Psych 156A/ Ling 150: Psychology of Language Learning

Lecture 6
Sounds of Words I

Quick Quiz 2

Will commence as soon as the quizzes are passed out.

15 minutes, open-note, non-collaborative.

15 minutes left

Quick Quiz 2

Will commence as soon as the quizzes are passed out.

15 minutes, open-note, non-collaborative.

5 minutes left

Quick Quiz 2

Will commence as soon as the quizzes are passed out.

15 minutes, open-note, non-collaborative.

1 minute left

Announcements

Homework 2 is due Tuesday (4/22/08).

Recap: Sounds of Language (Speech Perception)

Learner's job: figure out phonemes (contrastive sounds of the language)

big vs. dig

Phonemes are language-specific
- r/l is a phonemic contrast (changes word's meaning) in English but not in Japanese

Lisa = Risa for some of my Japanese friends

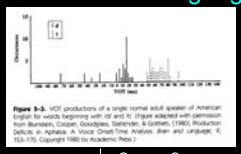
- Dental D vs. retroflex d is a distinction in Hindi, but not in English

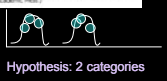
Sounds of Language (Speech Perception)

Time course: weird?

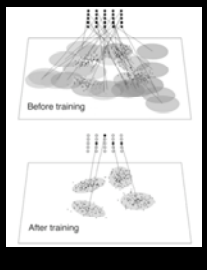
Children of the world acquire knowledge of phonemes before they can figure out what different words are - and when different meanings are signaled by different words

Sounds of Language (Speech Perception)





Hypothesis: 2 categories



Time course: not so weird…

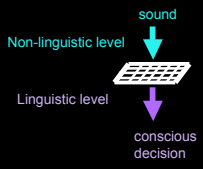
Children may be able to key into distributional information available about sounds in the language and figure out the relevant categories

How change happens

One idea: Functional reorganization

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

Janet Werker



How change happens

One idea: Functional reorganization
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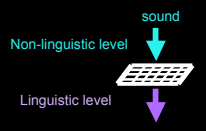


Usefulness of the native language sound filter:
When infants are learning words, they only want to key into meaningful sound differences. So, imposing the native language sound filter means they can figure out what sounds are important for making words and distinctions between words.

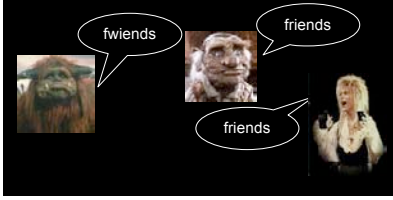
goblin vs. goooblin (not meaningful)

goblin vs. koblin (meaningful)

Learning Words

Word Forms

Computational Problem:
Map variable word signals to more abstract word forms

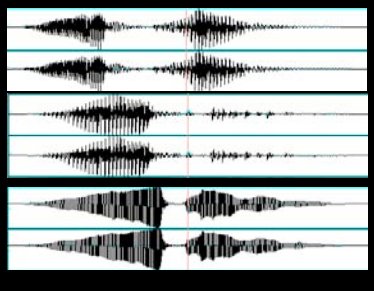


"friends"

What's Involved in Word Learning

Word learning: mapping among concept, word, and word's variable acoustic signal

"goblin"



Word Learning Experiment (Stager & Werker 1997)

Learning nonsense words that are minimal pairs (differ by one phoneme): 'bih' vs. 'dih'. Comparing against words that are not: 'lif' vs. 'neem'

"Switch" Procedure: measures looking time

...this is a ***bih***...look at the ***bih***

Habituation

Test

Same: look at the ***bih!***

Switch: look at the ***dih!***

Word Learning Experiment (Stager & Werker 1997)

14 month olds

...this is a ***dih***...look at the ***dih***

...this is a ***bih***...look at the ***bih***

Habituation

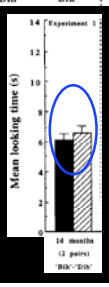
Test

Same: look at the ***bih!***

Switch: look at the ***dih!***

Word Learning Experiment (Stager & Werker 1997)

14 month olds



No looking time difference = 14 month olds didn't notice the difference!

Word Learning Experiment (Stager & Werker 1997)

8 month olds & 14 month olds

…this is a ***bih***…look at the ***bih***

Habituation

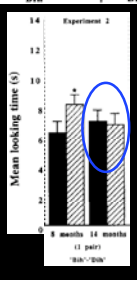
Same: look at the ***bih!***

Switch: look at the ***dih!***

Test

Word Learning Experiment (Stager & Werker 1997)

8 month olds & 14 month olds

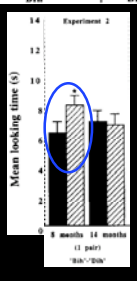


No difference in looking time = 14 month olds didn't notice the difference again!

Word Learning Experiment (Stager & Werker 1997)

8 month olds & 14 month olds

But 8 month olds did! They have a difference in looking time. They look longer at the "bih" object when it is labeled "dih"



Word Learning Experiment (Stager & Werker 1997)

14 month olds

…this is a *lif*…look at the *lif*

Habituation

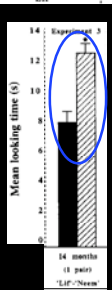
Test

Same: look at the *lif!*

Switch: look at the ***neem!***

Word Learning Experiment (Stager & Werker 1997)

14 month olds



Here, the 14 month olds look longer at the "lif" object when it's labeled "neem". They notice the difference.

Word Learning Experiment (Stager & Werker 1997)

14 month olds

…this is a ***bih***…look at the ***bih***

Habituation

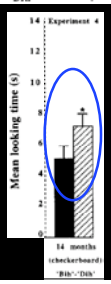
Same:
look at the ***bih!***

Switch:
look at the ***dih!***

Test

Word Learning Experiment (Stager & Werker 1997)

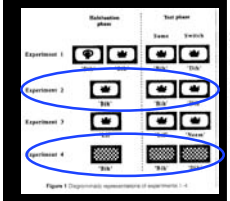
14 month olds



Here, the 14 month olds look longer at the "bih" "object" when it's labeled "dih". They notice the difference.

Word Learning Experiment (Stager & Werker 1997)

Key: Experiment 2 vs 4



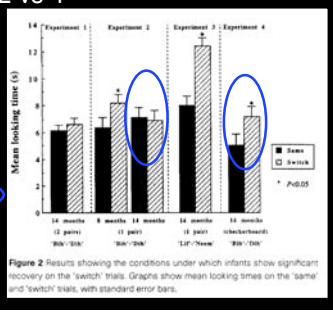


Figure 2 Results showing the conditions under which infants show significant recovery on the 'switch' trials. Graphs show mean looking times on the 'same' and 'switch' trials, with standard error bars.

Key Findings

14 month olds can discriminate the minimally contrasting words (Expt. 4)

But they fail to notice the minimal change in the sounds when they are paired with objects, i.e., when they are *words* (Expt. 2)

They *can* perform the task, when the words are more distinct (Expt. 3)

Therefore, 14 month olds use more detail to represent sounds than they do to represent words

What's going on?

They fail specifically when the task requires word-learning

They *do* know the sounds…but they fail to use the detail needed for minimal pairs to store words in memory

What is going on?

- Is this true for all words?
- When do they learn to do this?
- What triggers the ability to do this?

Was the task too hard for 14 month olds?

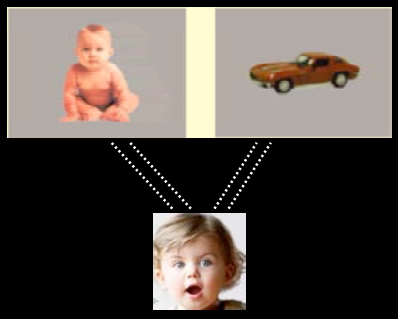
Swingley & Aslin (2002)

Maybe the problem with the younger infants was that these were *novel* words

What would happen if we tested children on familiar words, like "baby"? Would they notice if they were mispronounced (like "vaby")?

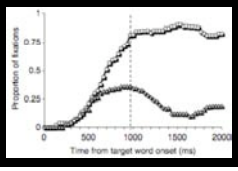
Eyetracking Task: measures fixations on target picture

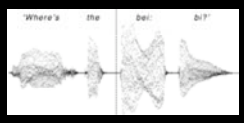
Where's the baby?



Eyetracking Task: measures fixations on target picture

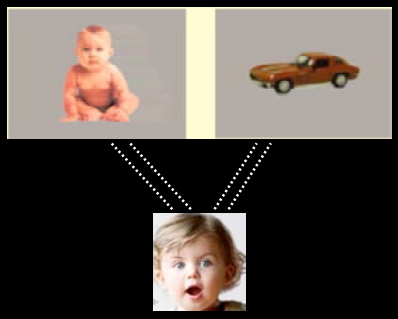
Where's the baby?





Eyetracking Task: measures fixations on target picture

Where's the vaby?



Was the task too hard for 14 month olds?

Swingley & Aslin (2002)

Maybe the problem with the younger infants was that these were *novel* words

Also, 18-23 month olds did better on this eyetracking task. Maybe younger kids will, too…

Swingley & Aslin 2002: Familiar Word Tests

14 month olds noticed the difference between correct pronunciations and mispronunciations when the words were familiar

Table 1. *Correctly pronounced (CP) target words and their mispronounced (MP) versions*

CP	MP-close	MP-distant
apple (/æpl̩/)	opple (/apl̩/)	opal (/opl̩/)
baby (/beˈbi/)	vaby (/veˈbi/)	raby (/ɹeˈbi/)
ball (/bɔl/)	gall (/gɔl/)	shawl (/ʃɔl/)
car (/kaɹ/)	cur (/kɜˑ/)	kier (/kiɹ/)
dog (/dɔg/)	tog (/tɔg/)	mog (/mɔg/)
kitty (/kɪti/)	pity (/pɪti/)	yitty (/jɪti/)

What children may be doing

One idea: Encode detail only if necessary

If children have small vocabularies, it may not take so much detail to distinguish one word from another. (*baby, cookie, mommy, daddy*…)

Neighborhood structure idea: When a child knows two words that are phonetically similar, more attention to detail is required to distinguish them.

Going with the neighborhood idea, look at Stager & Werker (1997)

"bih" and "dih" are too close, and kids don't know any words close enough to motivate attention to the "b"/"d" difference when word-learning

…this is a ***bih***…look at the ***bih***

Habituation

Test

Same:
look at the ***bih!***

Switch:
look at the ***dih!***

Swingley 2005: Familiar Words for Younger Children

(Dutch) 11 month olds noticed the difference between correct pronunciations and mispronunciations when the words were familiar (Headturn Procedure: tests ability to hear sound differences)

Familiar	Nonword	Onset-MP
beɦ	baɦ	deɦ
beɾ	bøɦ	deɾ
bœyk	bœyn	kœyk
eɦt	eɸ	eɦt
h nt	haɦ	x nt
haɾ	heɦ	saɾ
hont	ho	font
ku	kus	xu
mont	maɦt	nont
nøɦ	nut	møɦ
paɦt	pøɦt	daɦt
pus	purt	tus
sxaɸ	sxeɾ	ɦaɸ
teɦ	to	peɦ
v s	vaɦt	v s
vut	veɦt	but

Swingley 2005: Familiar Words for Younger Children

(Dutch) 11 month olds noticed the difference between correct pronunciations and mispronunciations when the words were familiar (Headturn Procedure: tests ability to hear sound differences)

But this is before they've likely learned many words…so it probably isn't just the number of words they know that drives the detailed representations of the sounds in the words.

Why does having a familiar word help? Another Idea

Idea: Maybe phonetic detail involves hearing the word a number of times - get a little more detail each time

{p/b/d/g}{a/o/u}{l/r} *"ball"*

…

(p/b}{a}{l/r}

…

{b}{a}{l}

If it's a novel word, kids haven't heard it enough yet.

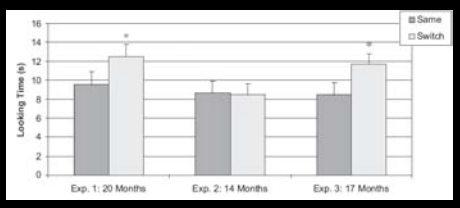
(Stager & Werker, 1997 = novel words with only 7 repetitions}

Werker et al. 2002: Vocabulary Size

Test

Same:
look at the *bih!*

Switch:
look at the *dih!*

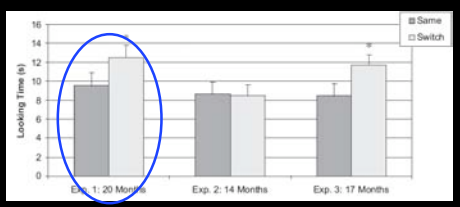


Werker et al. 2002: Vocabulary Size

Test

Same:
look at the *bih!*

Switch:
look at the *dih!*



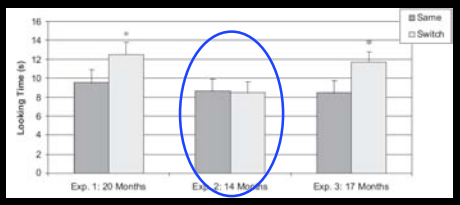
20 month olds notice

Werker et al. 2002: Vocabulary Size

Test

Same:
look at the *bih!*

Switch:
look at the *dih!*



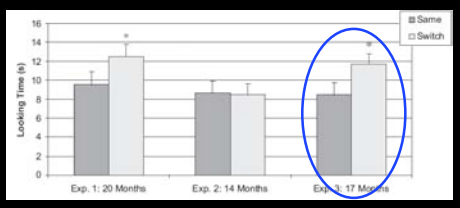
14 month olds don't

Werker et al. 2002: Vocabulary Size

Test

Same:
look at the *bih!*

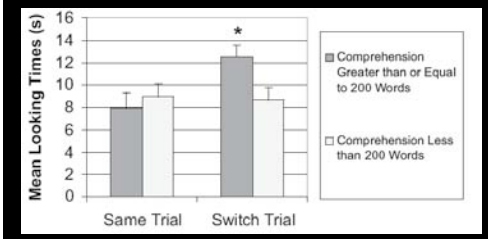
Switch:
look at the *dih!*



17 month olds do

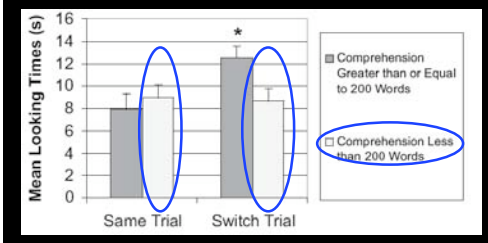
Werker et al. 2002: Vocabulary Size

Zoom in on the 17 month olds



Werker et al. 2002: Vocabulary Size

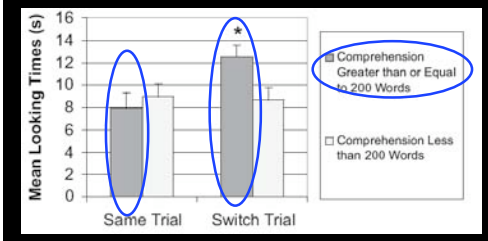
Zoom in on the 17 month olds



Those with a small vocabulary look like 14 month olds - they can't tell the difference.

Werker et al. 2002: Vocabulary Size

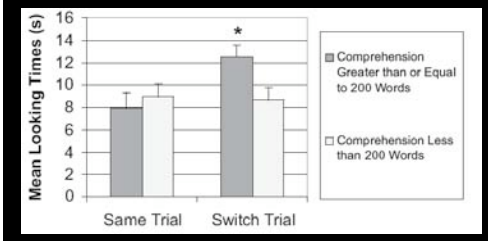
Zoom in on the 17 month olds



Those with a large vocabulary look like 20 month olds - they *can* tell the difference.

Werker et al. 2002: Vocabulary Size

Zoom in on the 17 month olds



Implication: Performance on novel words *does* depend on how many words the child knows.

Why does having a familiar word help? Revising another Idea

Idea: Maybe phonetic detail involves hearing the word a number of times - get a little more detail each time and realize which sounds are phonemic in the language

{p/b/d/g}{a/o/u}{l/r}

…

(p/b}{a}{l/r}

…

{b}{a}{l}

If it's a novel word with a sound contrast children haven't encountered often enough, they will not distinguish it. (Stager & Werker (1997) results, Werker et al. (2002) results)

Word-learning & phonetic detail

Word-learning is very hard for younger children, so detail is initially missed when they first learn words

Many exposures are needed to learn detailed word forms at earliest stages of word-learning

Success on the Werker/Stager task seems to be related to the ***vocabulary spurt***, rapid growth in vocabulary after ~50 words