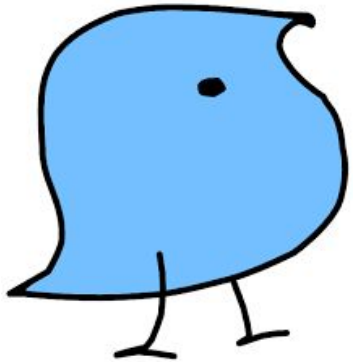
Language as a Mechanism for Social Learning

Winter 2020 - CSSA Language & Culture Talk Series



Andrew Shibata

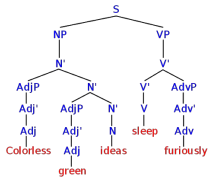
- 2nd year CogSci PhD student
- Working with Dr Sarah Creel
- UC Berkeley ‘17
  - Triple major in Cognitive Science, Linguistics, and Statistics
  - Minor in K-12 STEM Education
- Fun facts
  - Taught a class about cult films in college
  - Learned to play the Berkeley bell tower
  - I’m on the UCSD League of Legends JV team and the Splatoon 2 team
  - Presented my research at a Linguistics and Pokemon conference in Tokyo

Φ

Philosophy

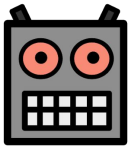
Ψ

Psychology



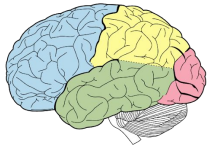
Linguistics

Artificial Intelligence



Anthropology

Neuroscience



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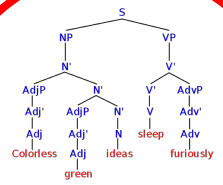

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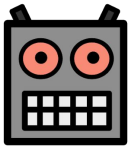

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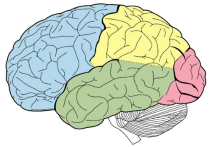


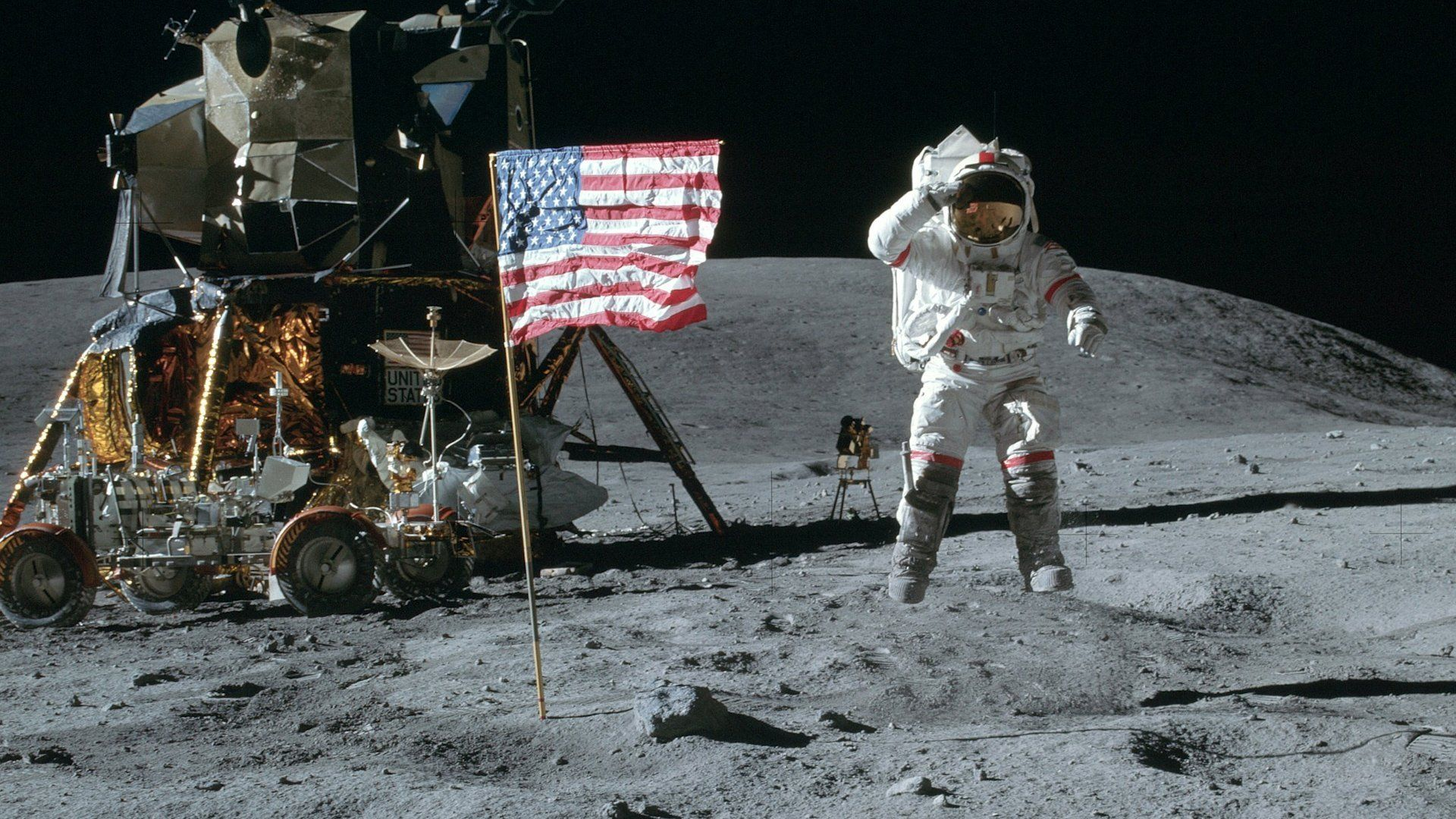
Language Reflects Cognition

Cognitive Phenomenon

- Attention
- Memory
  - Short Term
  - Critical Periods
- Mental Representations
- Multi-sensory Perception
- Pattern Recognition
- Hierarchical Logical Structure

Linguistic Context

- Cocktail Party Effect
- Memory
  - Verbal Working Memory
  - Language Acquisition
- Phonological (sound) Categories
- McGurk Effect
- Talker Identification
- Syntactic Reasoning



Language as a Mechanism for Social Learning

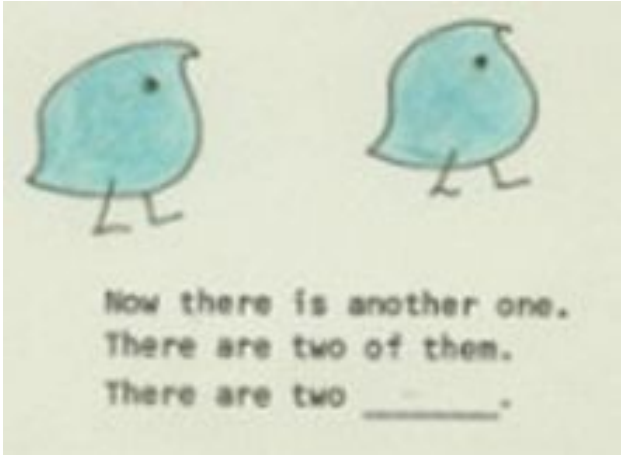
- One stance in Cognitive Science is that the mind is an information processor
- Language is a primary way we interact with massive amounts of information
- Humans can achieve incredible feats coordinated through language

Primary disciplines of (Berkeley) linguistics

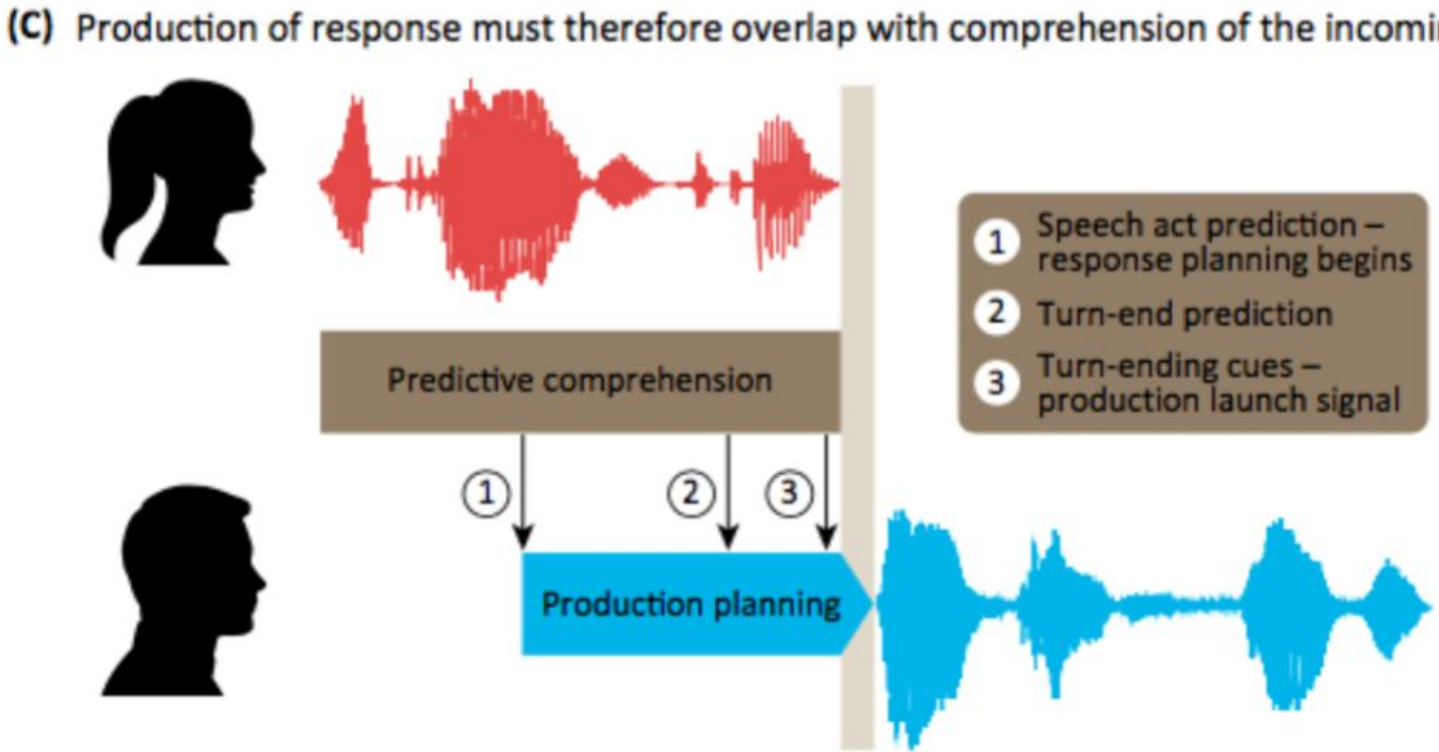
Discipline	The study of...
Phonetics	Speech sound production and perception
Phonology	The grammar of sounds
Morphology	Word-level internal structure
Syntax	Sentence-level structure
Historical Linguistics	Language and sound change

The Wug Test

- Children as young as 4 have understanding of abstract linguistic rules and can use them productively with unfamiliar words
- Learned through social interaction with speech
- Demonstrates understanding of plurality, phonological variation (dogs/ cats/fishes), and syntactic agreement (number)



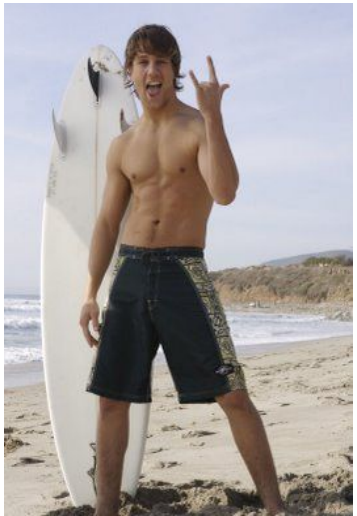
Conversation Analysis: Complexity in Turn Taking



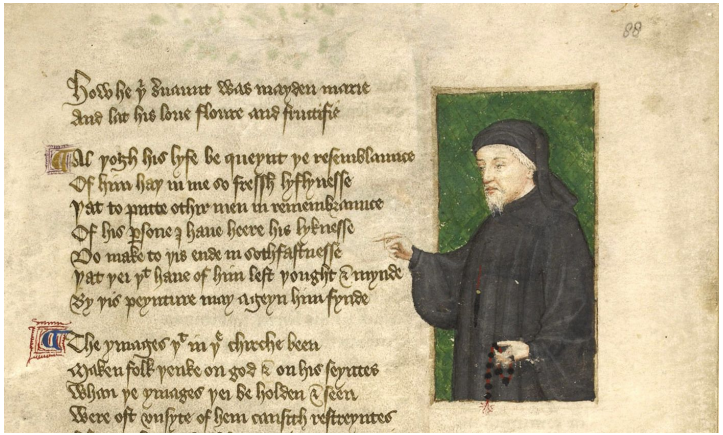
Levinson, 2015

Language Exhibits Social Identity

- Accents, dialects, vocabulary mark where you're from and how you identify
- This has real world consequences, whether positive or negative
  - Extensive research on African-American Vernacular English and issues such as housing and education inequality
  - Speech features tied to identities such as gender, sexuality, race, socio-economic status



Language Changes Over Time



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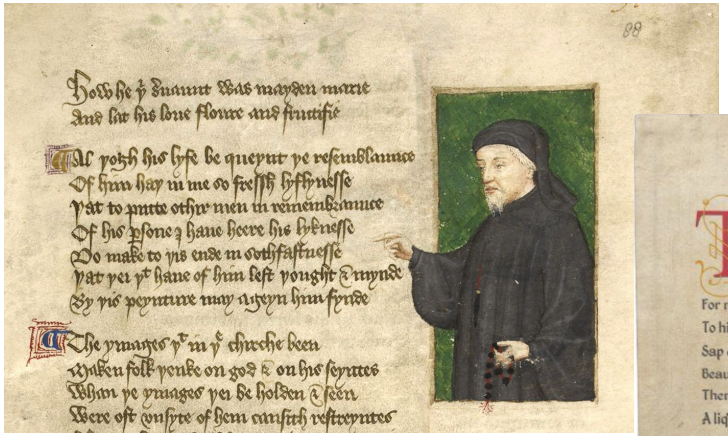

Sonnet 5

Those hours, that with gentle work did frame
The lovely gaze where every eye doth dwell,
Will play the tyrants to the very same
And that unfair which fairly doth excel;
For never-resting time leads summer on
To hideous winter, and confounds him there;
Sap checked with frost, and lusty leaves quite gone,
Beauty o'er-snowed and bareness every where:
Then were not summer's distillation left,
A liquid prisoner pent in walls of glass,
Beauty's effect with beauty were bereft,
Nor it, nor no remembrance what it was:
But flowers distilled, though they with winter meet,
Leese but their show; their substance still lives sweet.

William Shakespeare

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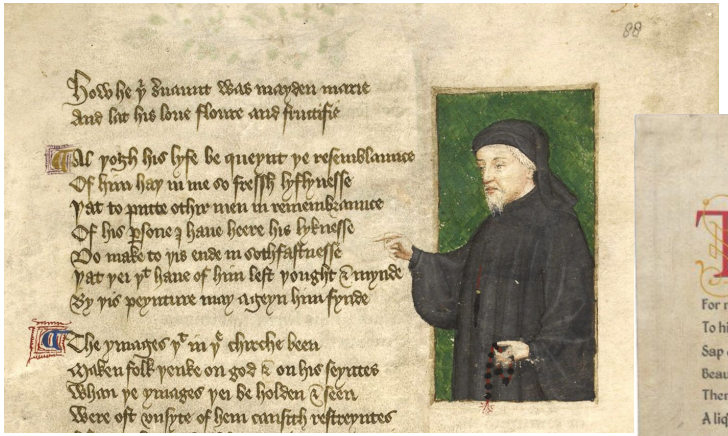

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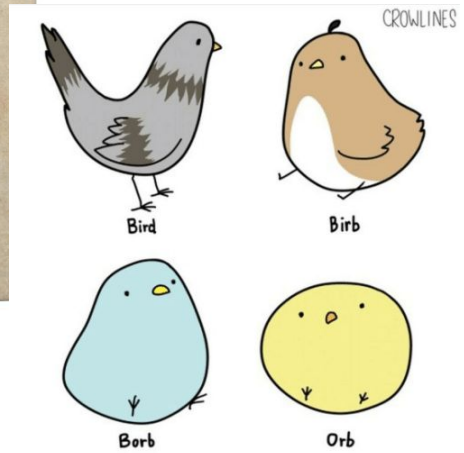
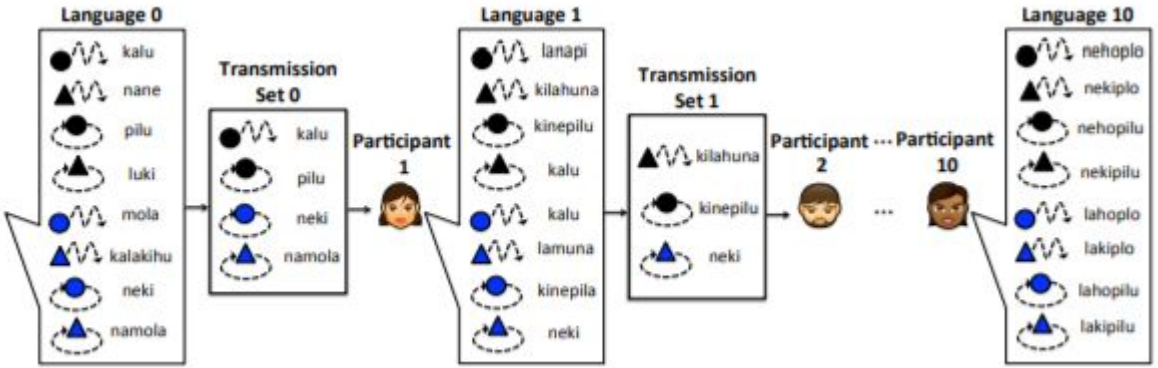


Bird scale

How/Why Does Language Change?

- One way to view language change is optimizing for informativity
- Cultural transmission can be studied in laboratory settings with iterated learning
- Structures emerge that are relevant and efficient



Kirby, Griffiths, & Smith (2014); Kirby, Cornish, & Smith (2008)

Even from a random starting point (Language 0), this language develops meaningful structure by Language 10

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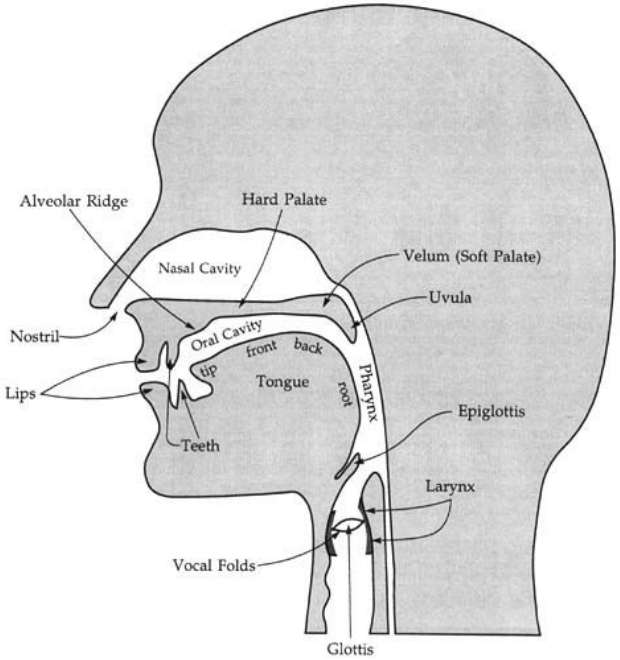
Phonetics - Speech sound production and perception

- 3 primary focuses
- **Articulatory**: How do humans produce speech?



Manner of Articulation \ Place of Articulation	Bilabial		Labio dental		Inter dental		Alveolar		Alveo-palatal		Palatal		Velar		Glottal	
Stop	p	b					t	d					k	g	ʔ	
Fricative			f	v	θ	ð	s	z	ʃ	ʒ						h
Affricate									tʃ	dʒ						
Nasal		m						n						ŋ		
Lateral Approximant								l								
Retroflex Approximant								ɹ								
Glide	ʍ	w										j				

State of the Glottis

Voiceless	Voiced

Phonetics - Speech sound production and perception

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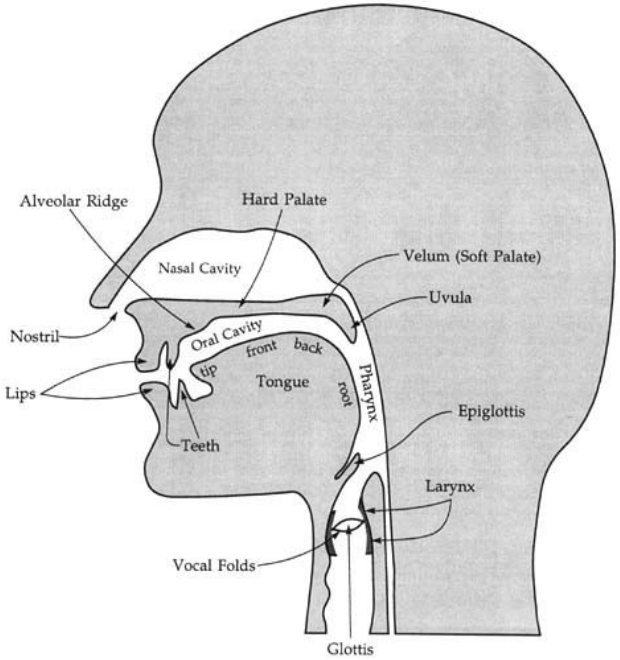
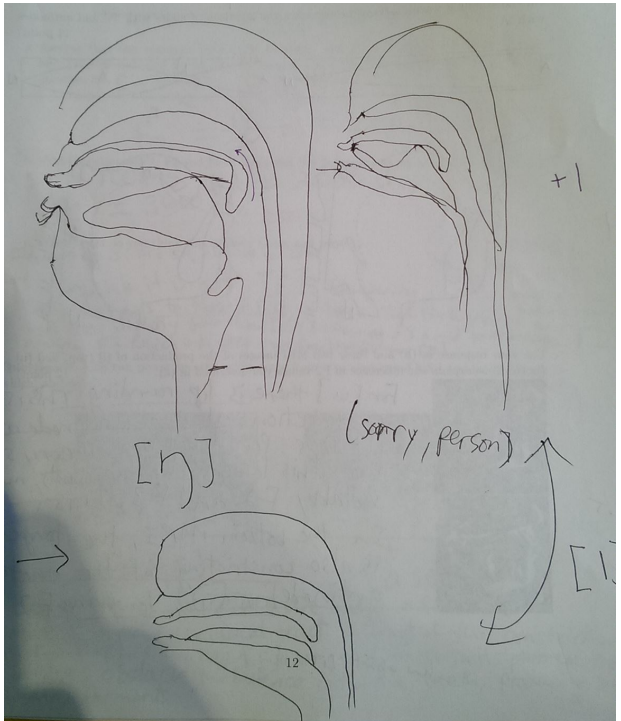
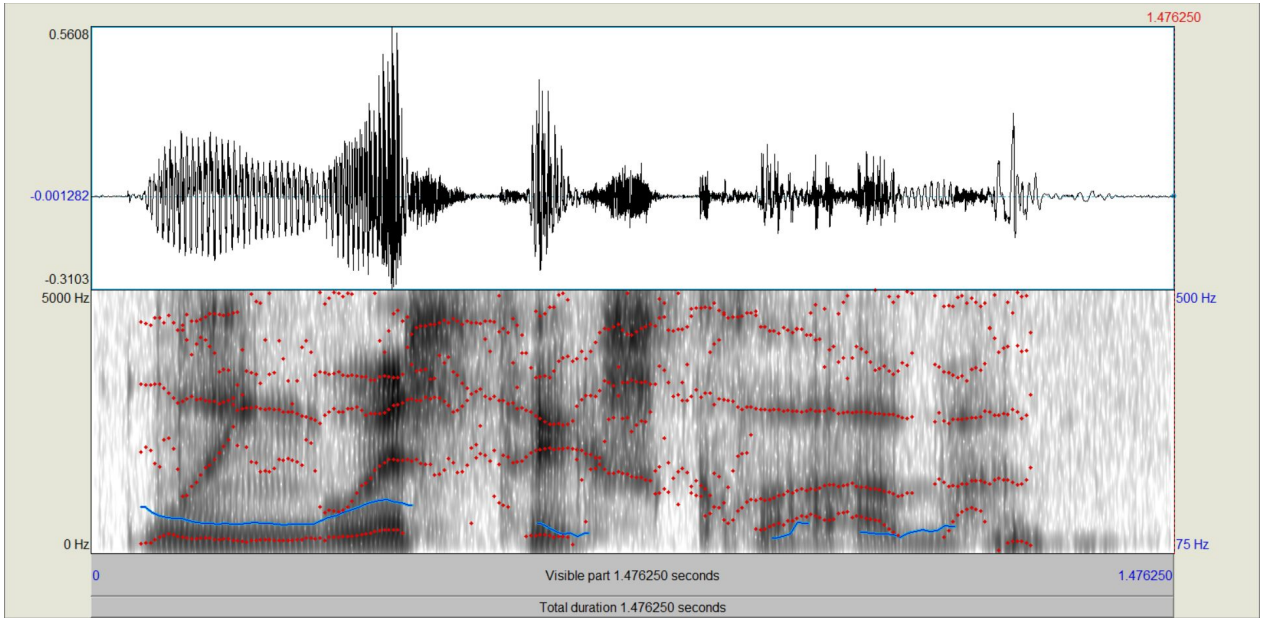




Phonetics - Speech sound production and perception

- 3 primary focuses
- **Articulatory**: How do humans produce speech?
- **Acoustic**: What are the physical properties of speech?



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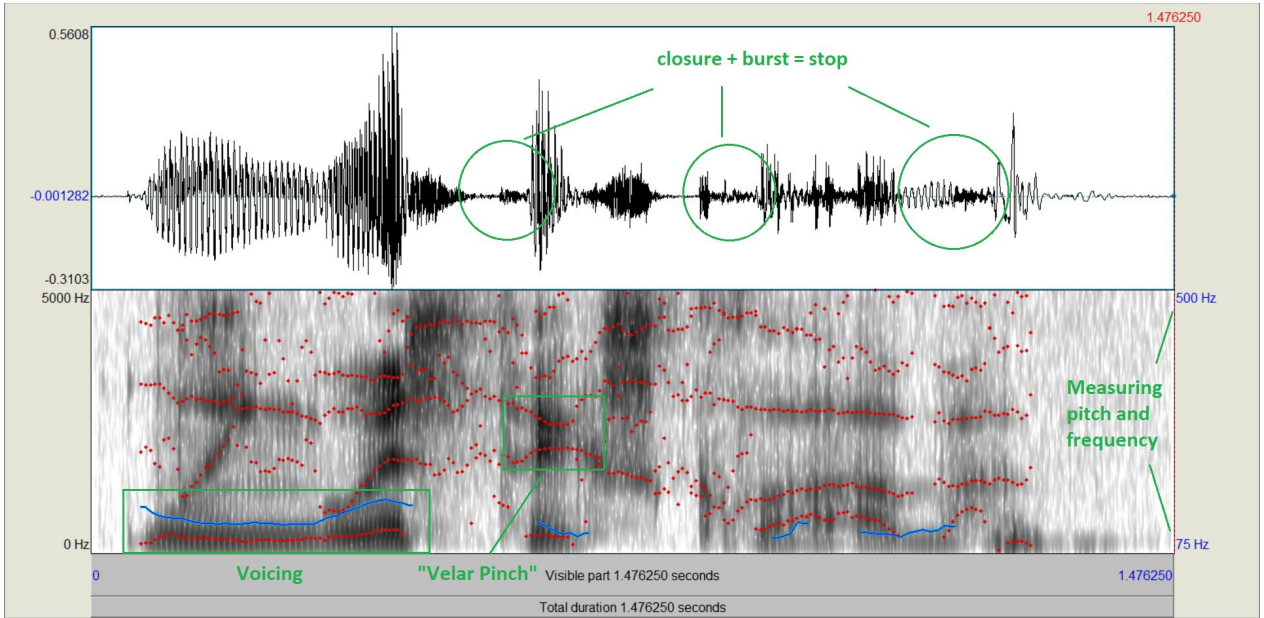
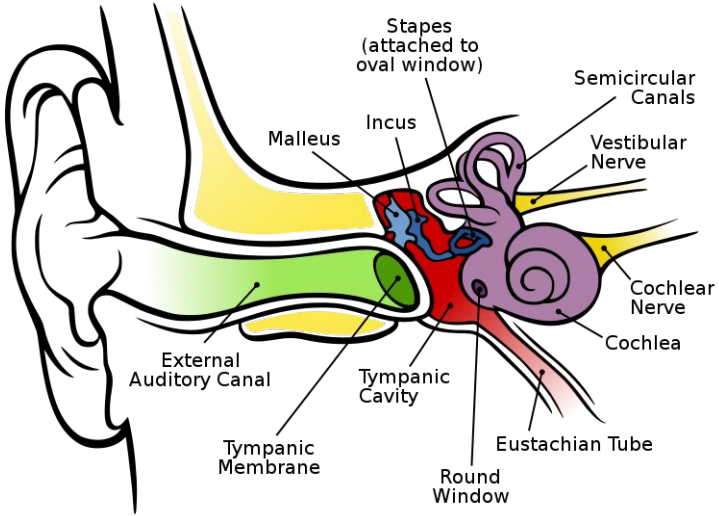


Phonetics - Speech sound production and perception

- 3 primary focuses
- **Articulatory**: How do humans produce speech?
- **Acoustic**: What are the physical properties of speech?
- **Auditory**: How do we perceive speech?



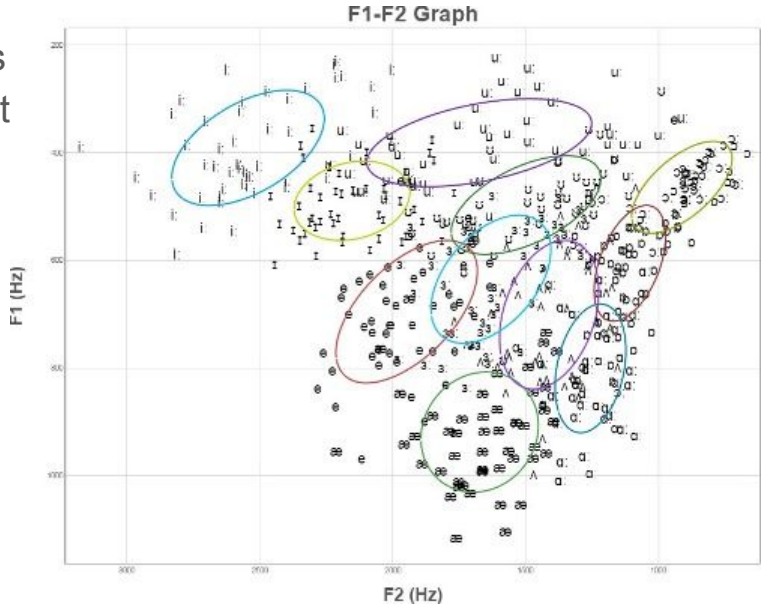
My Focus: The Perception-Production Link

Perception-Production Link? Production → Perception

- One theoretical framework (that I asssume) is that our ability to perceive speech arises from our experience articulating and producing speech
  - **Motor Theory** (Liberman et al., 1967)
    - Humans use articulatory knowledge to decode message from acoustic signal
  - **Direct Realism Theory** (Fowler, 1986)
    - The articulatory info from the acoustic signal *is* the message
- Maybe the 2 systems are independent?
  - **General Auditory stances** (Stevens & Blumstein, 1981; Diehl & Kleunder, 1989)
- Untangling these perspectives isn't the focus of this study, but the design can address this
  - "Can listeners recover articulatory information from just the acoustic signal?"

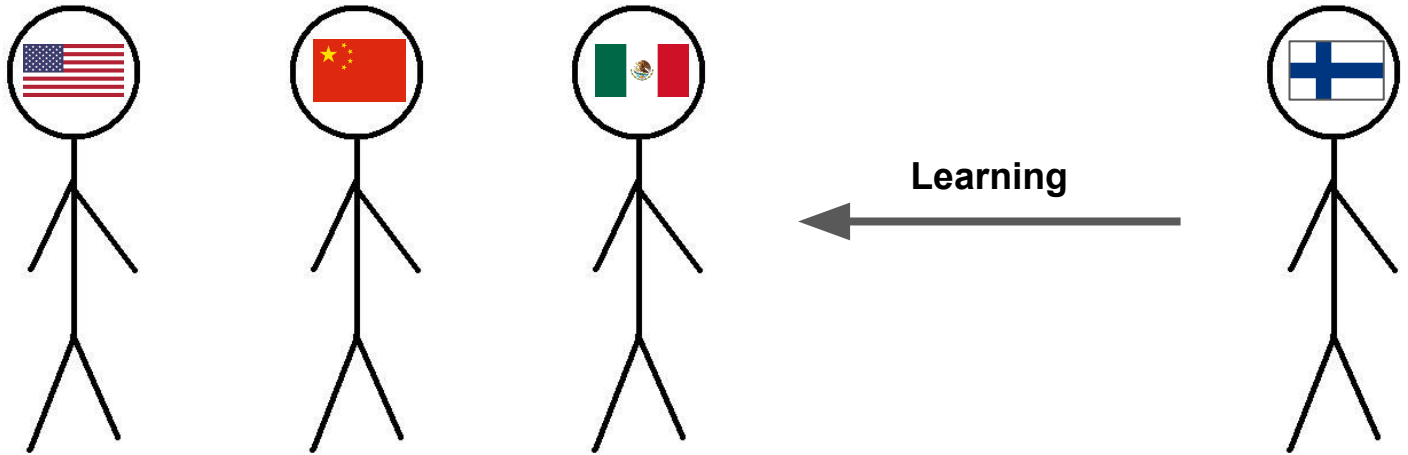
Perception-Production Link? Perception → Production

- It may be reasonable to assume that our knowlege of how to produce sounds comes from our experience perceiving sounds
- **Exemplar Theories** (Goldinger, 1996; Johnson, 1997)
  - We store detailed episodic speech traces
  - From these distributions emerge phonemic categories
  - When we speak, we draw from our knowledge of what we think those sounds *should* sound like based on our observations
    - Regional dialect variation arises from this
- In the context of second language learning, we should have no/few initial observations to build our perception OR production off of
  - “The Birth of a Phonological Category”



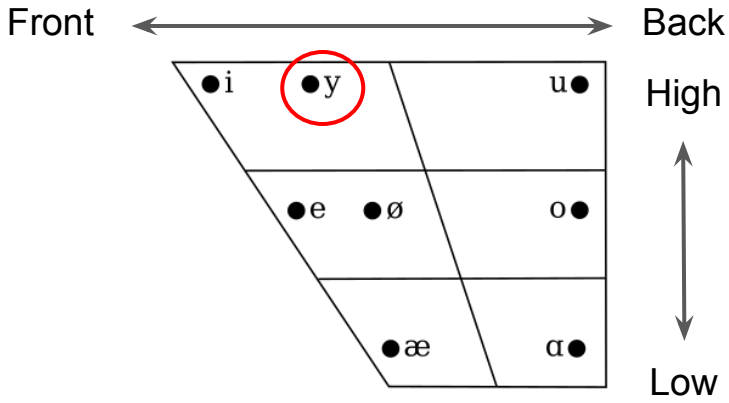
Research Questions

- How does the structure of a person's native language vowel system influence their ability to learn unfamiliar contrastive features of a non-native language?
- Do perception and production bias in the same direction and magnitude…
  - Within an individual speaker?
  - Across individuals of the same language background group?

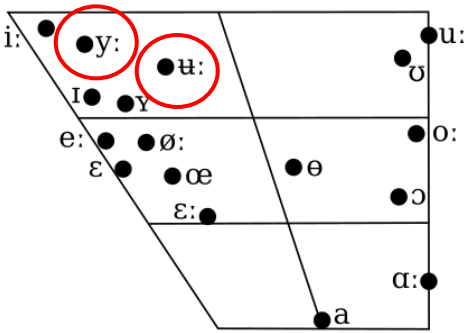


Vowel Quality (Type) Contrasts

- While only 5% of people in Finland are native Swedish speakers, it's an official language and is taught in schools



Finnish vowel inventory



Swedish vowel inventory

- The contrast between /y:/$_{Swed}$ and /ʉ:/$_{Swed}$ are reported to be difficult for Finnish speakers to perceive and produce
  - This would be an example of Categorized-Uncategorized assimilation

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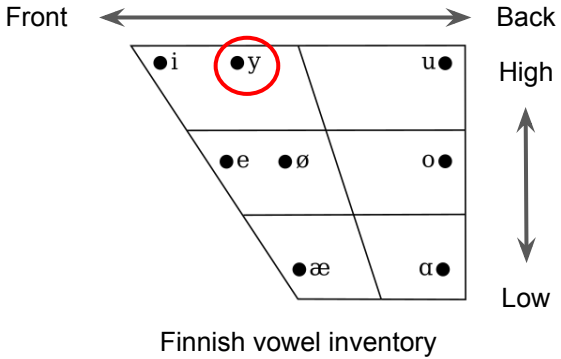

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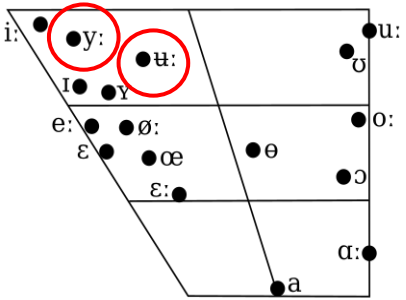

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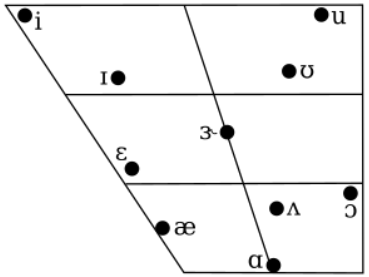
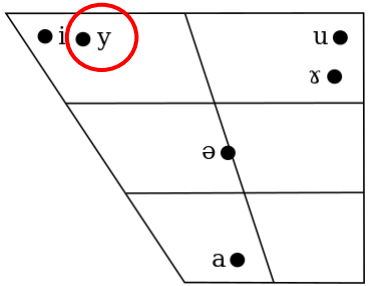
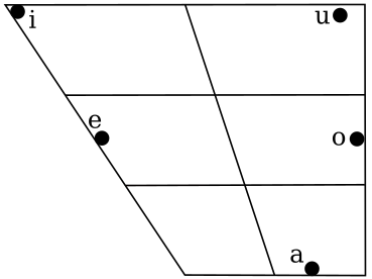


English vowel inventory



Mandarin vowel inventory



Spanish vowel inventory

- Mandarin **DOES** use /y/. Higher perceptual salience → More accurate production?
- Stimulus words: /ty:ti/~/tʉ:ti/

Non-native imitation of Finnish /i/~/i:/ or /y:/~/ʉ:/