

Phonological generalization from distributional evidence

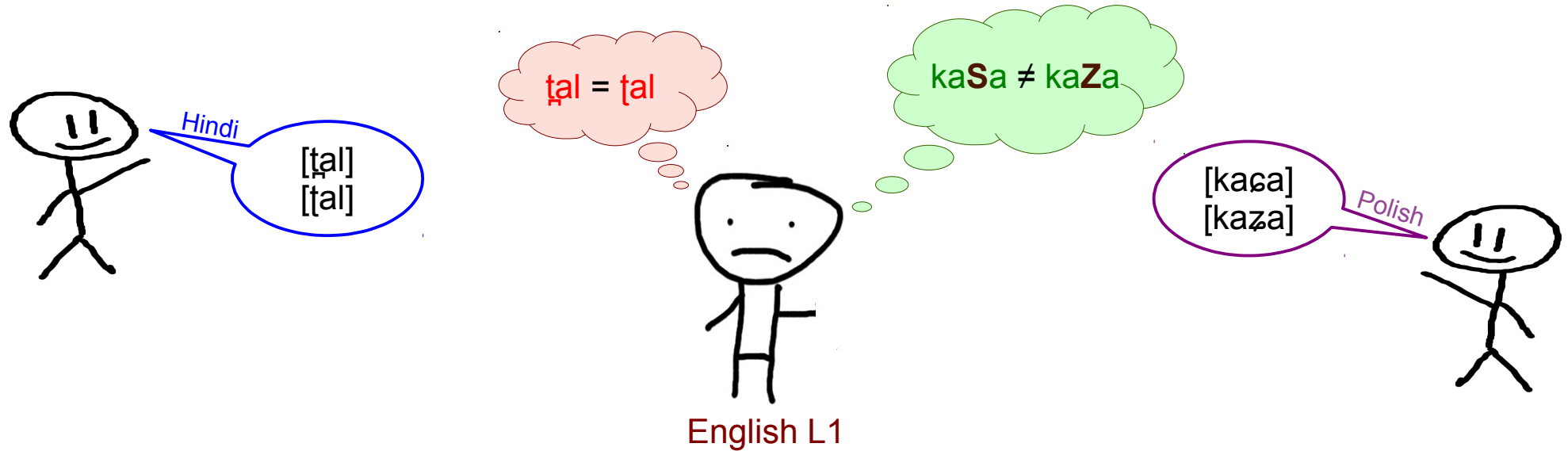
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[bɔ'ʒɛna 'pajɔ̃k]

UC San Diego

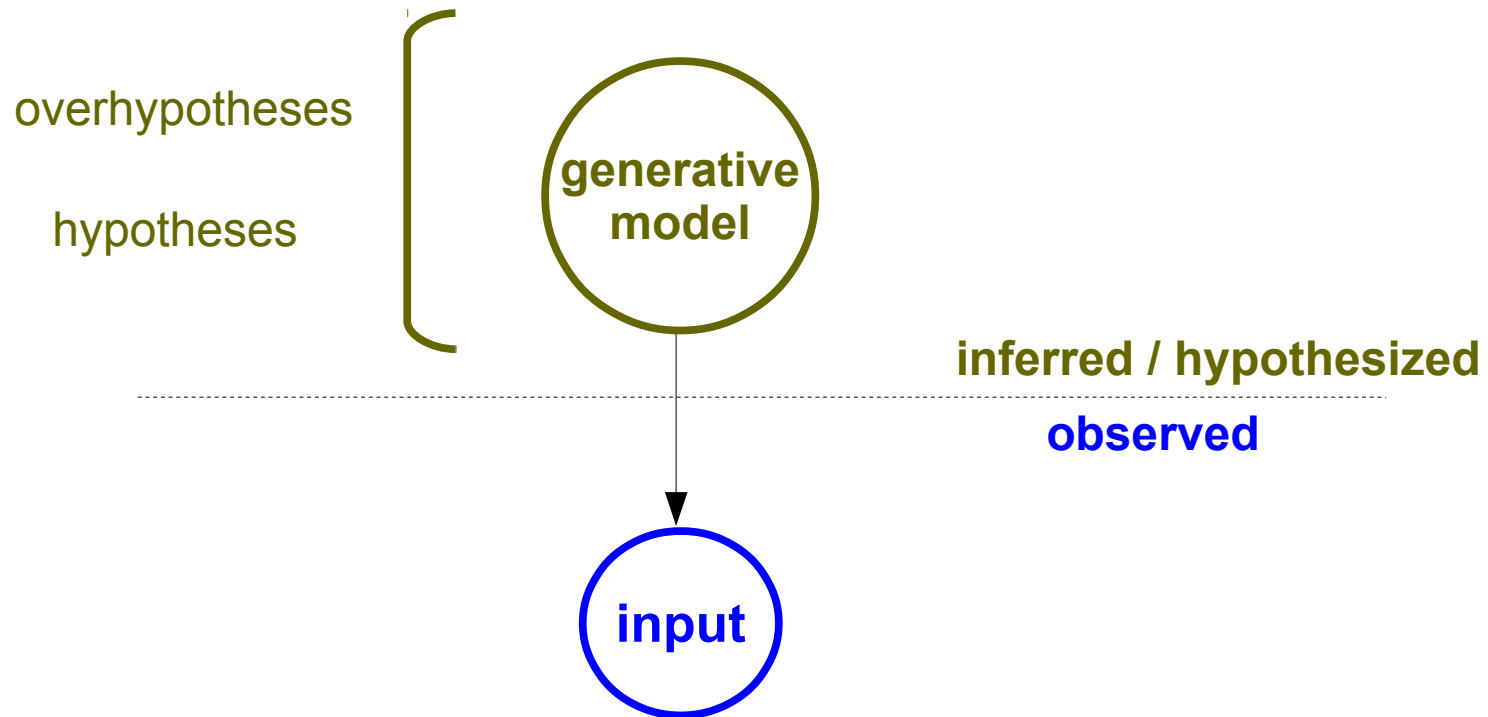
Main question

How do people learn L2 phonetic categories?

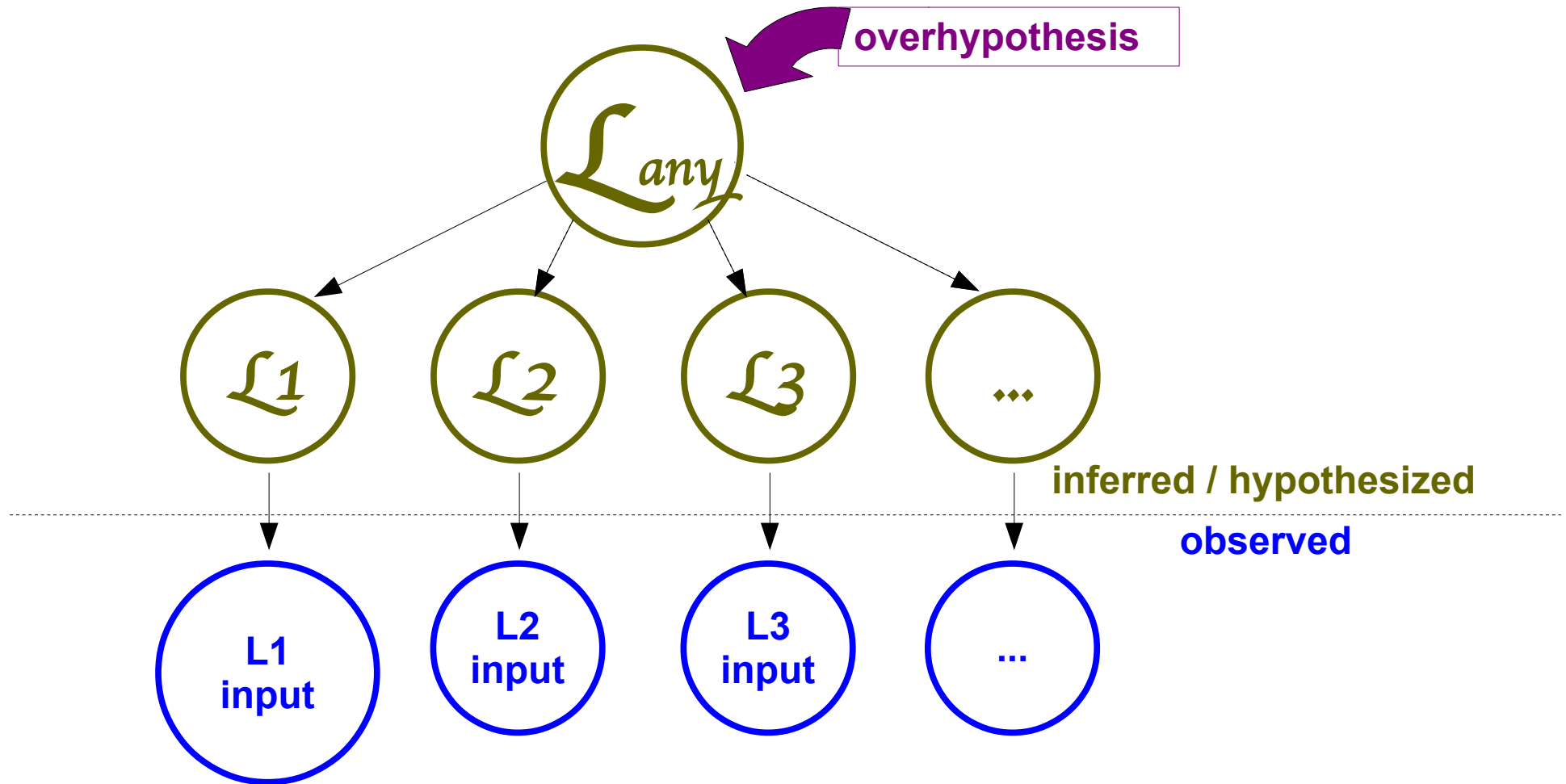


Framework

- Learning as hypothesis construction and testing
(Gerken 2010, Tenenbaum & Griffiths 2001, Tenenbaum et al. 2011, Xu & Tenenbaum 2007)



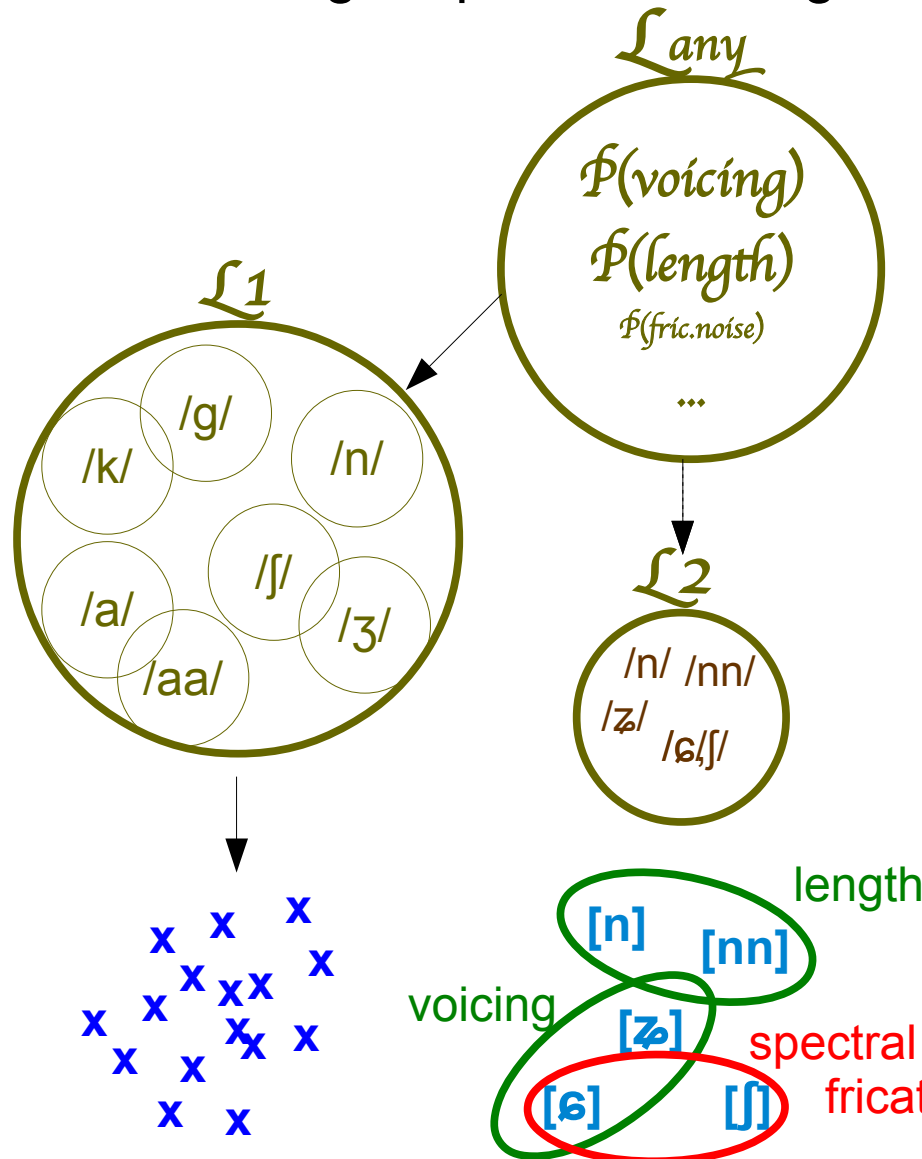
Proposal: application to L2 acquisition



Proposed model: phonological acquisition

- Learning L2 phonetic categories proceeds by combining:

- previous language knowledge
- distributional information from language input



We predict that there could be generalization across segments

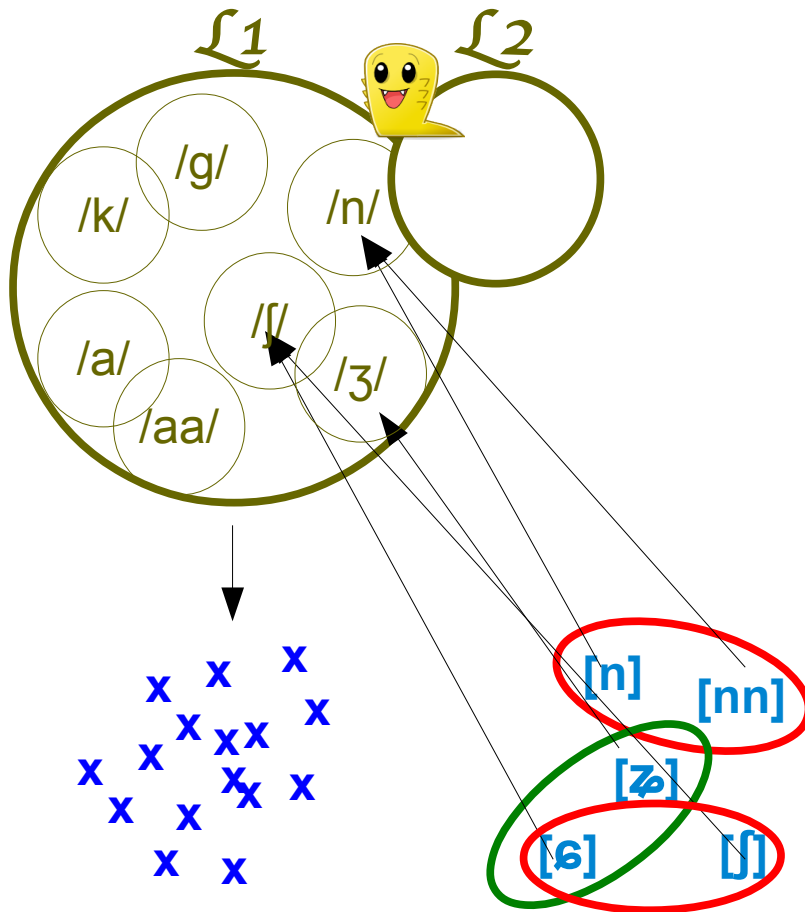
discrimination/categorization
easy

discrimination/categorization
hard

Models of L2 phonological acquisition

(Best 1995, Flege 1995, Kuhl & Iverson 1995)

- L2 sounds are mapped (or assimilate) onto most similar L1 categories (some commitment regarding how to assess similarity is needed)



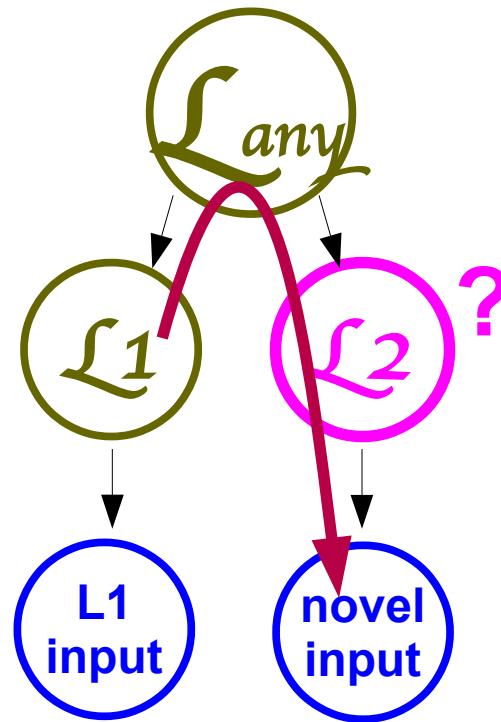
**No claims about
generalization across
segments**

discrimination/categorization
easy

discrimination/categorization
hard

Previous work: Pajak 2010, CogSci Pajak 2010, Psychonomics

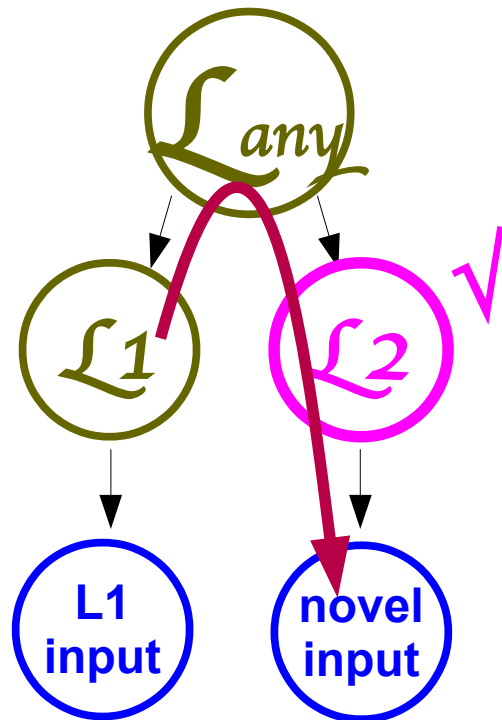
- Demonstrated generalization across segments in perception of nonnative contrasts



Experiment

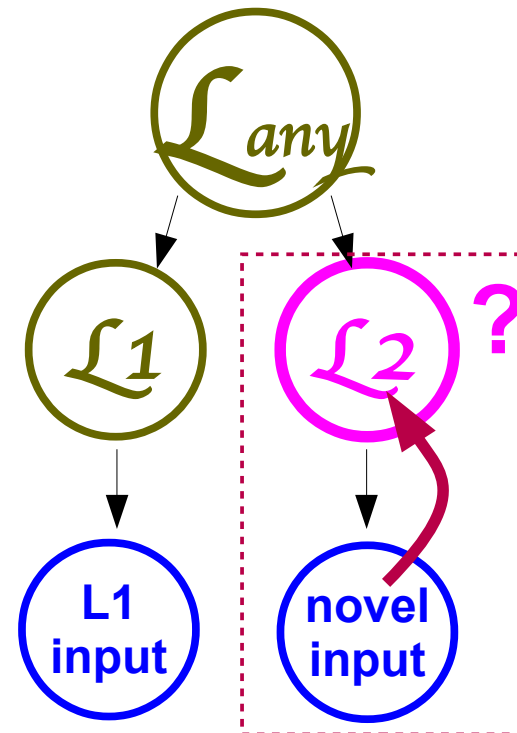
- How are inferences about the L2 affected by the input?
- Crucially, is there generalization across segments?

Previous work



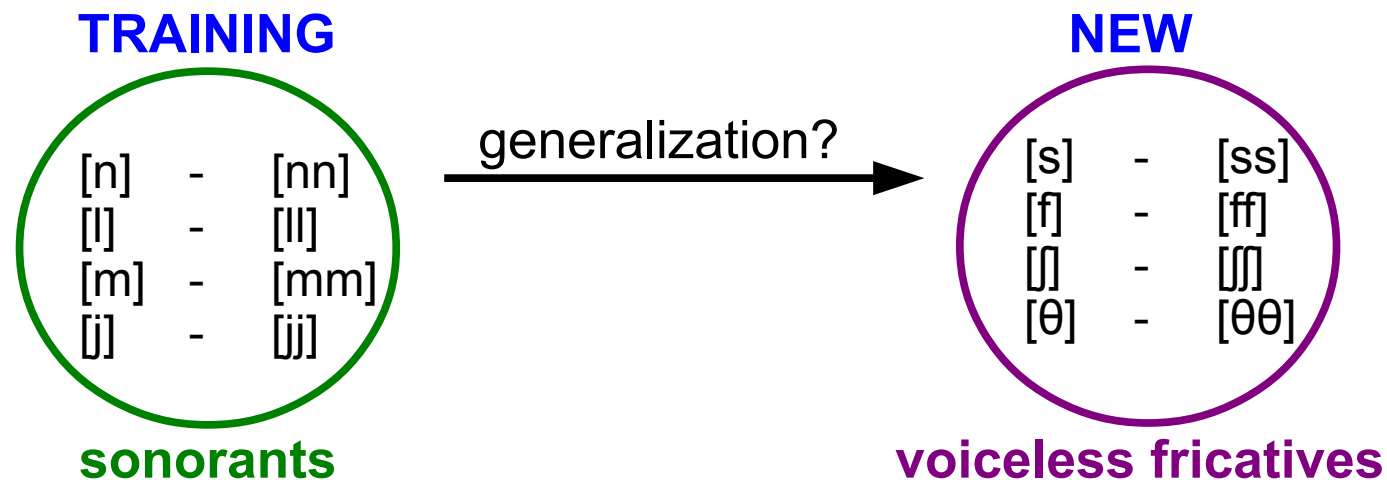
(Pajak, 2010, CogSci)
(Pajak, 2010, Psychonomics)

Current experiment



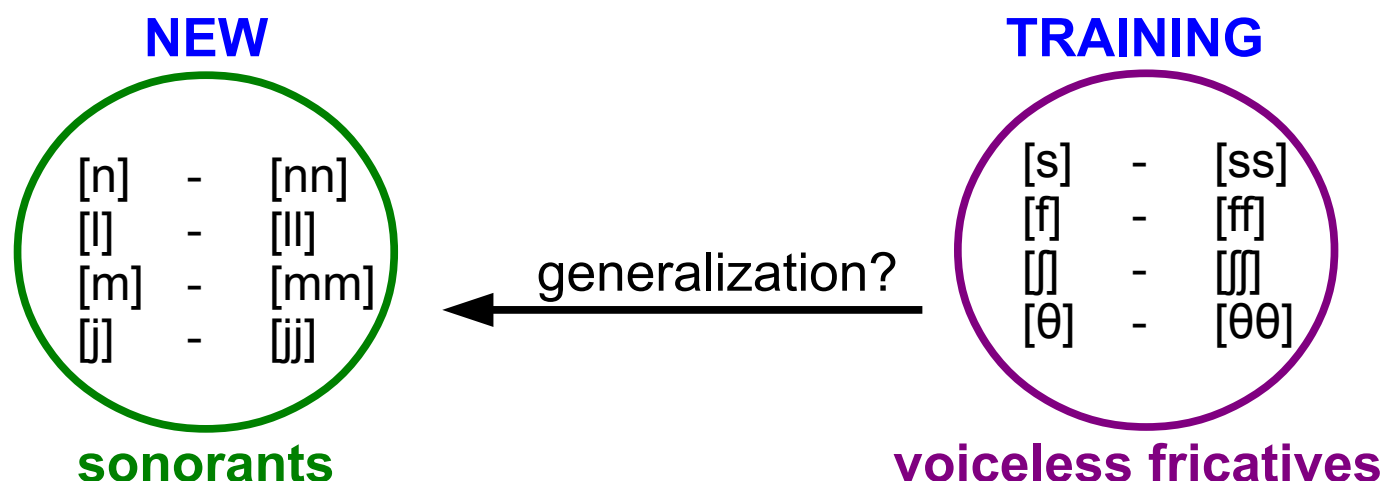
Experiment: overview

- Exposing English monolinguals to evidence suggesting a novel length contrast in a new language



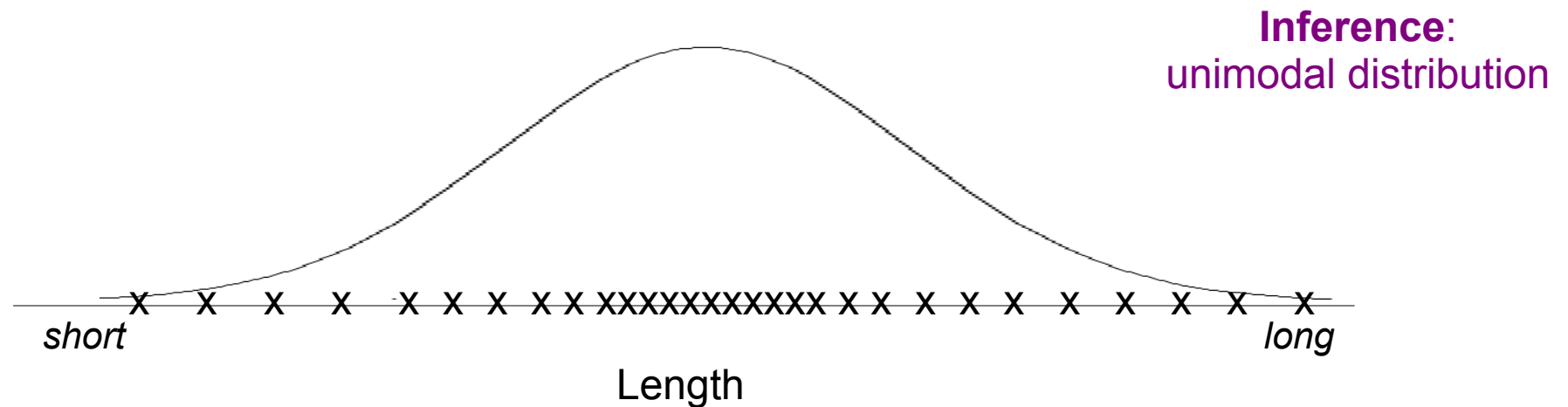
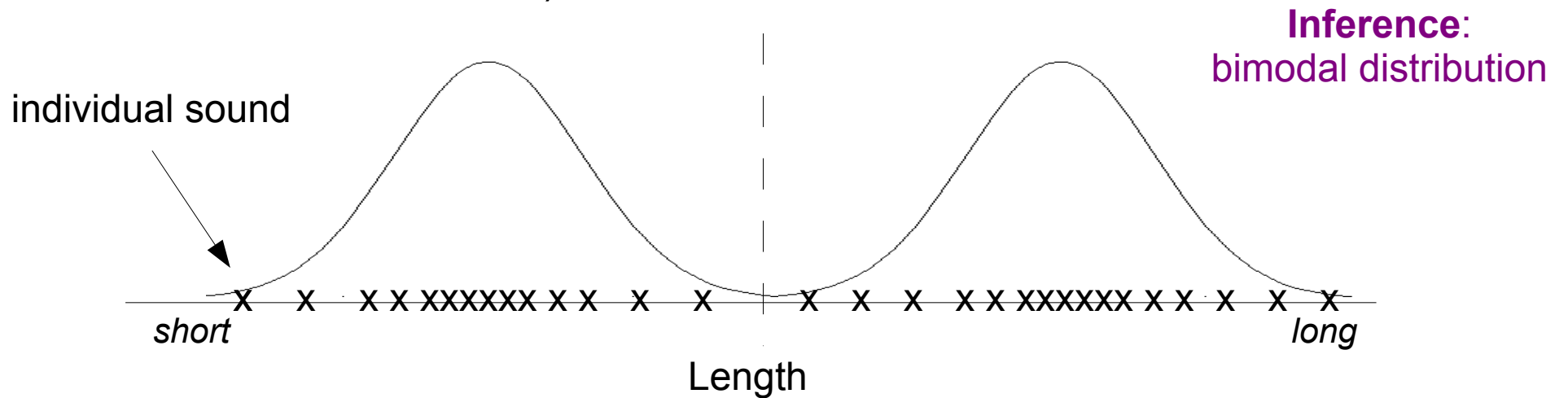
Experiment: overview

- Exposing English monolinguals to evidence suggesting a novel length contrast in a new language



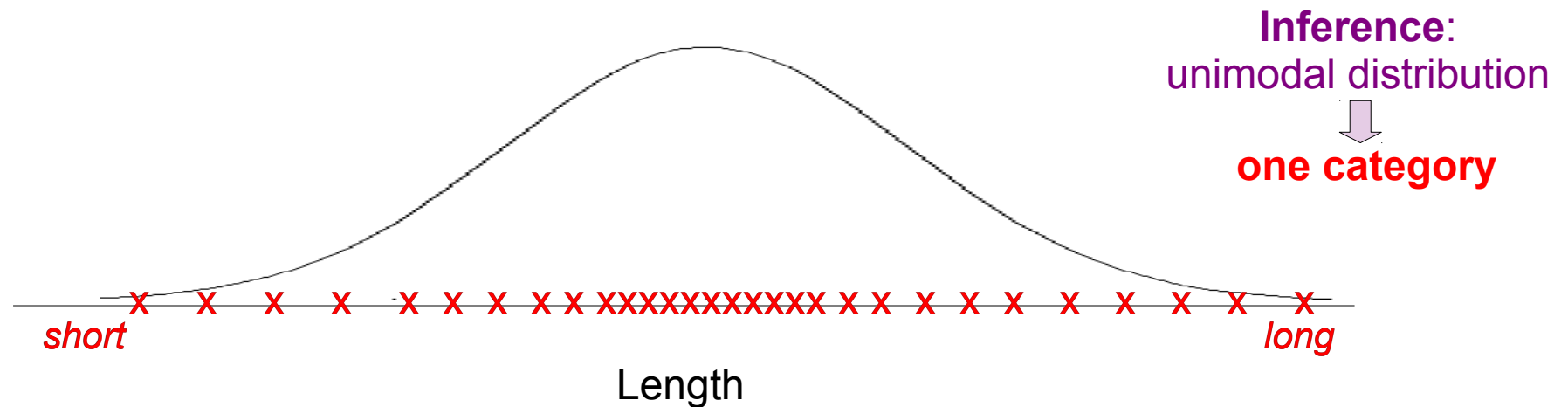
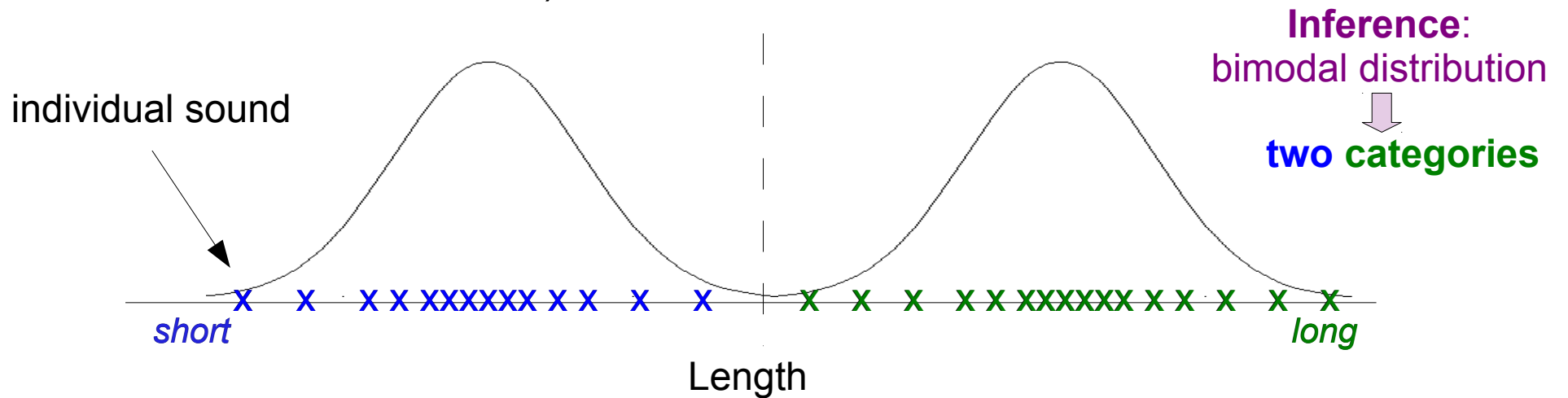
Experiment: paradigm

- Distributional learning paradigm (Maye & Gerken 2000, Maye, Werker, & Gerken 2002)



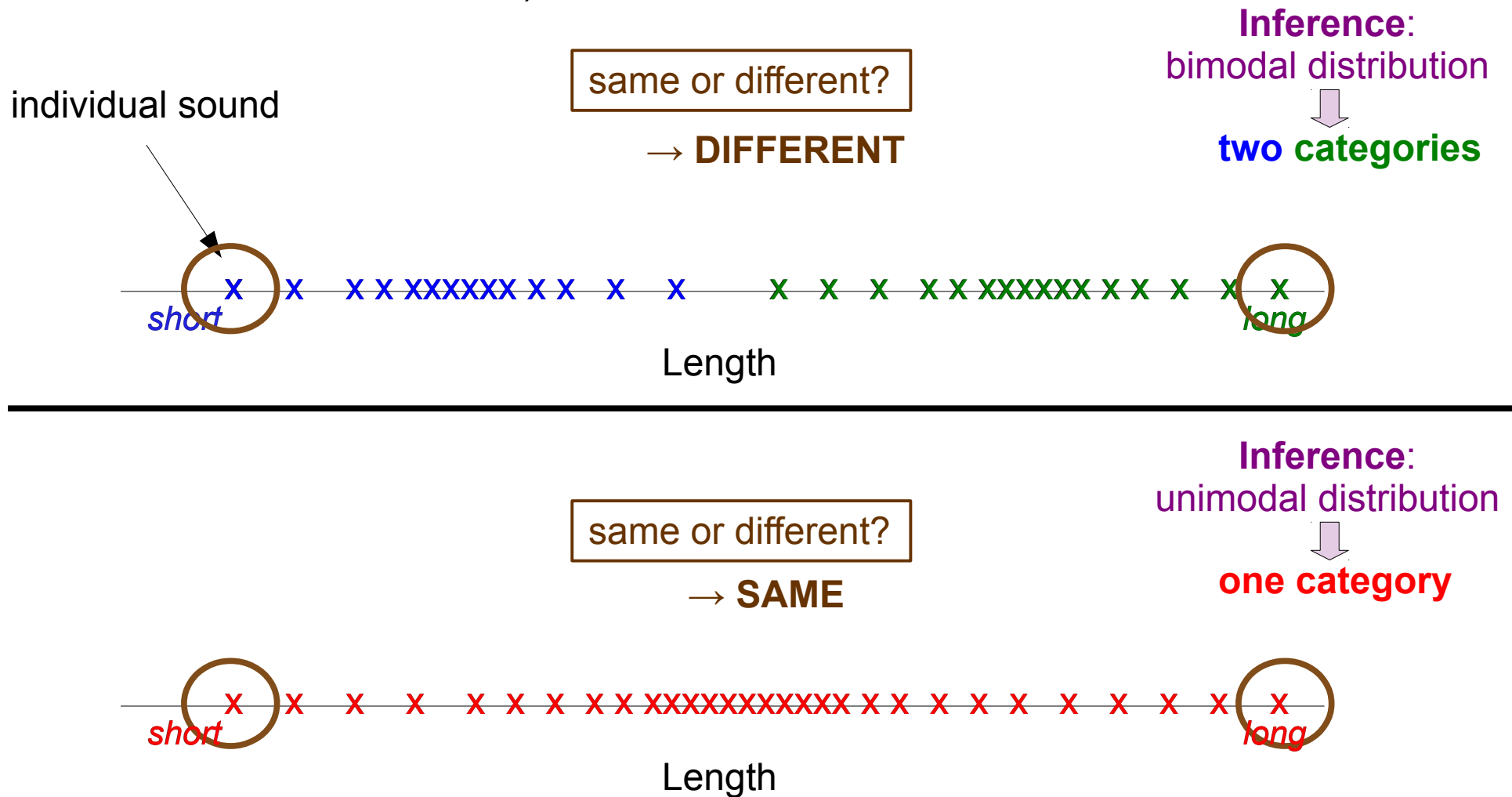
Experiment: paradigm

- Distributional learning paradigm (Maye & Gerken 2000, Maye, Werker, & Gerken 2002)

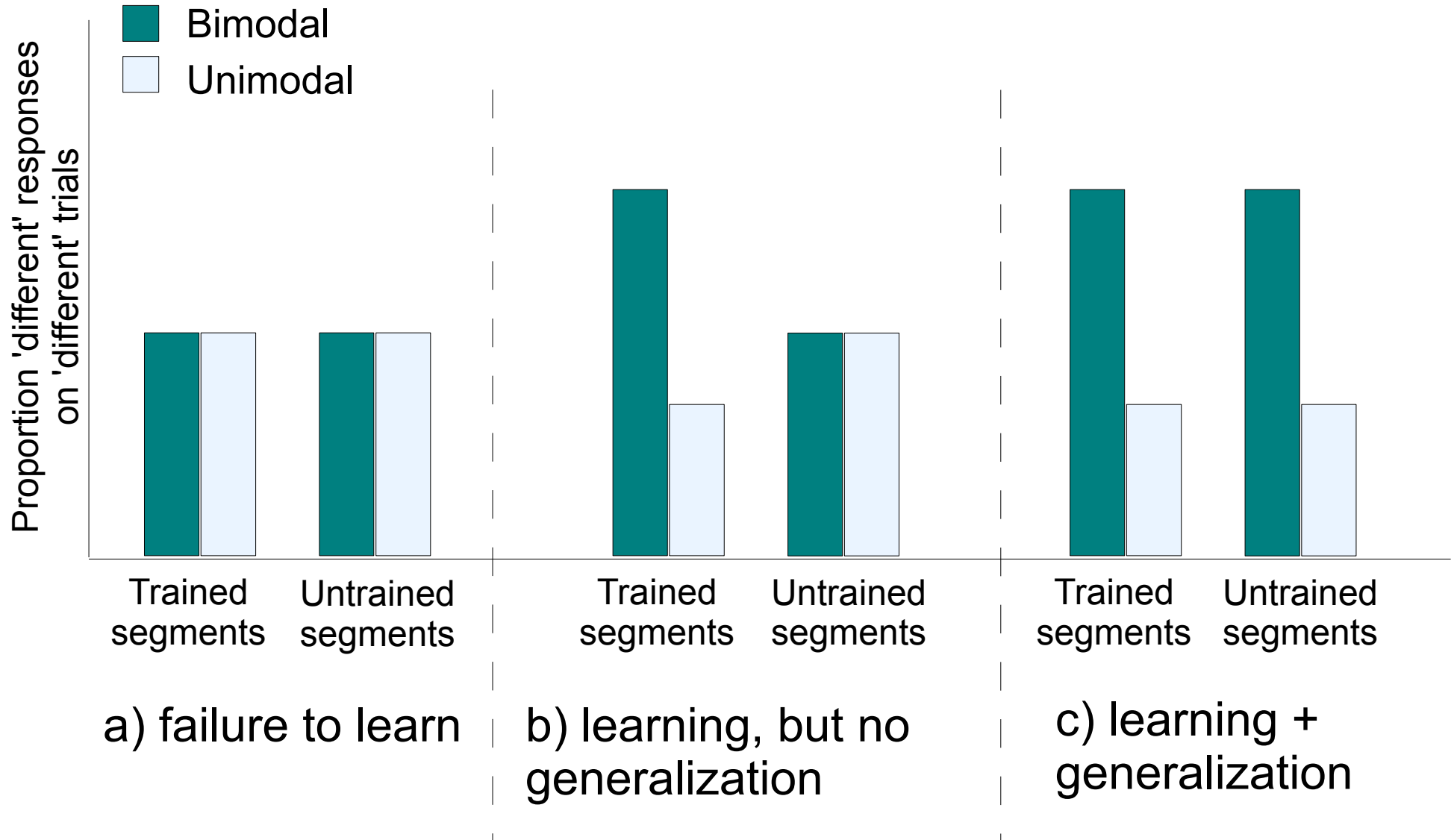


Experiment: paradigm

- Distributional learning paradigm (Maye & Gerken 2000, Maye, Werker, & Gerken 2002)



Distributional learning: output scenarios

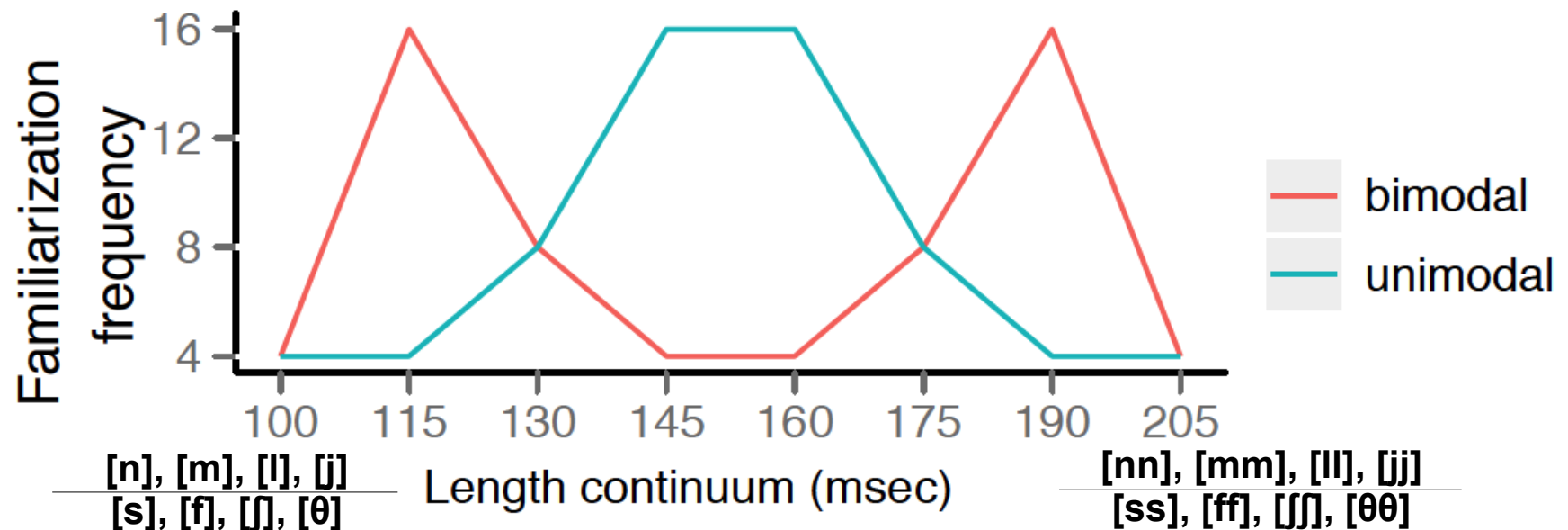


Experiment: ppts & instructions

- 48 English monolinguals not familiar with any other language that has length contrasts.
- Instructions
 - ◆ You'll be learning (sounds from) a new language.
 - ◆ First, you'll listen to words from that language.
 - ◆ Then, you'll hear pairs of words and, based on what you learned, decide whether these are two different words or the same word repeated twice.
 - ◆ The same word can be pronounced a bit differently (e.g., with different intonation) – follow your intuition in deciding what counts as 'different' in this language.

Experiment: design & materials

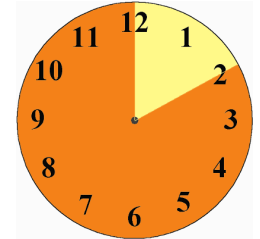
	TRAINING SEGMENTS	
MODALITY	bimodal sonorant-trained	bimodal fricative-trained
	unimodal sonorant-trained	unimodal fricative-trained



Experiment: training



[aja]_{145ms}
[ina]_{205ms}
[adʒa]
[ila]_{115ms}
[ama]_{160ms}
[ira]
...

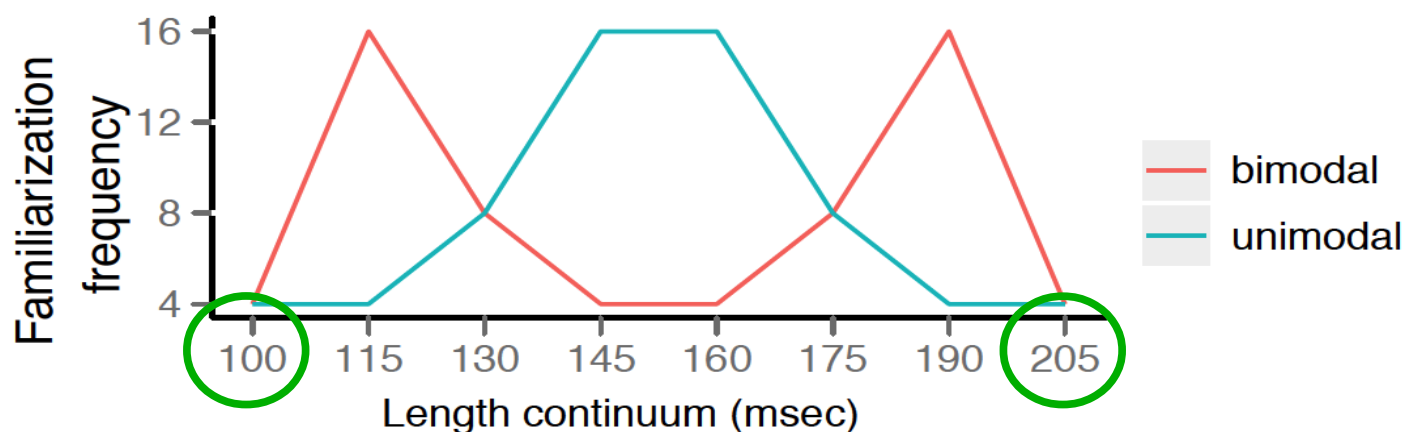
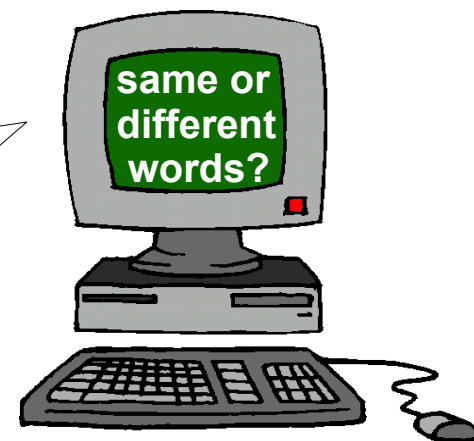


Experiment: testing

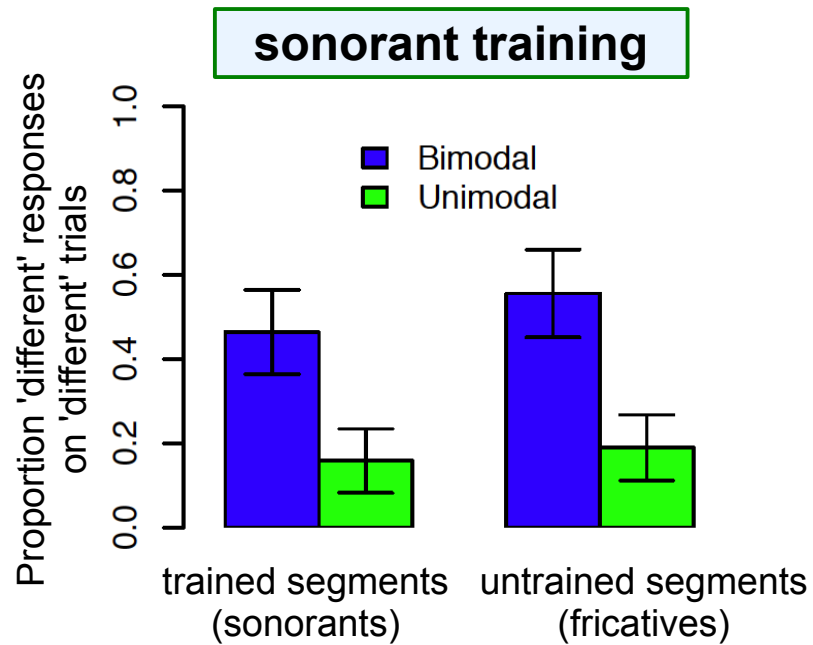
Identical testing for all participants:
→ sonorants & fricatives



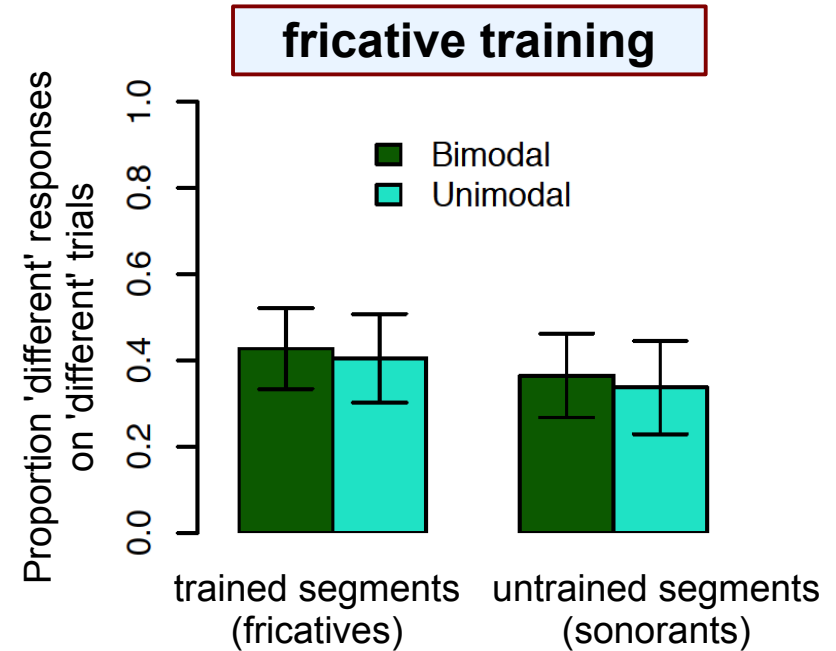
word1 word2
word1 word2
...



Experiment: results – 'different' trials



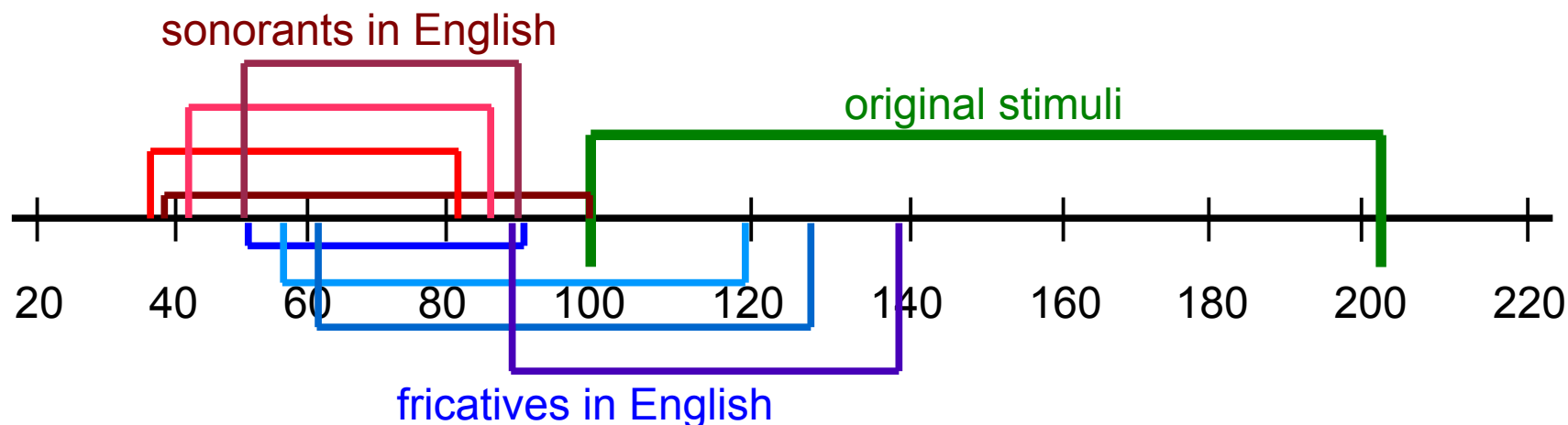
**learning &
generalization
across
segments**



**failure
to learn**

Experiment: discussion

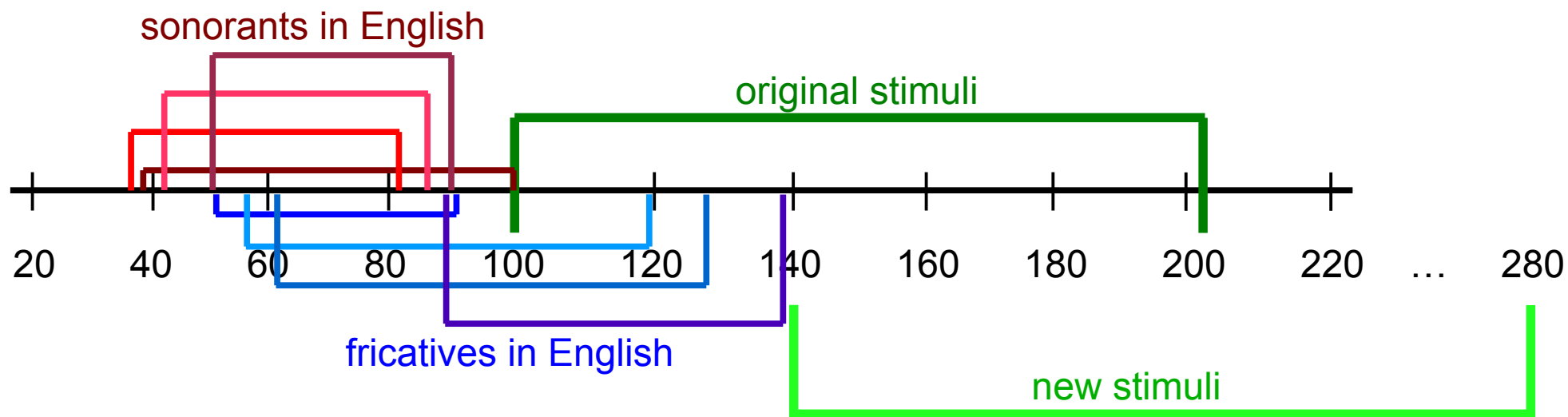
- Why wasn't the contrast learned for fricatives?
 - ♦ stimuli continuum too short for fricatives



(duration ranges taken from the phonetically annotated portion of the Switchboard corpus)

Experiment: discussion

- Why wasn't the contrast learned for fricatives?
 - ◆ stimuli continuum too short for fricatives

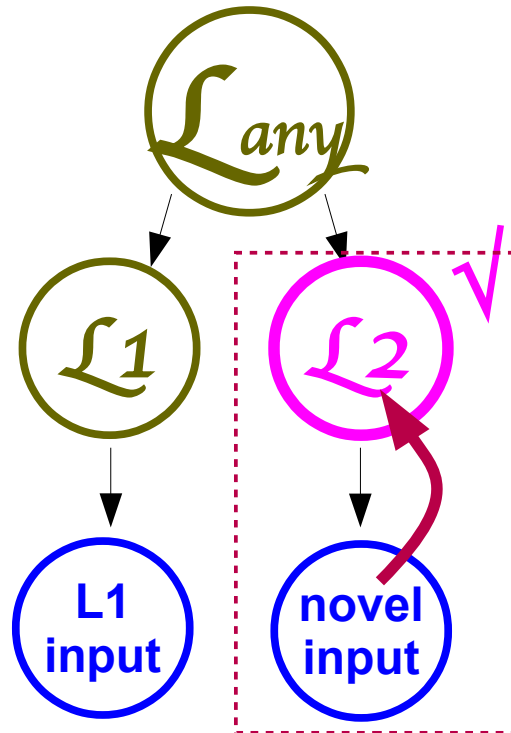


- ◆ confirmed by preliminary follow-up results with a longer continuum

(duration ranges taken from the phonetically annotated portion of the Switchboard corpus)

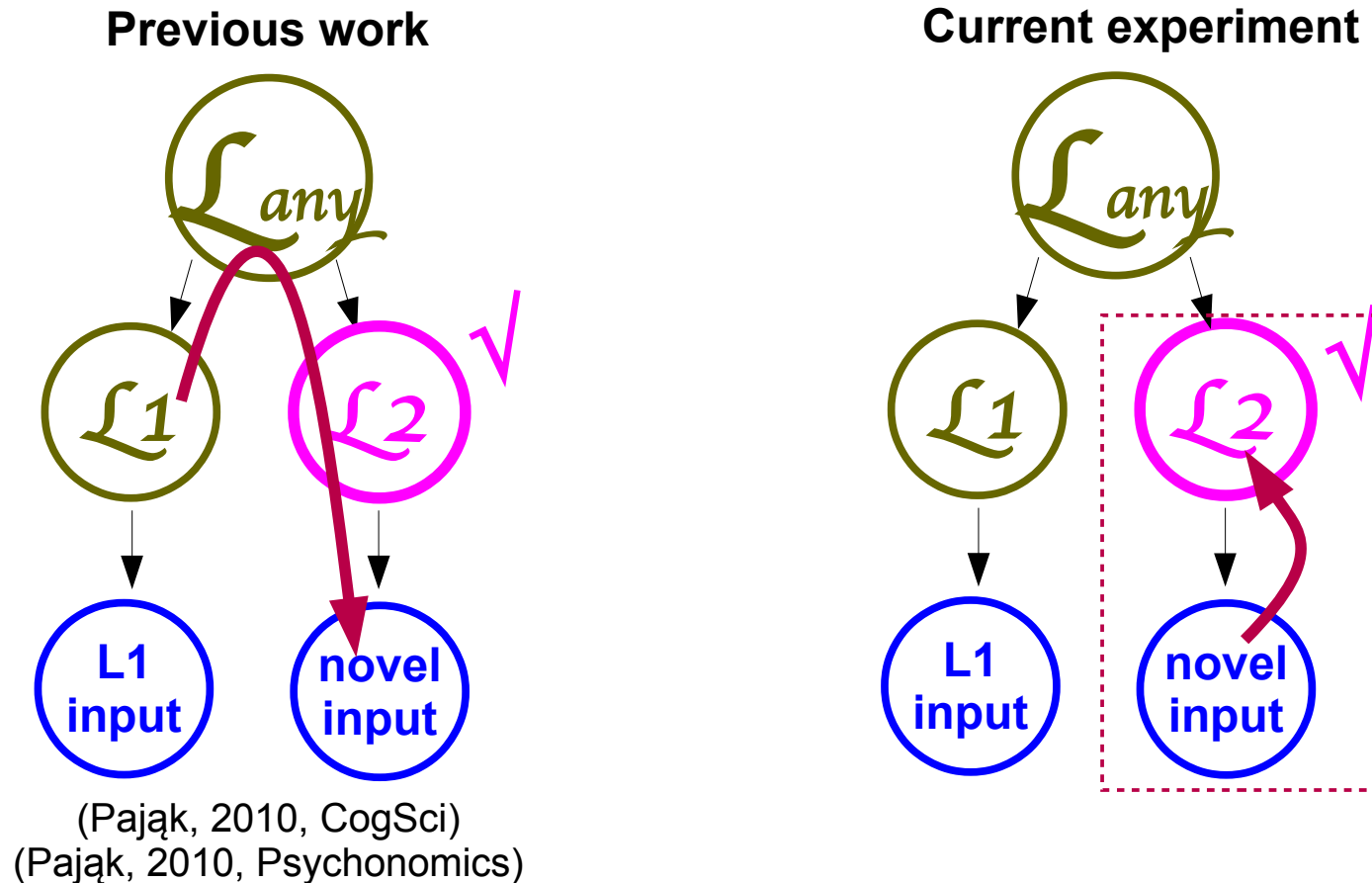
Experiment: summary

- Short distributional training can overcome L1 biases
- There is generalization across segments



Conclusion

- This supports the view that L2 learning is based on inductive inference and generalization, and not on parasitic representations and L2-to-L1 mappings.



Thank you

Discussion:

Eric Baković, Klinton Bicknell, Sarah Creel, Vic Ferreira, Tamar Gollan, Carolyn Quam, Sharon Rose, *Computational Psycholinguistics Lab, Language Acquisition & Sound Recognition Lab, San Diego Phonology Interest Group*

Research assistants:

Mike Brooks, Annabelle Cadang, Rafi Feliciano, Nicole Pyon

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