Psych 156A/ Ling 150: Acquisition of Language II

Lecture 5
Sounds of Words

Announcements

- Be working on HW1 (due 4/19/12)
- Be working on review questions for sounds and sounds of words
- Read Saffran, Aslin, & Newport (1996) for next time

Word Forms

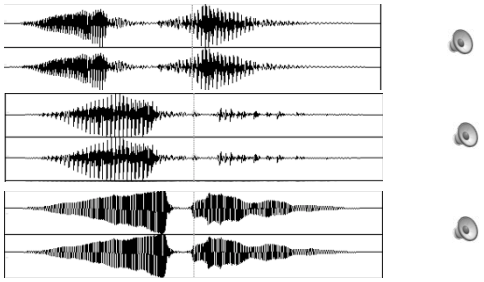
Computational Problem:
Map variable word signals to more abstract word forms

"friends"

What's Involved in Word Learning

Word learning: mapping between 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*

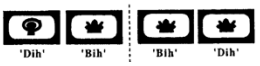
Habituation 

Test

Same: look at the *bih!* 

Switch: look at the *dih!* 

Word Learning Experiment (Stager & Werker 1997)

Experiment 1 

14-month-olds

…this is a *dih*…look at the *dih*

…this is a *bih*…look at the *bih*

Habituation 

Test

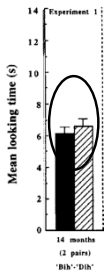
Same: look at the *bih!* 

Switch: look at the *dih!* 

Word Learning Experiment (Stager & Werker 1997)

Experiment 1 

14-month-olds



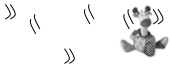
No looking time difference = 14-month-olds didn't notice the difference!

Word Learning Experiment (Stager & Werker 1997)

Experiment 2 

8-month-olds & 14-month-olds

…this is a *bih*…look at the *bih*

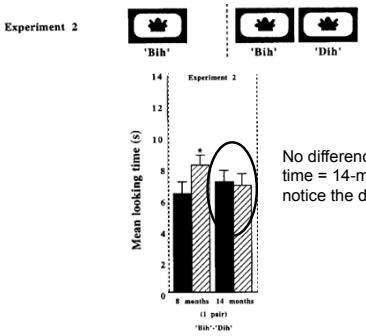
Habituation 

Test

Same: look at the *bih!* 

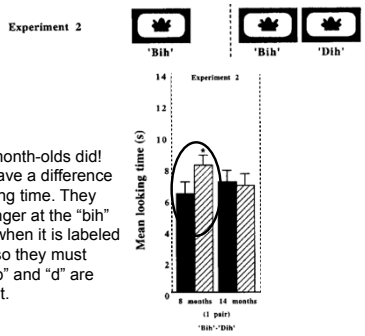
Switch: look at the *dih!* 

Word Learning Experiment (Stager & Werker 1997)



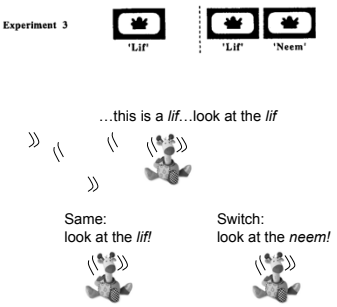
No difference in looking time = 14-month-olds didn't notice the difference again!

Word Learning Experiment (Stager & Werker 1997)

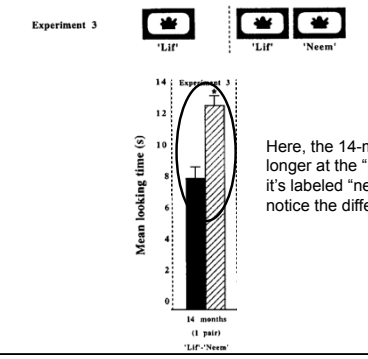


But 8-month-olds did! They have a difference in looking time. They look longer at the "bih" object when it is labeled "dih" - so they must know "b" and "d" are different.

Word Learning Experiment (Stager & Werker 1997)

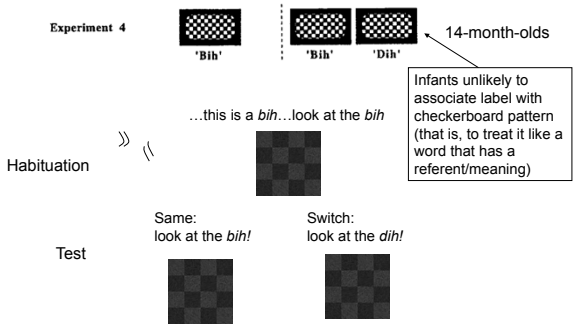


Word Learning Experiment (Stager & Werker 1997)

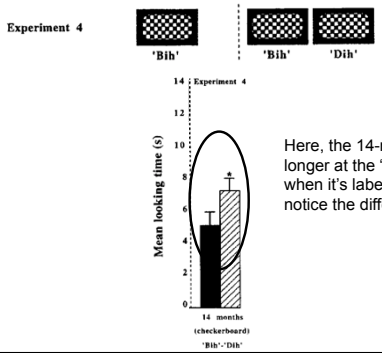


Here, the 14-month-olds look longer at the "lif" object when it's labeled "neem". They notice the difference.

Word Learning Experiment (Stager & Werker 1997)



Word Learning Experiment (Stager & Werker 1997)



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

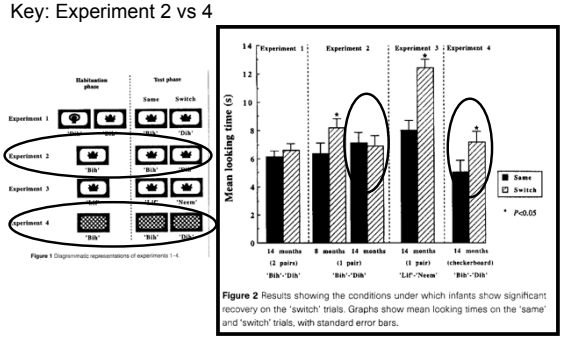


Figure 2 Results showing the conditions under which infants show significant recovery on the 'switch' trials. Graphs show mean looking times on the 'same' and 'switch' trials, with standard error bars.

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 with associated meaning* (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's going on?

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

What children may be doing

One idea: Encode detail only if necessary

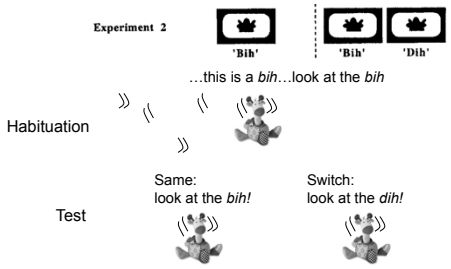
If children have small vocabularies, it may not take so much detail to distinguish one word from another. (*baby, cookie, mommy, daddy*…)

Neighborhood structure idea: When a child knows two words that differ only by a single phoneme (like "cat" and "bat"), more attention to detail is required to distinguish them.

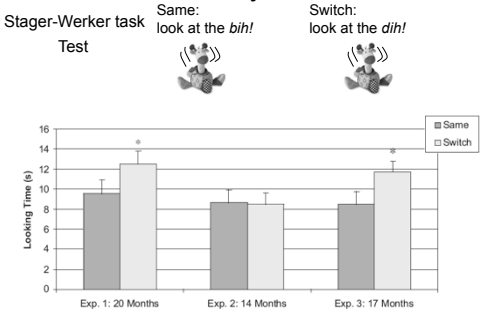
Prediction: The content of children's vocabulary drives their ability to notice the difference between words that differ minimally (ex: by a single phoneme)

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

"bih" and "dih" are too close (they differ only by one phoneme), and 14-month-old kids don't know any words close enough to motivate attention to the "b"/"d" difference when word-learning



Werker et al. 2002: Vocabulary Size Matters



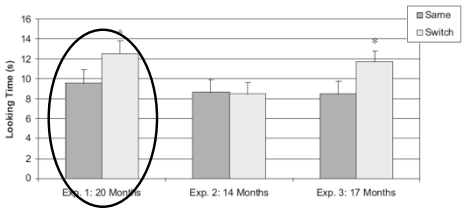
Werker et al. 2002: Vocabulary Size Matters

Stager-Werker task

Test

Same: look at the *bih!*

Switch: look at the *dih!*



20-month-olds notice

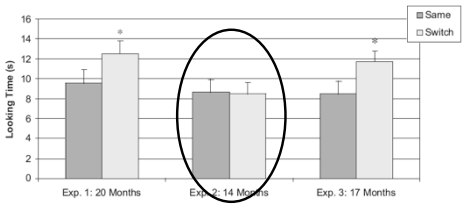
Werker et al. 2002: Vocabulary Size Matters

Stager-Werker task

Test

Same: look at the *bih!*

Switch: look at the *dih!*



14 month-olds don't

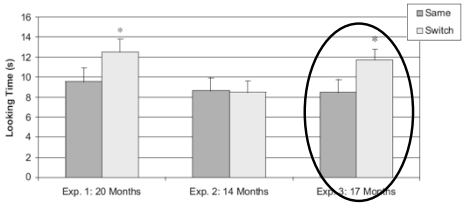
Werker et al. 2002: Vocabulary Size Matters

Stager-Werker task

Test

Same: look at the *bih!*

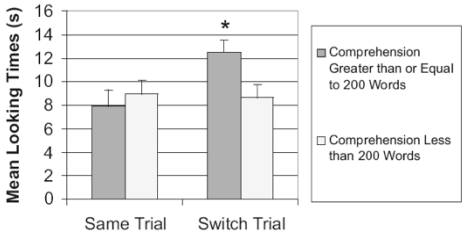
Switch: look at the *dih!*



17-month-olds do

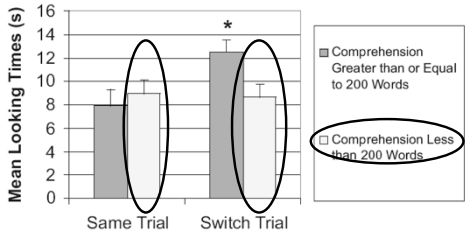
Werker et al. 2002: Vocabulary Size Matters

Zoom in on the 17-month-olds



Werker et al. 2002: Vocabulary Size Matters

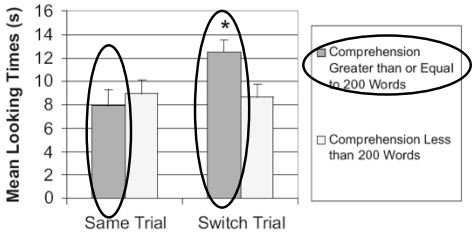
Zoom in on the 17-month-olds



Those with a small vocabulary look like 14-month-olds - they can't tell the difference for a novel word they haven't heard much.

Werker et al. 2002: Vocabulary Size Matters

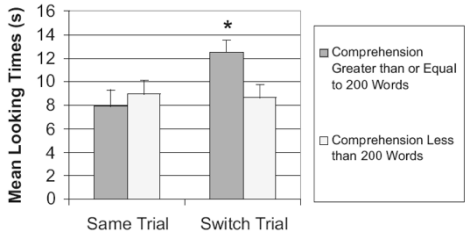
Zoom in on the 17-month-olds



Those with a large vocabulary look like 20-month-olds - they *can* tell the difference for a novel word, even though they haven't heard it much.

Werker et al. 2002: Vocabulary Size Matters

Zoom in on the 17-month-olds



Implication: Performance on Stager-Werker task with novel words *does* depend on how many words the child knows.

More vocabulary = more necessary distinctions

Werker et al. 2002: Performance on Stager-Werker task with novel words depends on how many words the child knows.

Implication: The content of children's vocabulary drives their ability to notice the difference between words that differ minimally (ex: by a single phoneme)

Prediction: This should apply to familiar words too. Specifically, children with small vocabularies should have trouble noticing phonemic differences in familiar words.

Swingley & Aslin 2002: Familiar Word Tests

But English 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 (/æpl/)	opple (/apl/)	opal (/opl/)
baby (/beᵗbi/)	vaby (/veᵗbi/)	raby (/ɹeᵗbi/)
ball (/bɔl/)	gall (/gɔl/)	shawl (/ʃɔl/)
car (/kaɹ/)	cur (/kɜ/)	kier (/kiɹ/)
dog (/dɔg/)	tog (/tɔg/)	mog (/mɔg/)
kitty (/kɪti/)	pity (/pɪti/)	yitty (/jɪti/)

Maybe these 14-month-olds just happen to have large vocabularies?

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
beɦn	baɦs	deɦn
beɾ	bøɦs	deɾ
bœyk	bœyn	kœyk
eɦnt	eɦp	eɦnt
h nt	haɦk	x nt
haɾ	heɦn	saɾ
hont	ho	font
ku	kus	xu
mont	maɦnt	nont
nøɦs	nut	møɦs
paɦrt	pøɦnt	daɦrt
pus	purt	tus
sxaɦp	sxeɾ	ʂaɦp
teɦn	to	peɦn
v s	vaɦnt	v s
vut	veɦnt	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 (and which words they know) that drives the detailed representations of the sounds in the words.

Point: Vocabulary can't be the only thing determining children's ability to distinguish the sounds of words. So what's the problem with the 14-month-olds in the Stager-Werker task?

Was the task too hard for 14-month-olds?

Yoshida, Fennell, Swingley, & Werker (2009)

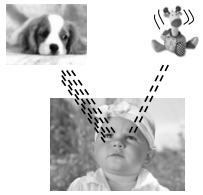
Maybe the problem with the 14-month-old infants was that the switch task was too hard - they have to be very confident that the close mispronunciation of the new word (*dih* for novel word *bih*) is not actually close enough

What would happen if we habituated 14-month-old children the usual way for the Switch procedure, but then tested them a different way that didn't require them to be as confident about the correct pronunciation of a word's form?

The Visual Choice Task "Preferential Looking"

Golinkoff, Hirsh-Pasek, Cauley & Gordon 1987

A two-alternative forced choice looking task that compares visual fixations to target and distractor objects



"Where's the dog?"

Familiar object better match for familiar word

The Visual Choice Task "Preferential Looking"

Golinkoff, Hirsh-Pasek, Cauley & Gordon 1987

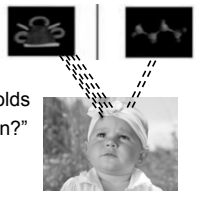
A two-alternative forced choice looking task that compares visual fixations to target and distractor objects

"Where's the tog?"

Novel object is a better match for novel word form
and importantly familiar object is a poor match - infant knows familiar word.

Yoshida, Fennell, Swingley, & Werker (2009)

Novel labels **"bin"** **"din"**



Test: 14-month-olds
"Where's the bin?"

14-month-old infants look significantly more at the correct novel object - they do have detail for words!

The problem with the Stager-Werker Task

Maybe the problem with the 14-month-olds in the Stager-Werker task was that they encoded the phonetic forms with low confidence. So, when tested on the original switch task, they didn't have enough confidence in their representation of the novel form to realize it was the wrong label for the novel object.

Yoshida et al. 2009: "Calling a *din* object by the word *bin* is not good pronunciation to the 14-month-old, but neither is it categorically incorrect."

Why does having a familiar word help?

Idea: Children build up more confidence in the word form the more times they hear it.

{p/b/d/g}{a/o/u}{l/r} = "pall", "dor"

… "gull", "ball"

(p/b}{a}{l/r} = "pall", "ball",

… "bar", "par"

{b}{a}{l} = "ball"

Recap: Sounds, Words, and Detail

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

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

When children are tested with a visual choice task, they show more knowledge of detailed word forms than when they are tested with a Switch procedure task.

Questions?

You should be able to do all the questions on HW1 and all the review questions for sounds & sounds of words.