Psych 156A/ Ling 150: Psychology of Language Learning

Lecture 4

Sounds II

Announcements

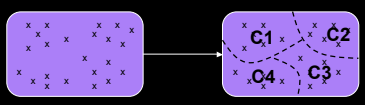
Quiz Results (generally)

- & the "noise" question…
- ("noise" = errors in child's input)
- (hard to learn the right rules/generalizations when there are errors in the very input you're using to form these rules)

Web page: ppt files are now also available for the lecture notes

Speech Perception: Computational Problem

Divide sounds into contrastive categories



Infant Speech Perception

How do we tell what infants know, or use, or are sensitive to?

Researchers use indirect measurement techniques.

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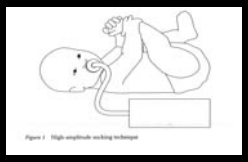
High Amplitude Sucking (HAS)



Infants are awake and in a quietly alert state. They are placed in a comfortable reclined chair and offered a sterilized pacifier that is connected to a pressure transducer and a computer via a piece of rubber tubing. Once the infant has begun sucking, the computer measures the infant's average sucking amplitude (strength of the sucks).

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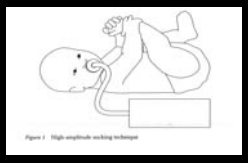

A sound is presented to the infant every time a strong or "high amplitude" suck occurs. Infants quickly learn that their sucking controls the sounds, and they will suck more strongly and more often to hear sounds the like the most. The sucking rate can also be measured to see if an infant notices when new sounds are played.

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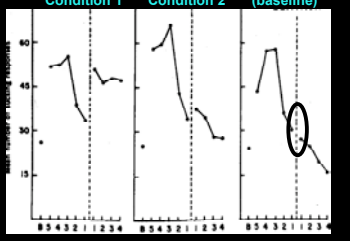

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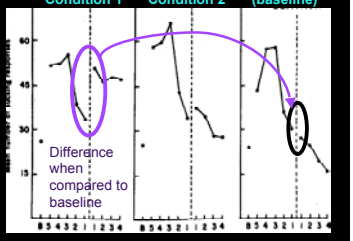

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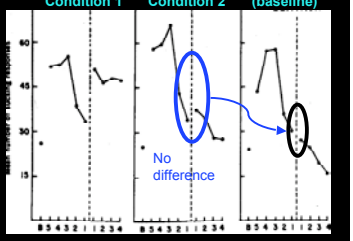

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Adult perception

"dæ" "tæ"

phonemic category phonemic category

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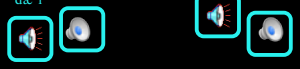

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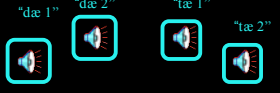

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Infants can't recognize a phonemic (but acoustically variable) sound across syllables (Jusczyk & Derrah 1987, Bertoncini et al 1988)

ba, bey, bi, bo, boo…

Implication: Syllable is relevant unit of perception for infants, not individual sounds

Infants do not perceive the individual sounds as the same from syllable to syllable. They readily perceive the differences.

Perceiving sound contrasts

Kids…

This ability to distinguish sound contrasts extends to phonemic contrasts that are non-native. (Japanese infants can discriminate contrasts used in English but not in Japanese, like r/l.) This goes for both vowels and consonants.

…vs. adults

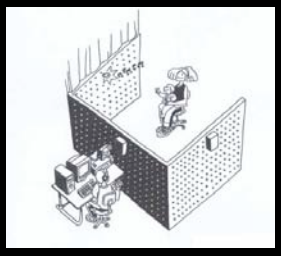
Adults can't, especially without training - even if the different is quite acoustically salient.

So when is this ability lost?

And what changes from childhood to adulthood?

Another useful indirect measurement

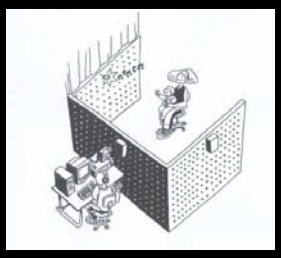
Head Turn Preference Procedure



Infant sits on caretaker's lap. The wall in front of the infant has a green light mounted in the center of it. The walls on the sides of the infant have red lights mounted in the center of them, and there are speakers hidden behind the red lights.

Another useful indirect measurement

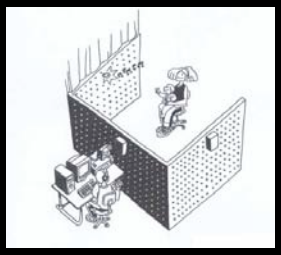
Head Turn Preference Procedure



Sounds are played from the two speakers mounted at eye-level to the left and right of the infant. The sounds start when the infant looks towards the blinking side light, and end when the infant looks away for more than two seconds.

Another useful indirect measurement

Head Turn Preference Procedure



Thus, the infant essentially controls how long he or she hears the sounds. Differential preference for one type of sound over the other is used as evidence that infants can detect a difference between the types of sounds.

Head Turn Preference Procedure Movie

"How Babies Learn Language"
(first part)

http://www.youtube.com/watch?v=mZAuZ--Yeqo

Speech Perception of Non-Native Sounds

Comparing perceptual ability

Werker et al. 1981: English-learning 6-8 month olds compared against English & Hindi adults on English & Hindi contrasts

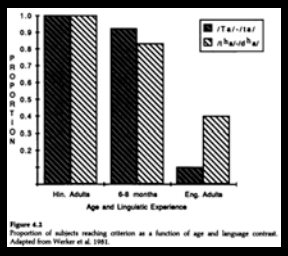


Figure 4.2
Proportion of subjects reaching criterion as a function of age and language contrast. Adapted from Werker et al. 1981.

Sound-Learning Movie

Infant Speech Discrimination

http://www.youtube.com/watch?v=GSIwu_MhI4A

Speech Perception of Non-Native Sounds

But when after 6-8 months is the ability to lost? Werker & Tees (1984)

Salish & Hindi contrasts

Change happens somewhere around 8-10 months, depending on the sound contrast.

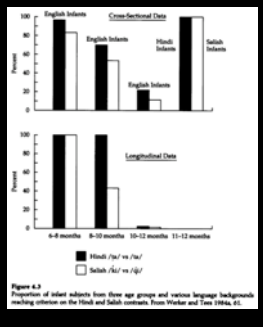


Figure 4.3
Proportion of infant subjects from three age groups and various language backgrounds reaching criterion on the Hindi and Salish contrasts. From Werker and Tees 1984a, 61.

How change happens

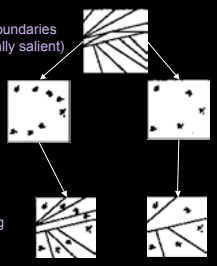
Maintenance & Loss Theory

Infants maintain contrasts being used in their language and lose all the others.

Natural boundaries (acoustically salient)

Patricia Kuhl

language data



contrasts remaining

"Perceptual Magnet"

How change happens

Maintenance & Loss Theory

Predictions for performance on non-native contrasts over time

Loss of discrimination ability is permanent and absolute

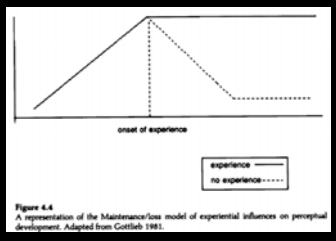


Figure 4.4
A representation of the Maintenance/loss model of experiential influences on perceptual development. Adapted from Gottlieb 1981.

How change happens

A problem with the Maintenance & Loss Theory

If it doesn't sound like speech, adults can tell the difference. Werker & Tees (1984) showed this with truncated portions of syllables of non-native contrasts. They told subjects the sounds were water dropping into a bucket, and to tell them when the bucket changed.

Non-linguistic perception

Pisoni et al. (1982), Werker & Logan (1985): adults can be trained if given enough trials or tested in sensitive procedures with low memory demands

Can be taught

Maintenance & Loss predictions not born out

How change happens

And another problem

Some non-native contrasts are easy for older infants and adults to discriminate. (Click languages (Zulu) - click sounds like "tsk tsk" nonspeech)

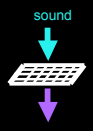
http://hctv.humnet.ucla.edu/departments/linguistics/VowelsandConsonants/course/chapter6/zulu/zulu.html

How change happens

Another theory: functional reorganization

Changes attested experimentally reflect operation of postperceptual processes that kick in for language

Janet Werker



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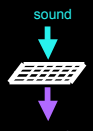

Explanatory power: the whole story

Very young infants respond to any detectable variation - so they can pick up any salient ones in surrounding language. Adults have bias for phonemic information since those are the ones relevant to language. If in non-language setting, adults can tell the nonphonemic differences.

Perceptual Ability Links

The effect of early exposure to sounds in a language:

Links with later language proficiency

Vowel discrimination at 6 months predicts vocabulary size at 13-24 months

Reading proficiency correlated with sound discrimination as neonate

Bilingual evidence: don't have true bilingual discrimination if exposed to sound system after 3-4 years of age