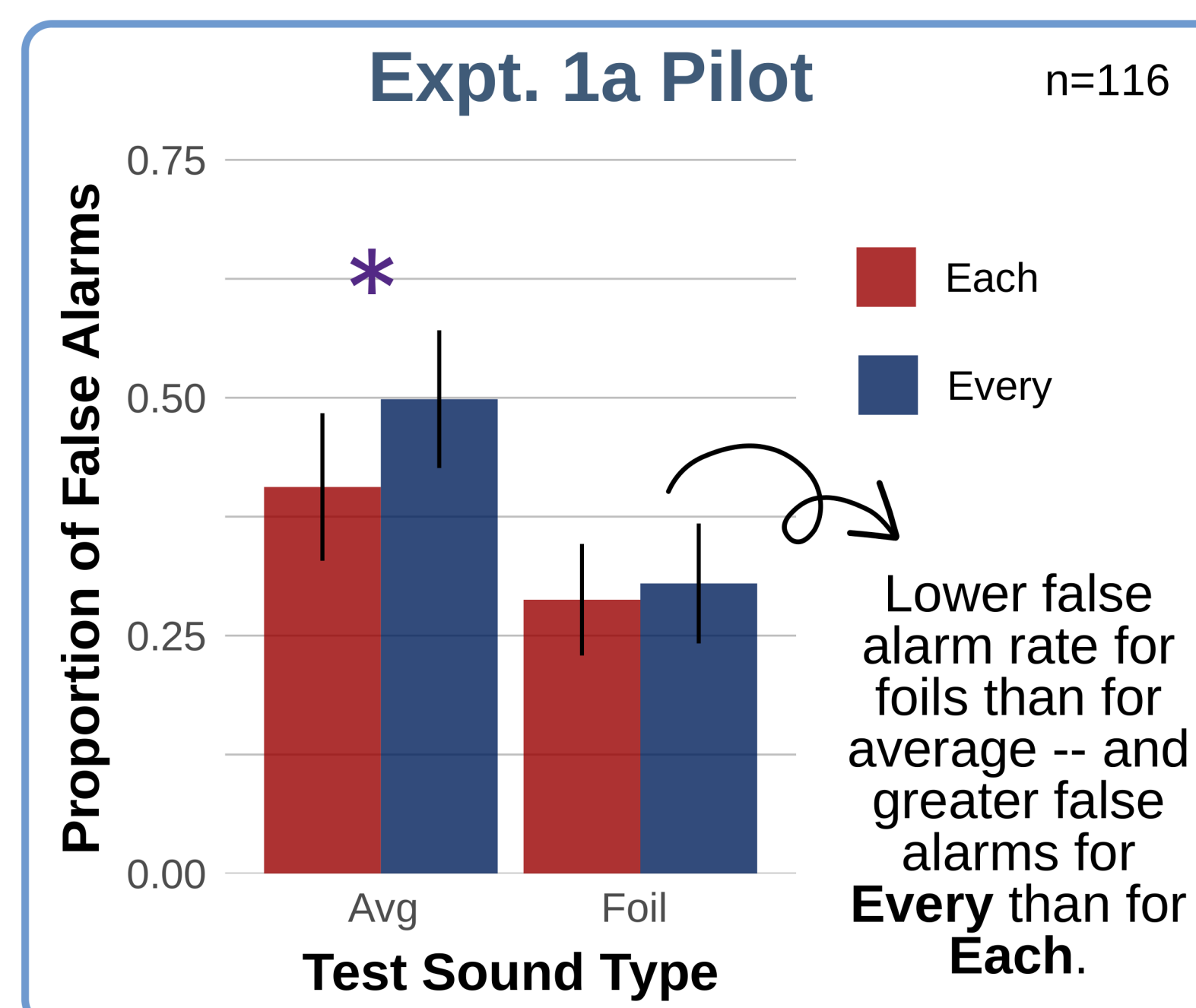
3 tones are played

Test tone was either:

- Average Tone** - Linear average frequency of the three tones
- Present Tone** - A tone that was played
- Foil Tone** - A tone that was not at all close to any of the ones played

Did you hear this tone?

a test tone is played



**"Every" leads people to falsely remember hearing the average!**

### Expt. 2: "Each" on temporal order memory?

**Each** tone is pleasant.

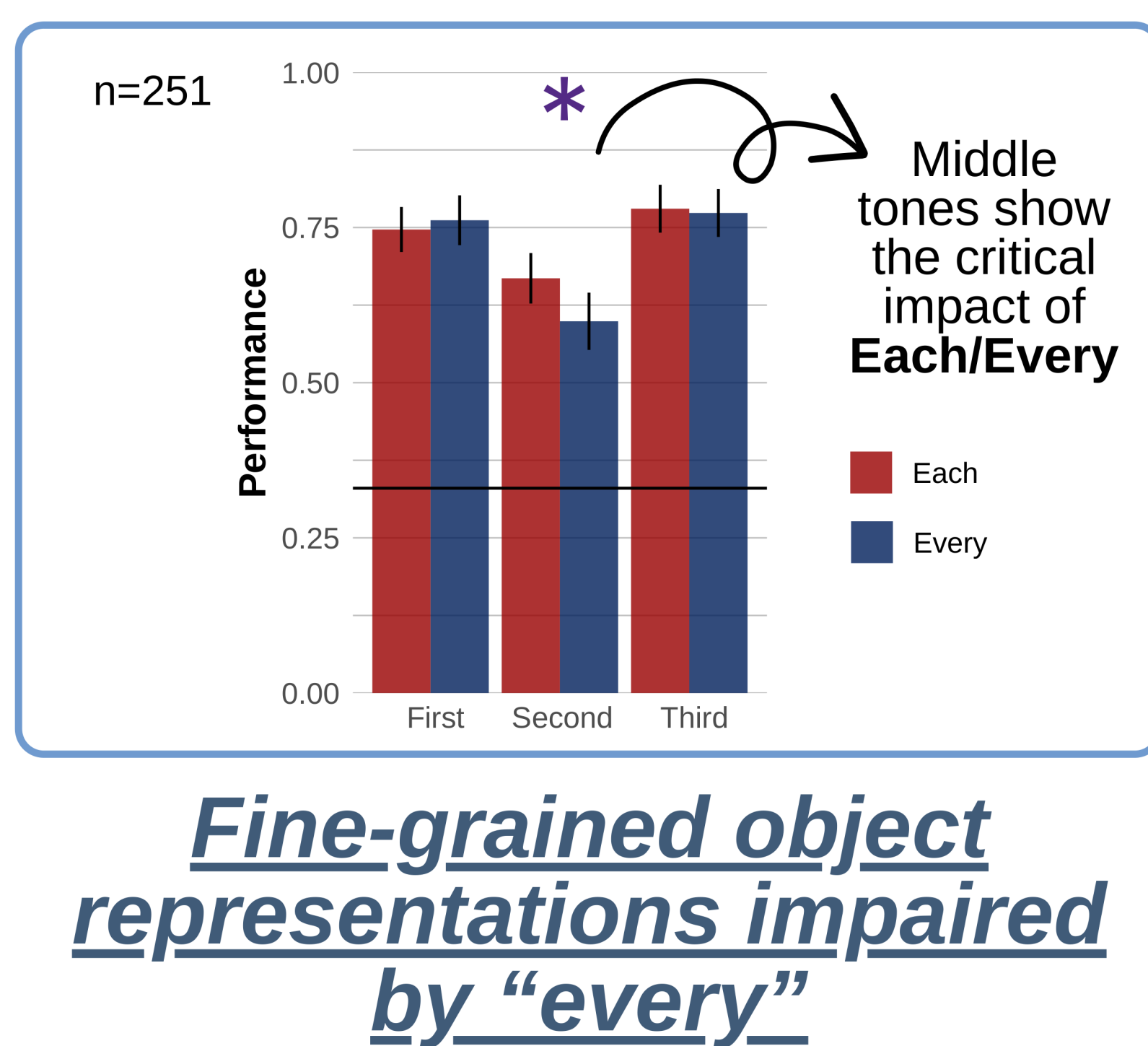
**Every** tone is pleasant.

3 tones are played

Was this the first, second, or third tone?

a test tone is played

Test tone was either the first, second, or third tone played



### Expt. 3: "Every" on ensemble memory?

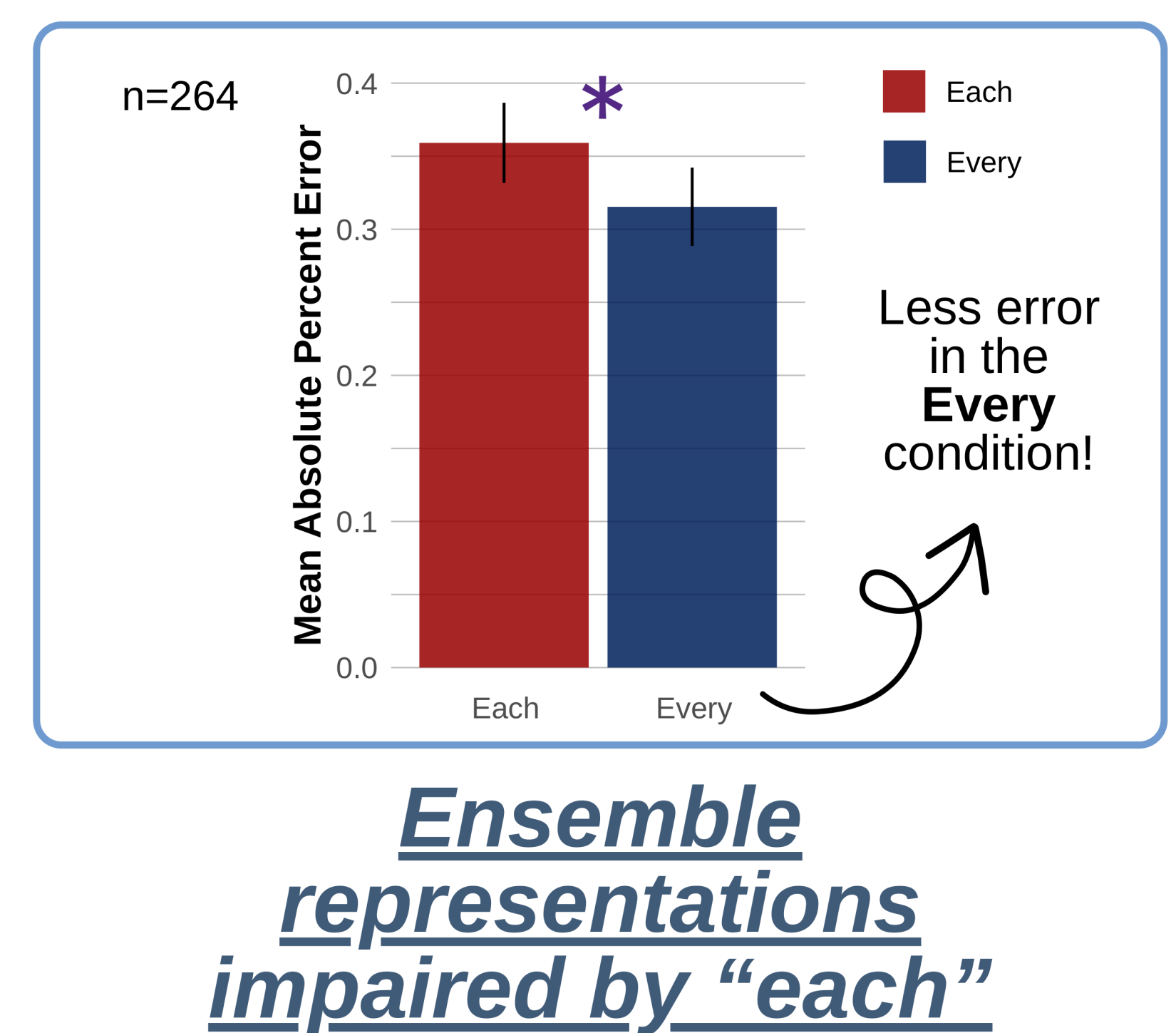
**Each** tone is pleasant.

**Every** tone is pleasant.

3 tones are played

Reproduce the average tone of the set.

Using a slider, subjects had to reproduce average tone



## Conclusions

### **Bridging language and event perception**

Events in time can be represented both as individuals and ensembles;  
 Language plays one role in determining which system is deployed  
 (even when the language used is entirely task-irrelevant!)

### **A new linguistic framing effect?**

The words "each" and "every" are ubiquitous and occur in contexts beyond objects in space, or events in time.  
 Imagine for instance "each dollar" versus "every dollar".