

Infant speech discrimination

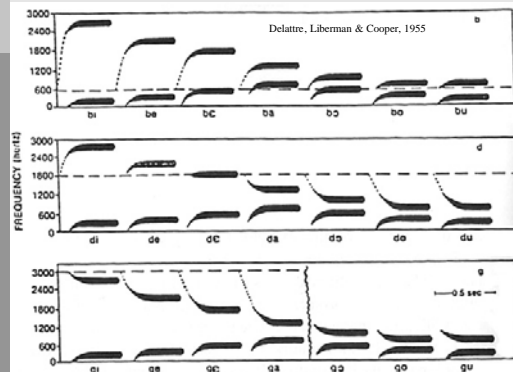
Learning the elementary sound units

- Languages differ in
 - phonemes
 - “th” in French, vs. French /y/ in English
 - how phones are grouped together to form meaningful distinctions
 - /t/ vs /d/ vs /tʰ/
 - ways sounds can combine sequentially
- An infant must learn these sound properties

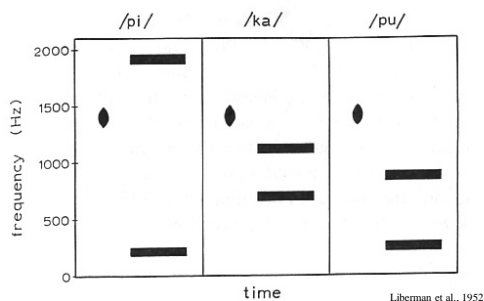
Early studies

- Can infants distinguish different speech sounds?
- Do they show categorical perception?

Why is this a question?



Why is this a question?



Categorical perception

- Surprisingly, adult listeners cannot distinguish all speech sounds.
- Generally, they only distinguish the speech sounds that result in meaningful differences in their native language.
- What about infants, prior to learning their language?

HASP



HASP at 2 months

Image from: F. Ramus & Laboratoire de Sciences Cognitives et Psycholinguistique

- AKA non-nutritive sucking paradigm
- Uses sucking rate as measure of interest
- Habituation / dehabituation paradigm

HASP

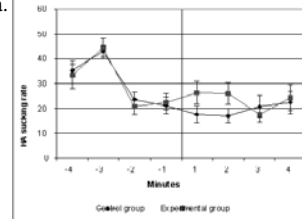
HASP data from Aslin et al!

Sample HASP data.



HASP at birth

Source: F. Ramus & Laboratoire de Sciences Cognitives et Psycholinguistique



Eimas, Siqueland, Jusczyk, & Vigorito 1971

- Tested infants 1 and 4 months of age
- Used /ba/ - /pa/ distinction
- Infants at both ages distinguished two phonemes from one another
- Infants failed to distinguish sounds within a given category
- Infants can distinguish speech sounds before they can produce them

What are the limits on this?

- It has been replicated with a variety of speech sounds
 - Stop place of articulation (/ba/ - /ga/, /bæ/-/dæ/)
 - Manner of articulation (/ba/-/wa/)
 - Non-stops (/la/-/ra/, /wa/-/ja/, /ma/-/na/)
 - Fricatives: seems less robust, but still present
 - Vowels (/a/-/i/, /i/-/u/)
 - Prosodic distinctions
 - Syllable-final & utterance-medial distinctions
- Basically, infants seem to be able to distinguish all native contrasts tested

Dealing with variability

- Different talkers produce sounds differently
- Can infants generalize across talkers saying the same phoneme (and still separate that from different phonemes)?

Dealing with variability

- Jusczyk, Pisoni & Mullennix (1992) recorded 12 talkers (6m, 6f) saying “bug” or “dug”
- Infants 2 months old heard all 12 talkers saying one word in preshift, then other word in postshift
- Infants showed increase in sucking, indicating recognition of change, despite irrelevant variation
- Others found similar results for irrelevant changes in prosody and speaking rate

Summary

- Infants seem to come to the language learning task with the ability to distinguish a wide range of speech contrasts, and to tolerate acoustic variability

What about foreign contrasts?

- Issue: Adults don't hear contrasts that aren't native in their language
- Some of the contrasts tested are not in all languages, but the English infants discriminated them
- Had they already learned the critical sounds?

What about foreign contrasts?

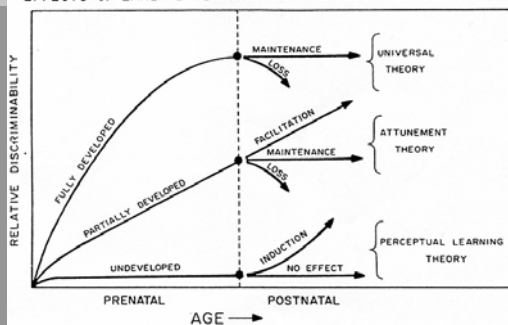
- Streeter (1976) examined /ba-/pa/ for Kikuyu infants
 - Kikuyu has voiced vs. prevoiced, but not voiced vs. voiceless
 - Infants (1 & 4 months) did discriminate the pair
- Lasky, Syrdal-Lasky & Klein (1975) examined /ba-/pa/ for Spanish infants
 - Spanish has voicing distinction, but it's a different one
 - Infants (4,5-6 months) discriminated the English contrast, but not the Spanish one

What about foreign contrasts?

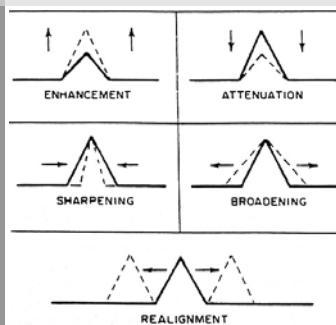
- A number of other studies show that infants do tend to succeed with foreign contrasts.
- But, adults don't!
- What changes? And how?

Effects of early experience

EFFECTS OF EARLY EXPERIENCE ON PHONOLOGICAL DEVELOPMENT



How do these categories change?



- Aslin suggested 5 ways language exposure could change speech sound discriminability

Conditioned headturn paradigm



Image in *How Children Develop* (Siegler, Deloache, Eisenberg), 2003

When does the change occur?

- Werker & Tees (1983)
 - Hindi contrast
 - Nthlakapmx contrast
 - English contrast

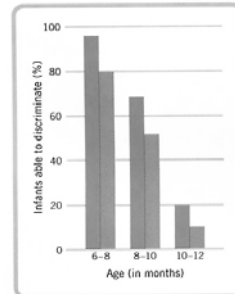


Image in *How Children Develop* (Siegler, Deloache, Eisenberg), 2003

Similarly...

- Japanese infants can distinguish /ra/-/la/ at 6-8 months, but not at 10-12 months
 - Tsushima et al., 1994

A complication

- Many non-native contrasts actually do occur in the language.
- They just aren't used contrastively.
- So not hearing the sound is not enough.
- Also, sounds not heard don't get lost!

Zulu clicks

- Best, McRoberts & Sithole (1988)
 - Listeners do just fine with nonnative click discrimination

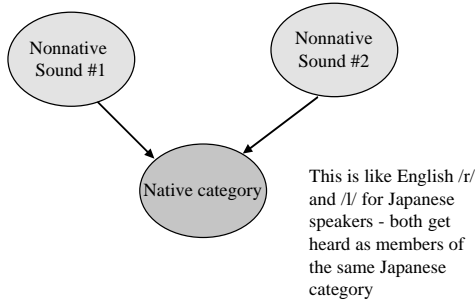


Zulu clicks from Peter Ladefoged & hctv.humnet.ucla.edu/departments/linguistics/VowelsandConsonants/course/chapter6/zulu/zulu.html

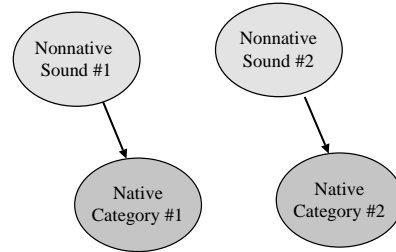
How can we explain this?

- Perceptual assimilation model
 - Best, 1993 & 1995
- Nonnative contrasts get mapped onto 1 or more native categories.
 - If mapped onto different categories, distinctions maintained
 - If mapped onto the same category, ability will decline
- Four types of mapping. . .

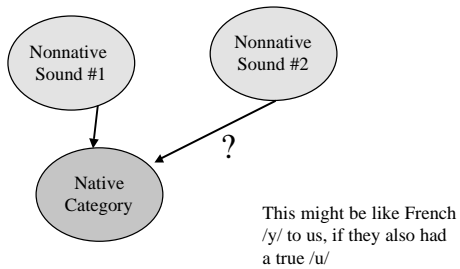
Single-category assimilation



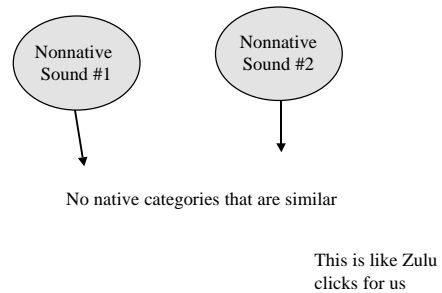
Opposing-category assimilation



Category-goodness difference assimilation



Nonassimilation

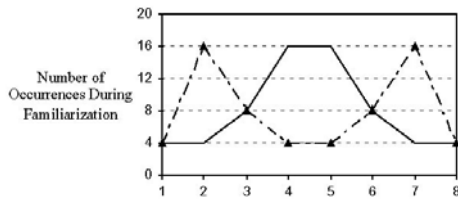


How does this work?

- How can an infant tell if the sounds she hears are all one category or are two categories?
- Possibility 1: Minimal pairs & word learning
 - If a child hears a meaning difference, the items must be separate categories (e.g., /b/ & /p/ are different because *bear* and *pear* are)
 - Problem: Changes in perception precede learning the words! (kids don't know many words in their first year of life)

How does this work?

- Possibility 2: Selective exposure
 - If a language only has one category, people won't produce the other sound.
 - Problem: This isn't accurate. In Thai, short-lag "b" and prevoiced "b" are separate categories. In English they aren't - but they're still heard. People use them interchangeably in English.

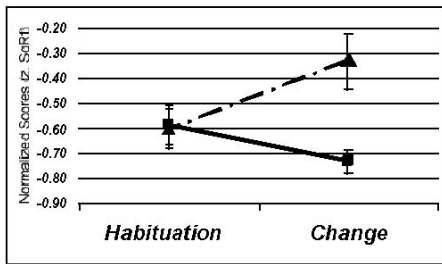


How does this work?

- Possibility 2: Statistics
 - If a language has 6

Evidence

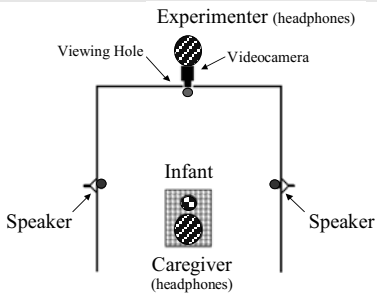
- Maye, Werker & Gerken (2002)



Other patterns

- Infants also begin to learn what combinations of sounds are more common in their language
 - Friederici & Wessels, 1993
 - Jusczyk, Luce & Charles-Luce, 1994
- And what prosodic patterns are more common
 - Jusczyk, Cutler & Redanz, 1993

Head-turn preference procedure



Segments or syllables?

- Jusczyk & Derrah, 1987
 - After familiarization with “bee, bah, bow, burr”, equivalent response to a change to “do” as to “boo”
- Bijeljac-Babic, Bertoncini & Mehler, 1993
 - Infants notice a switch from 2 to 3 syllables, but not a switch from 4 to 6 phonemes (if # syllables remains constant)

Memory & Attention

- Attention to stressed vs. unstressed syllables?
- Attention to onsets vs. rimes
 - Bauman, Goodman & Jusczyk, 1995
- Short term memory over 2-minute delay
 - Jusczyk, Kennedy, Jusczyk, 1995
- LTM over 2 weeks