Psych 56L/ Ling 51:
Acquisition of Language

Lecture 8
Phonological Development III

Announcements

Homework 1 returned

Review questions for phonological development available

Midterm review session on Monday

Midterm next Wednesday
- structure: ~30 matching, ~20 true/false, ~5 short answer
- open-note (including IPA conversion chart), open-book, open-lecture-notes (printouts or on your laptop)

Understanding How Phonological Development Works

What we have to account for

(1) Developmental changes that occur in speech perception and speech production

(2) How children ultimately achieve the ability to distinguish and produce sound patterns of their language

Behaviorist Theory

Idea: use behaviorist mechanisms of imitation and reinforcement

Implementation: Babies produce the sounds they do because they imitate the sounds they hear and get positive reinforcement for doing so.

Behaviorist Theory

Problem: Ignores maturational constraints. Some sounds are later because they're harder to physically produce (ex: θ, ʒ), not because they aren't reinforced.

Problem: Parents do not selectively reinforce speech sounds - parents delight in all kinds of sounds children make (ex: laughter, burps, raspberries, …)

Problem: Phonology isn't just about sounds - it's also about developing mental representations of contrastive sounds and the rules for when sounds are combined together. This isn't conscious knowledge, and so it's not able to be reinforced.

Behaviorist Theory

Basic Problem: Not fundamentally wrong, just mistaken. Positive reinforcement and a rich linguistic environment to imitate certainly help phonological acquisition. They're just not exclusively responsible for it.

Rule & Constraint-Based Approaches

Idea: phonology is a system that represents sounds in terms of features and involves rules that operate over these representations to produce speech. Children's job is to learn the rules and relevant features for their language.

Two instantiations of this:
(1) learning applicable phonological rules in Universal Grammar
(2) learning rankings of rules in Optimality Theory

English ASPIRATE rule: aspirate stop sound (like "t") at beginning of a word if it's not in a consonant cluster; otherwise do not aspirate it

"top" --> [tʰap]   "stop" --> [stap]   "trip" --> [trɪp]

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Notice distribution of sounds & posit rule: ASPIRATE

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Notice distribution of sounds & rank this rule above opposing rules: ASPIRATE more important than "pronounce all t sounds the same"

"top" --> [tʰap]   "stop" --> [stap]   "trip" --> [trɪp]

Biologically-Based Theories

Idea: phonological system is driven by inherent biological constraints (which then interact with the child's experience with the language).

Instantiation: development of sound is shaped by the development of the child's motor capacity.

Support 1: Correlation between development and crosslinguistic variation
Sounds appearing early in infants' vocal productions are most common sounds among the world's languages (ex: /m/). Sounds appearing late are the rarest (ex: /r/).

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Support 2: Correlation between phonological processes employed by children and crosslinguistic variation
Ex: Children often make a word-final consonant voiceless (ex: "bad" --> /bæt/, and this is a process some languages use (ex: German)

Cognitive Problem-Solving Approach

Idea: burden is on child's problem-solving abilities (rather than, say, on biological constraints or prior knowledge). Predicts substantial individual differences, correlating with individual problem-solving abilities.

Support: Research on individual differences still inconclusive. However, there does appear to be a common trajectory, despite disparities in individual problem-solving abilities.
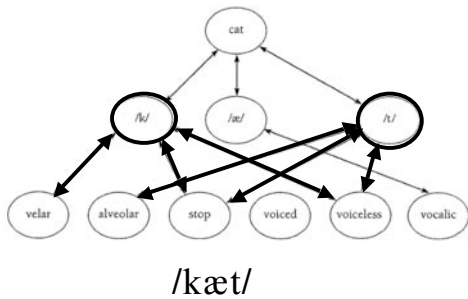

Connectionist Approach

Idea: rules are just a human's way of dealing with regularities in the data. What brains actually do is approximate the sound they intend to produce using a neural network (ex: saying /wæbɪt/ for "rabbit"). Predicts perception should be fine, however.
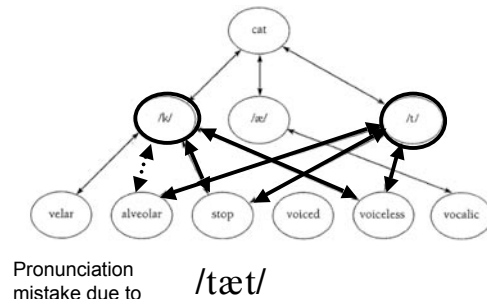
Instantiation: Neural network representation, where sounds (like /k/) are connected to phonological features (like velar, stop, and voiceless)

Connectionist Approach
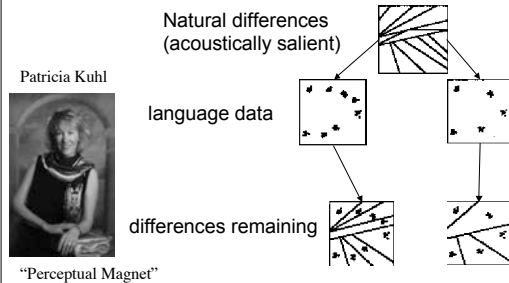

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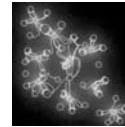
Connectionist Approach

Pronunciation mistake due to incorrect feature association

/tæt/

Connecting the Connectionist Approach to Speech Perception: The Native Language Magnet Theory

Empirical data: infants learn to distinguish native sound contrasts and to ignore non-native sounds contrasts before they begin word-learning (~10-12 months)
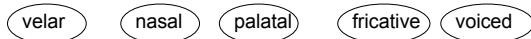
Idea: experience hearing sounds of one language alters infant's perception of distances among sounds, making differences that do not matter perceptually smaller and differences that do matter perceptually larger.

Connecting the Connectionist Approach to Speech Perception: The Native Language Magnet Theory

Patricia Kuhl

Natural differences (acoustically salient)

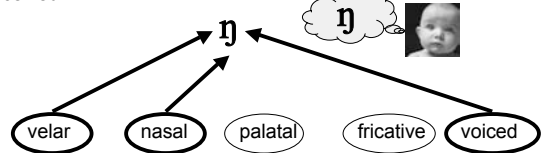language data

differences remaining

"Perceptual Magnet"

Connecting the Connectionist Approach to Speech Perception: The Native Language Magnet Theory

Idea: Exposure to native language data produces dedicated neural networks in the brain for processing native language sounds.   If patterns come in that do not match the feature associations in these neural nets (ex: from a foreign language), these patterns are not processed - and so not perceived.

velar   nasal   palatal   fricative   voiced

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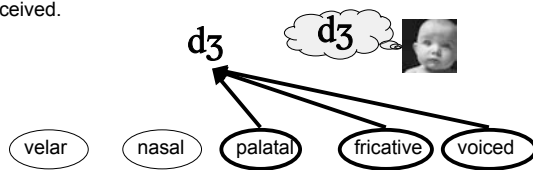
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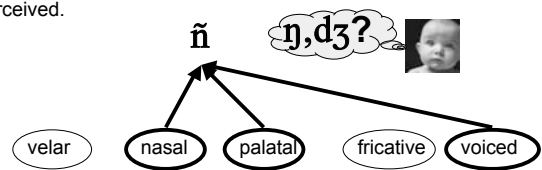velar   nasal   palatal   fricative   voiced

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Theories of Phonological Development: Recap

Multiple theories proposed to explain empirical data on children's speech perception and speech production.

Some are not compatible with current data (ex: behaviorist), while most others are able to explain some aspects of the current data, if not all aspects.

Current approaches differ in whether they view development as acquisition of actual rules or instead as acquisition of regularities in the input.

Questions?