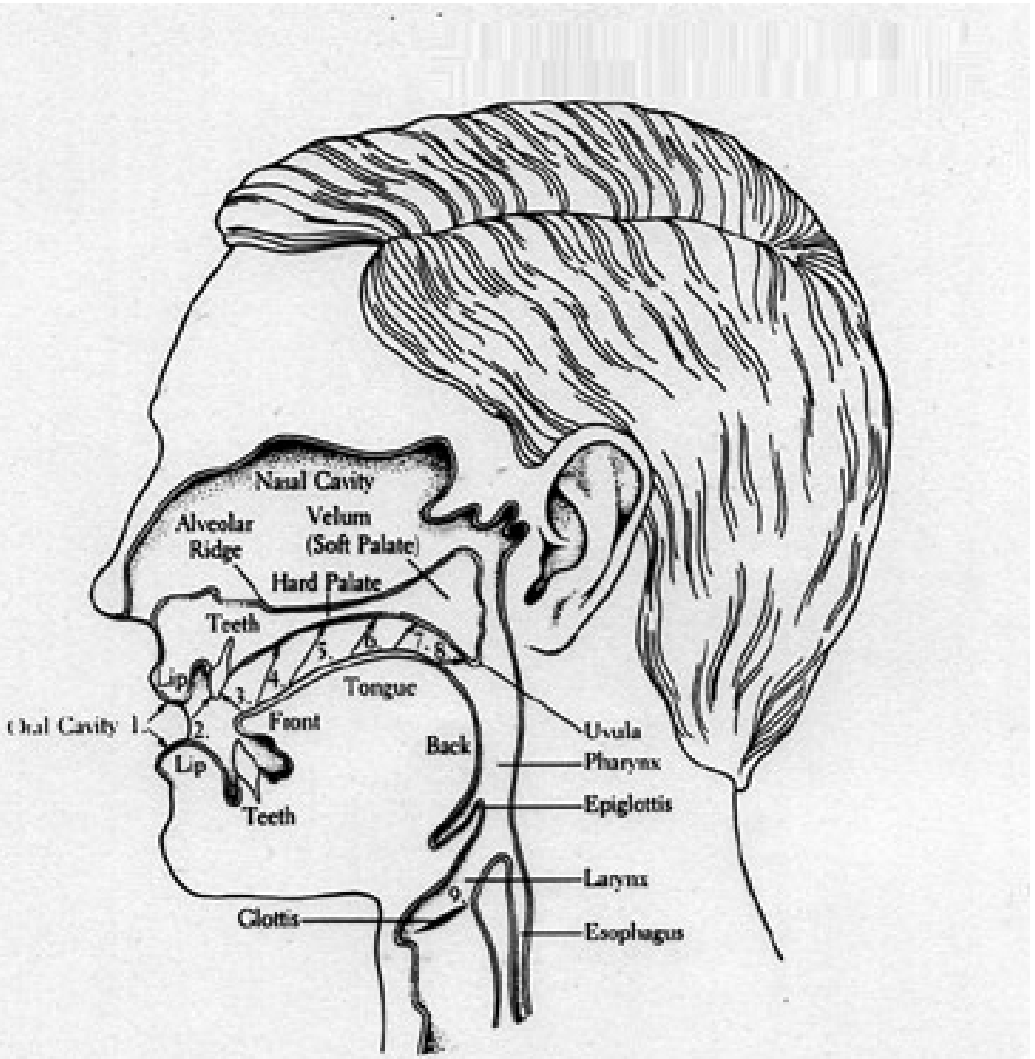
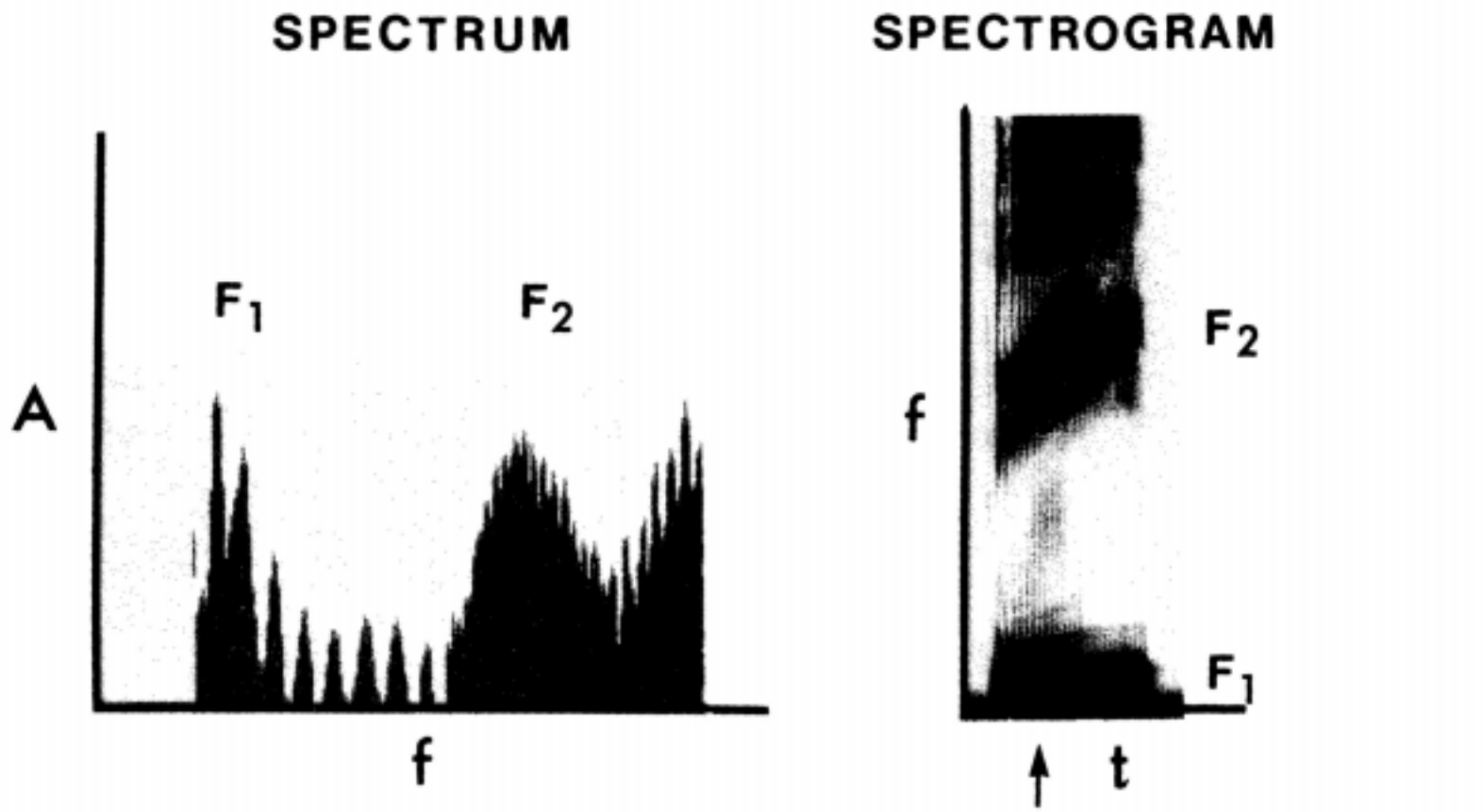
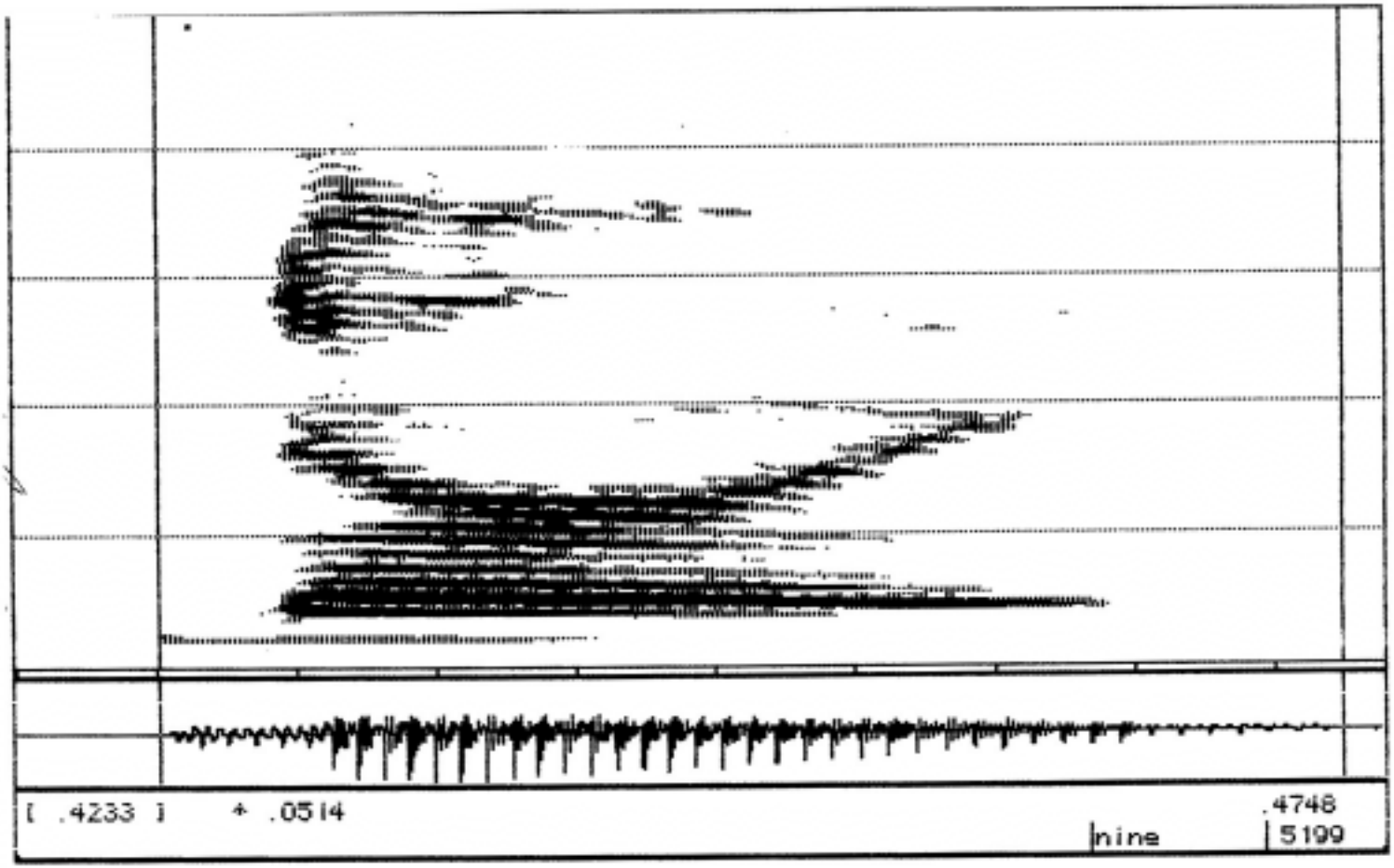


Figure 4-1. The vocal tract; places of articulation: 1 = bilabial, 2 = labiodental, 3 = dental, 4 = alveolar, 5 = palatoalveolar, 6 = palatal, 7 = velar, 8 = uvular, 9 = glottal (from Fromkin & Rodman, 1974).


SPECTRUM
SPECTROGRAM
A
F1
F2
f
f
F2
F1
t
a section of one moment during /i/
/i/ in the word 'beat'

Spectogram of the word “nine”

frequency



time

Variations in Voice Onset Time

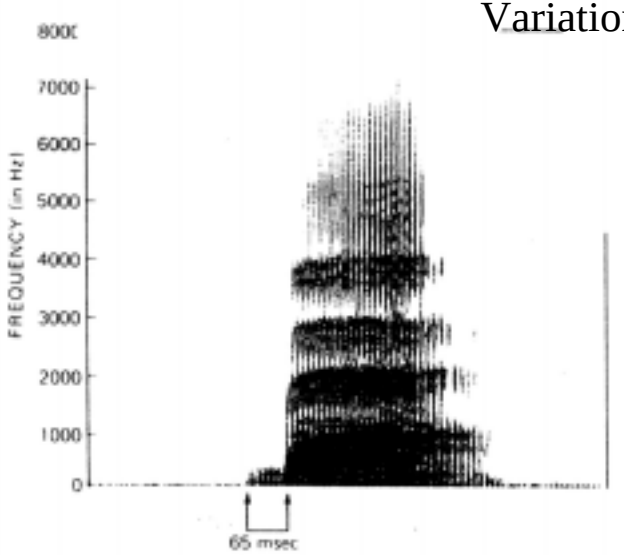
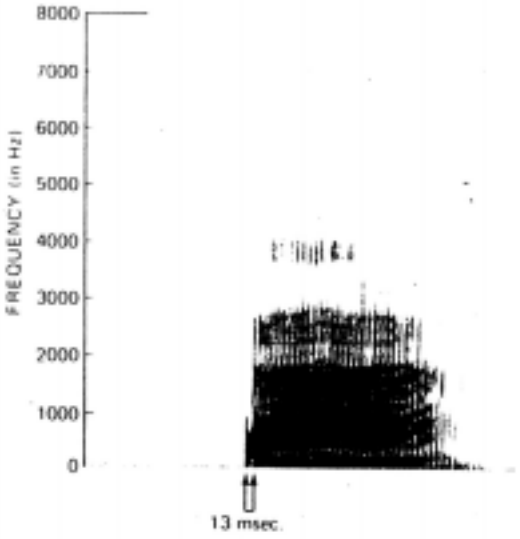
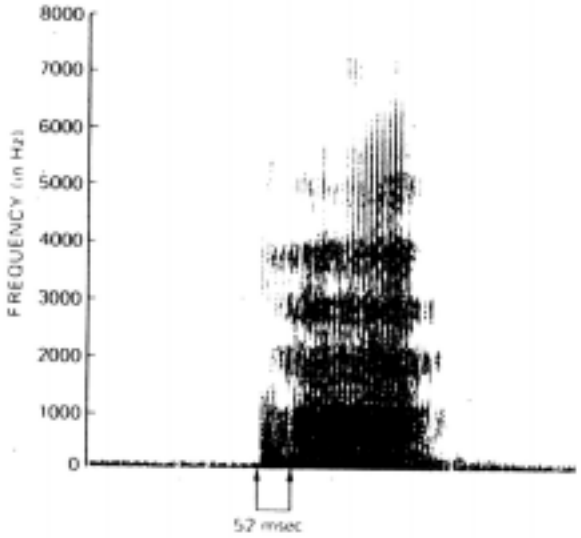


Figure 3-4A

Prevoiced - 65 ms

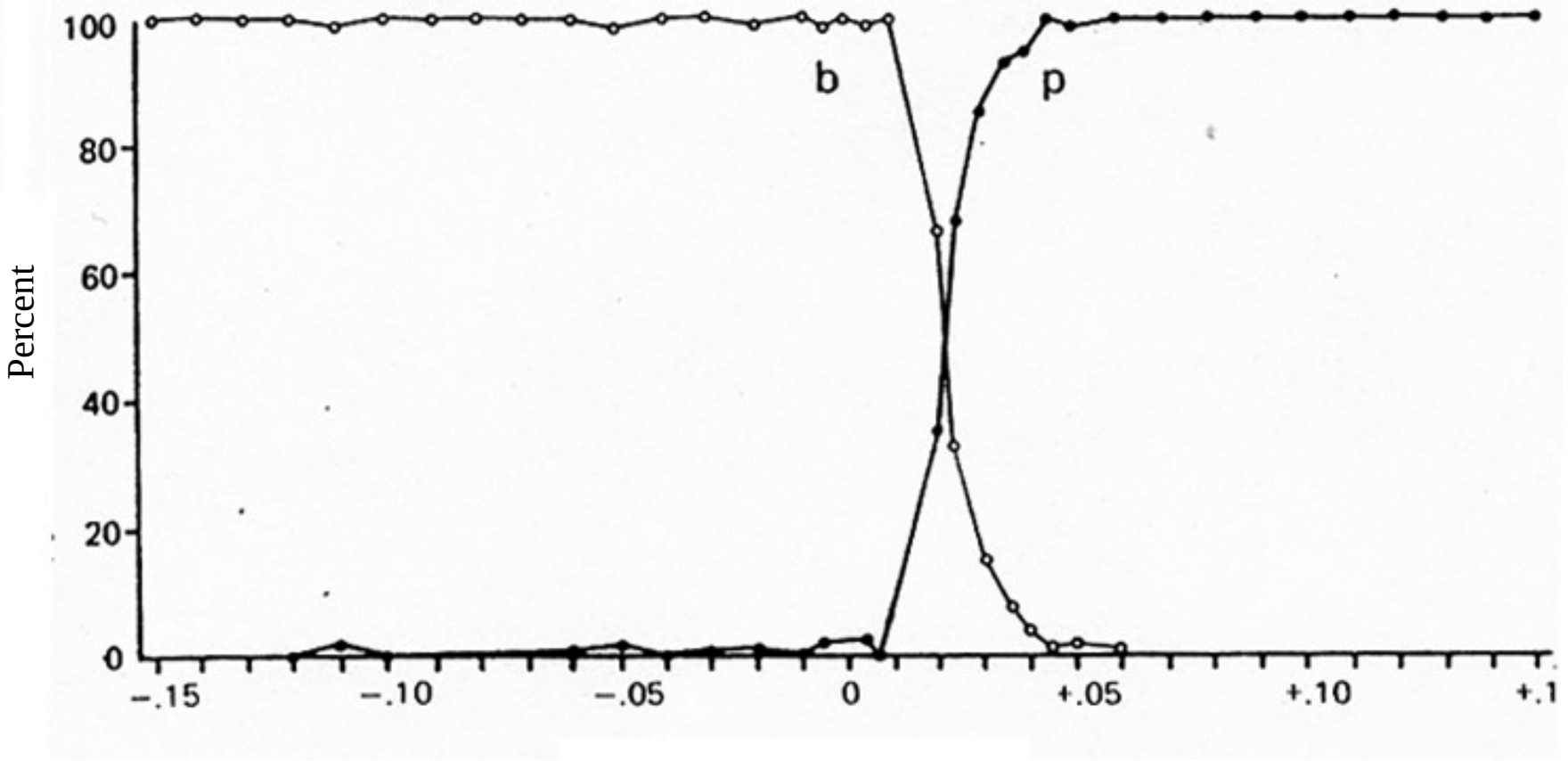


Voiced /di/ - 13 ms



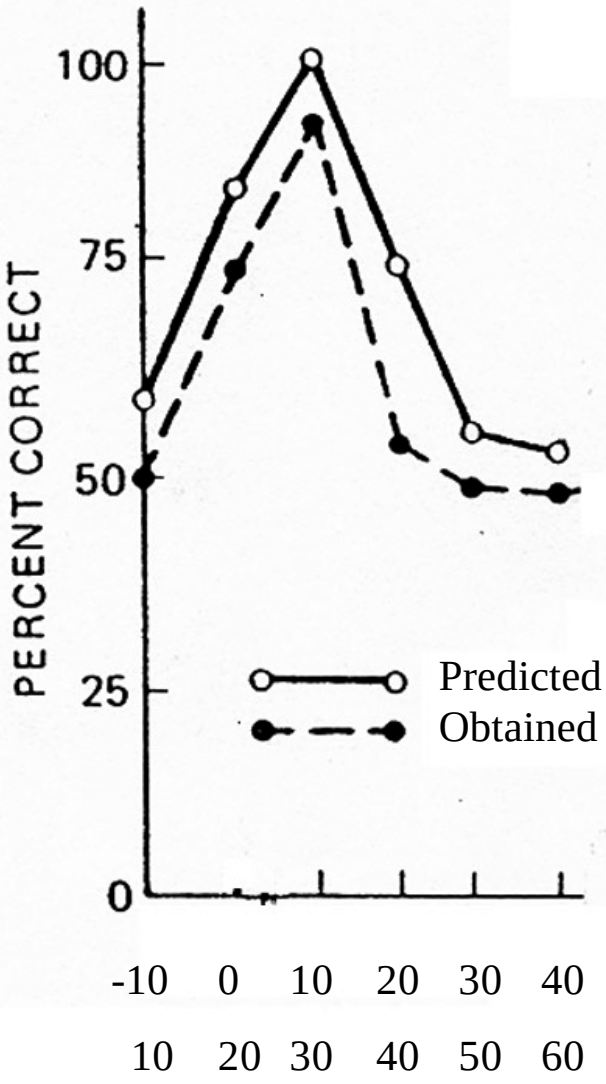
Voiceless /ti/ - 54 ms

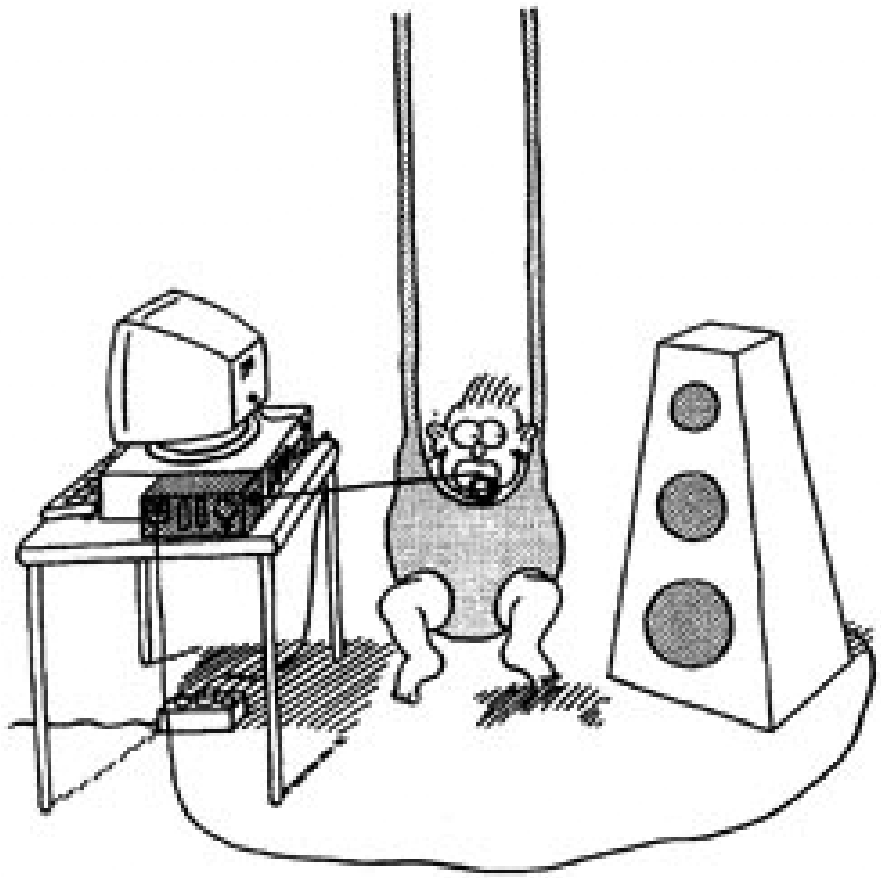
Identification of stimuli varying on voice onset time as ba or pa



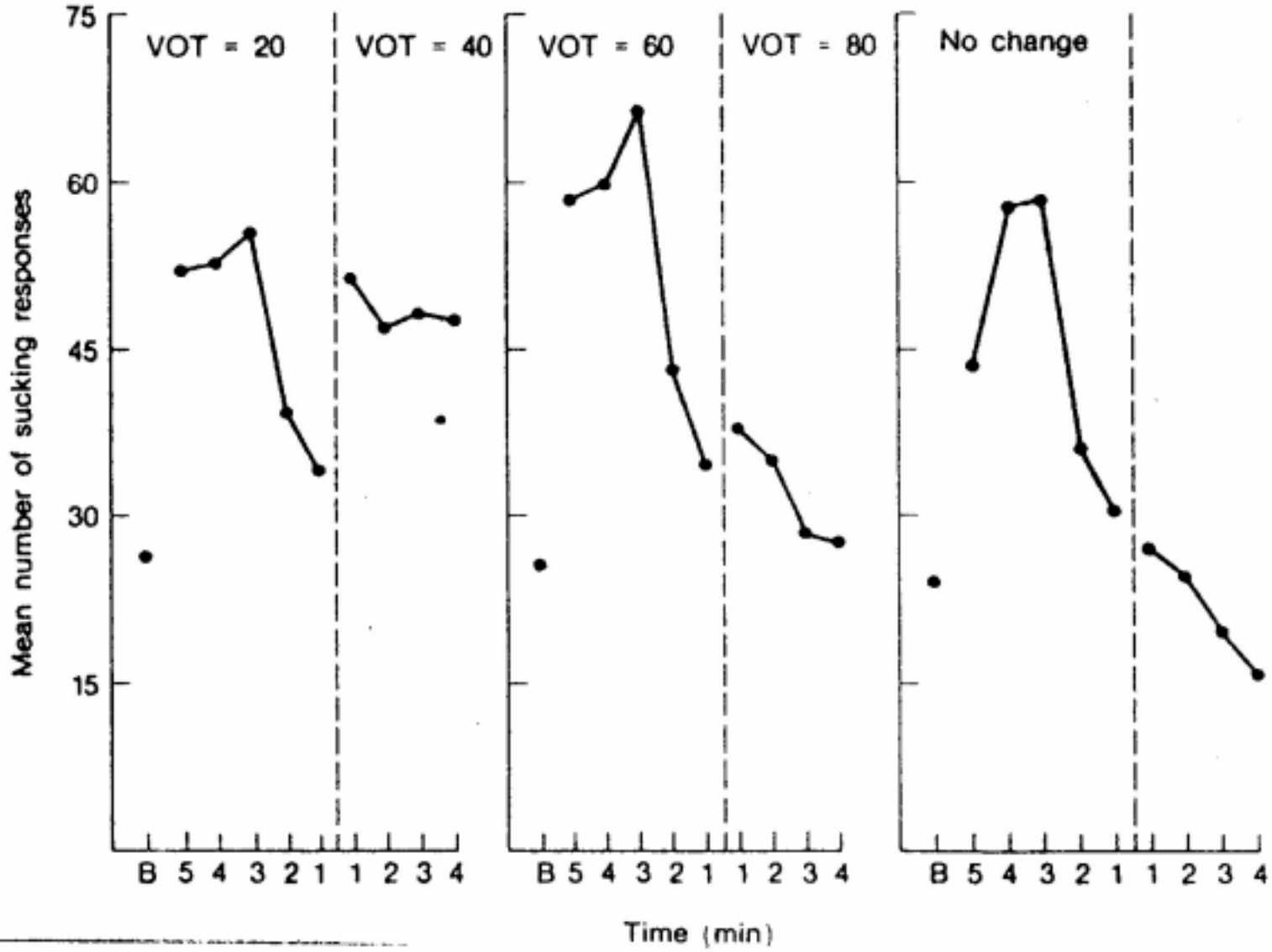
Voice Onset Time

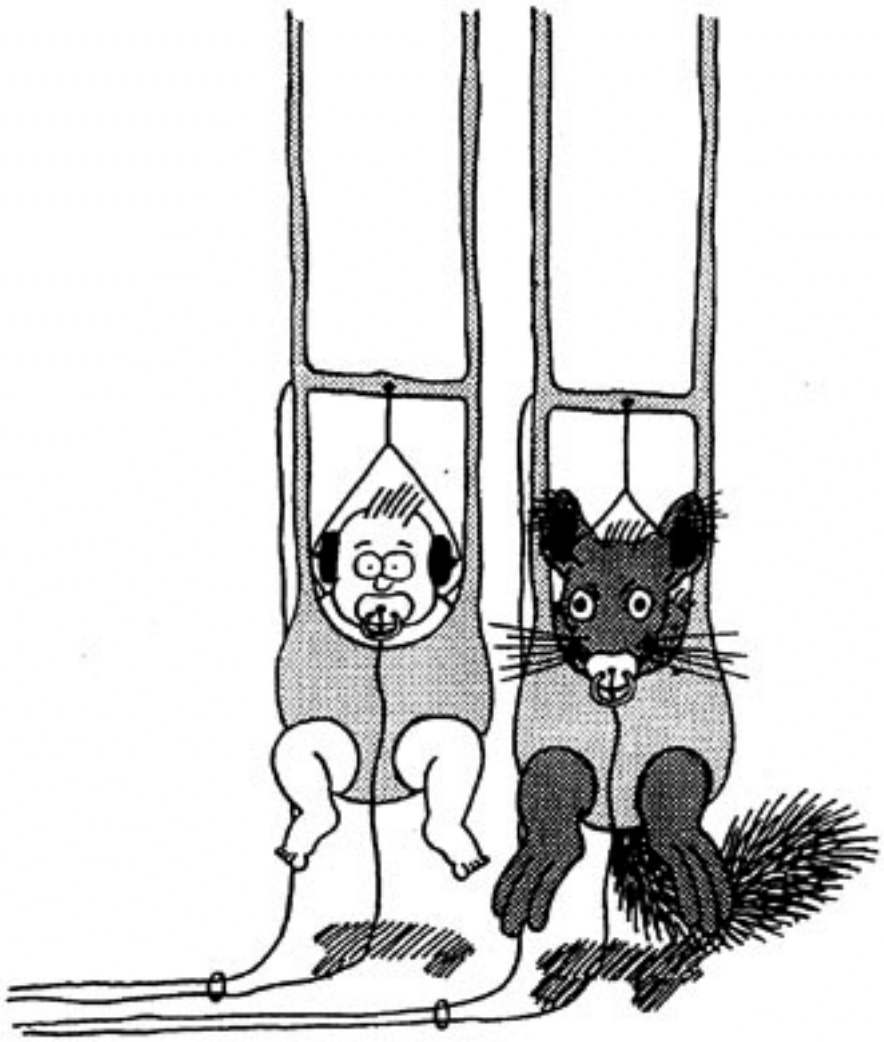
Discrimination of ba-pa stimuli





Can Infants Perceive Speech?





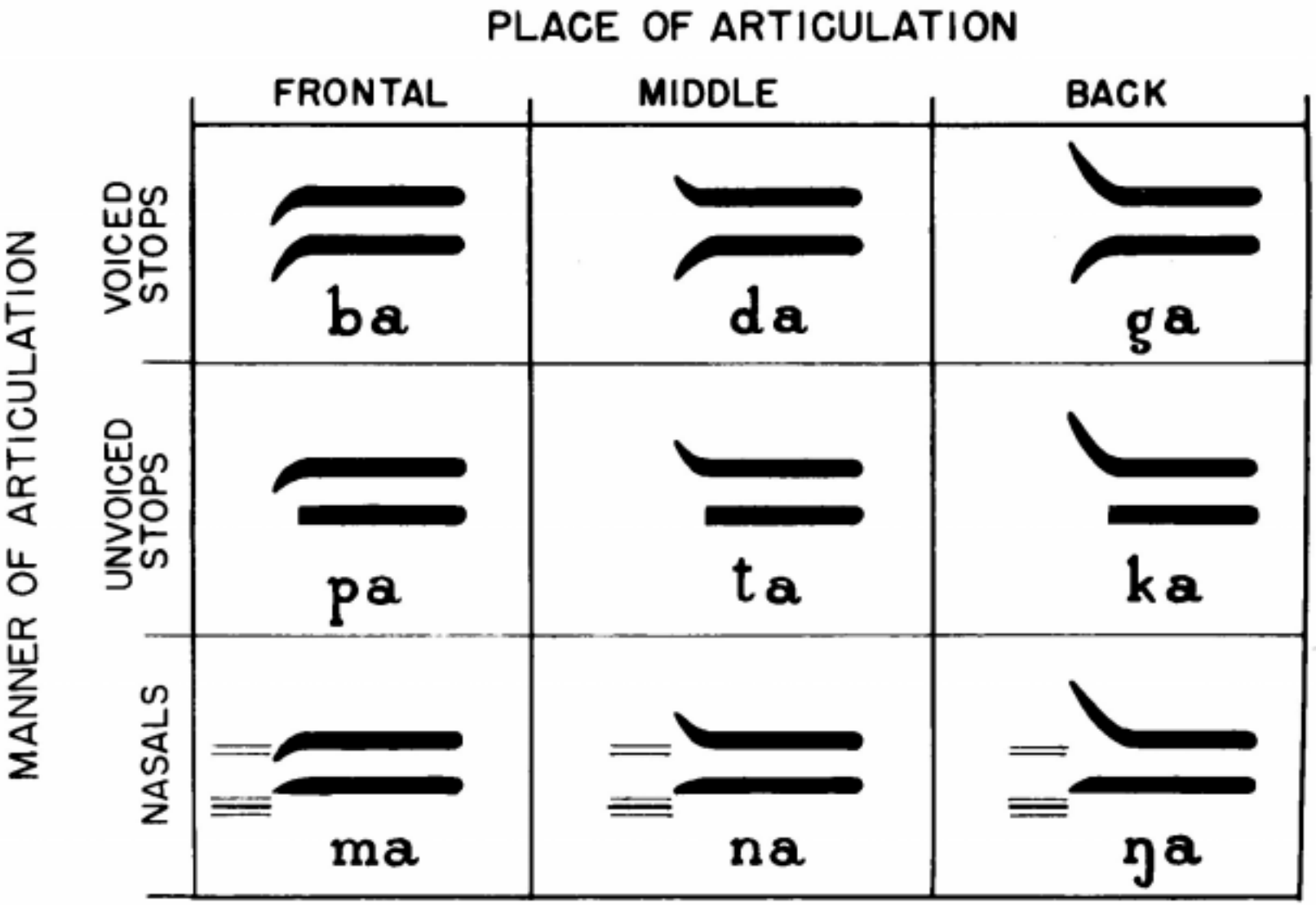


Figure 5.18. Summary figure showing synthetic patterns for consonants varying in place and manner of articulation. (Reprinted with permission from A. M. Liberman *et al.: Journal of Experimental Psychology. 52,* © 1956, American Psychological Association.)

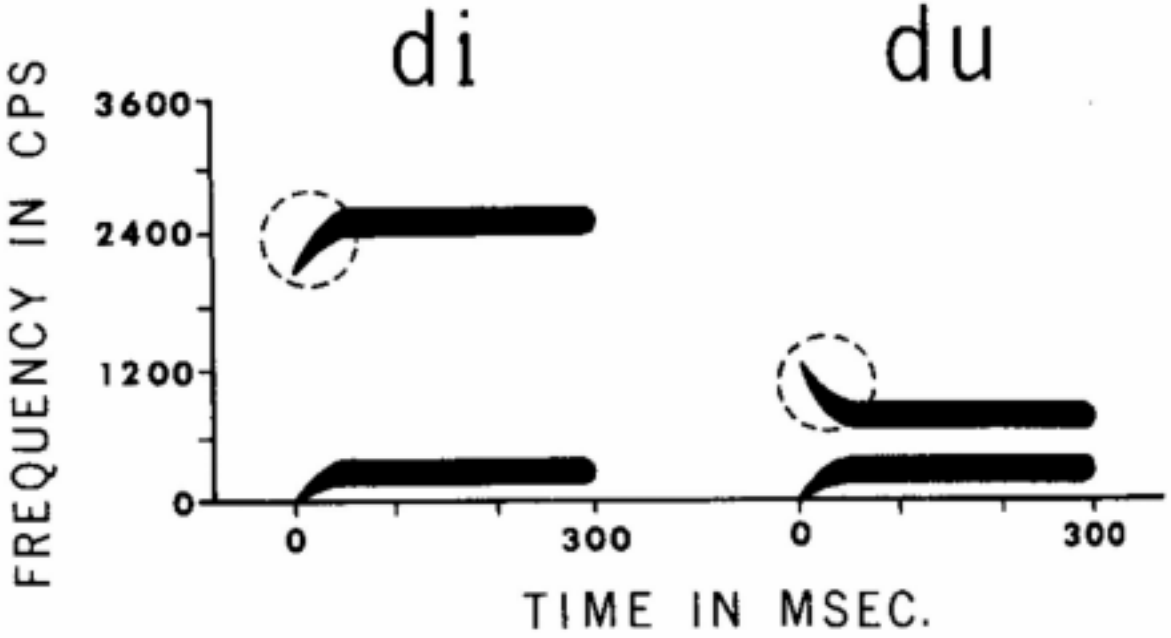


Figure 5.31. Synthetic patterns showing the syllables /di/ and /du/. Notice the difference in the direction of the F_2 transition. (Reprinted with permission from A. M. Liberman: *Cognitive Psychology. 1,* 1970.)

Continuous speech - segmentation problem

“alameno” letter name?

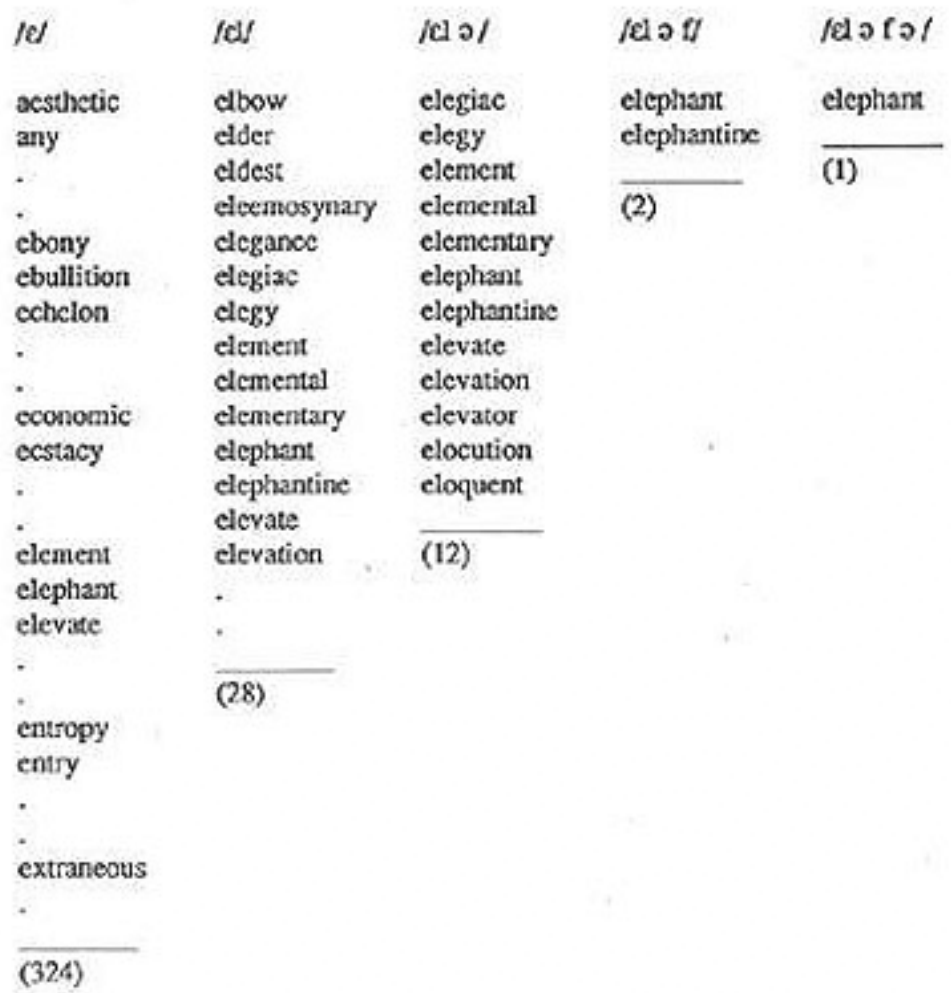
“Oh, say can you see by the donzerly light”

Effects of context - Pollack & Pickett (1964)

Surreptitiously record spontaneous speech

In context, subjects identity 98% of words
Excise words in isolation - only 46% correct

Cohort model
Marslen-Wilson



/ɛ/	/ɛl/	/ɛl ə/	/ɛl ə f/	/ɛl ə f ə/
aesthetic	elbow	elegiac	elephant	elephant
any	elder	elegy	elephantine	_____
.	eldest	element	_____	(1)
.	eleemosynary	elemental	(2)	
ebony	elegance	elementary		
ebullition	elegiac	elephant		
echelon	elegy	elephantine		
.	element	elevate		
.	elemental	elevation		
economic	elementary	elevator		
ecstacy	elephant	elocution		
.	elephantine	eloquent		
.	elevate	_____		
element	elevation	(12)		
elephant	.			
elevate	.			
.	_____			
.	(28)			
entropy				
entry				
.				
.				
extraneous				
.				
_____				
(324)				

FIG. 10 "Illustration of how the word *elephant* is recognized, according to the cohort mode
(Marslen-Wilson, 1984). Phonemes are recognized categorically and on-line in a left-to-right fashio
as they are spoken. All words inconsistent with the phoneme string are eliminated from the cohort
The number below each column represents the number of words remaining in the cohort set a
that point in processing the spoken word. Note that the example is for British pronunciation i
which the third vowel of *elephantine* is pronounced /ɪ/" (from Massaro, 1989a).

Effects of subsequent context on speech perception

I better do my laundry.

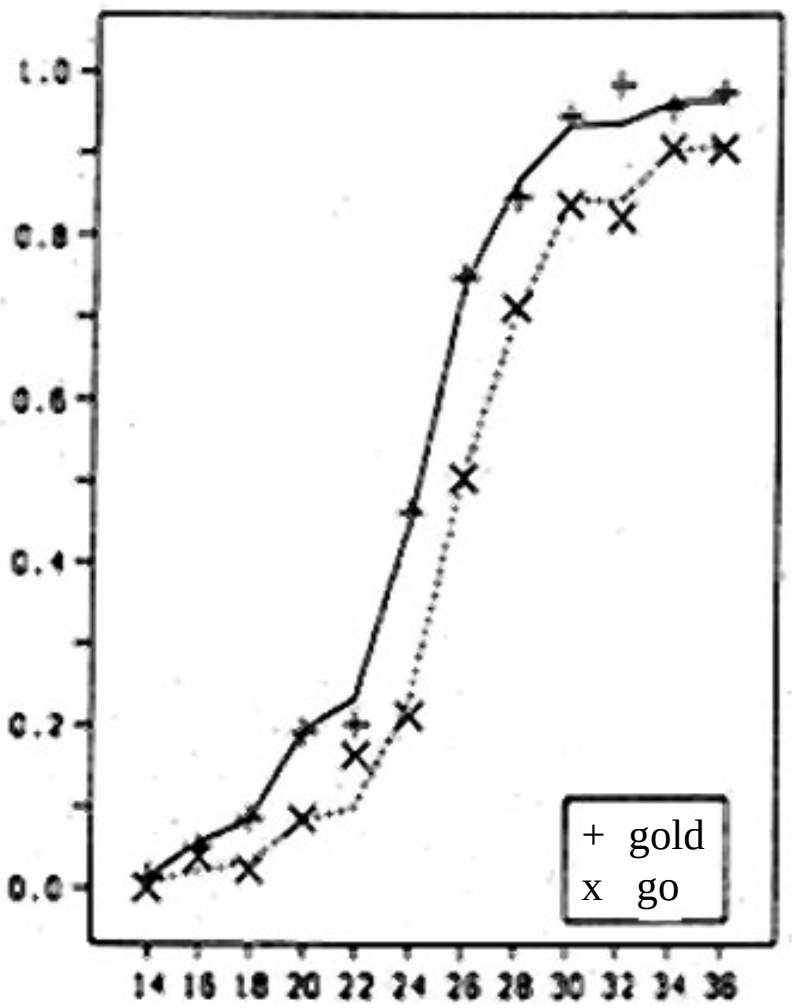
I bet her five dollars.

Experiment (Massaro):

I want *to* go under the building.
I want *the* gold under the building.

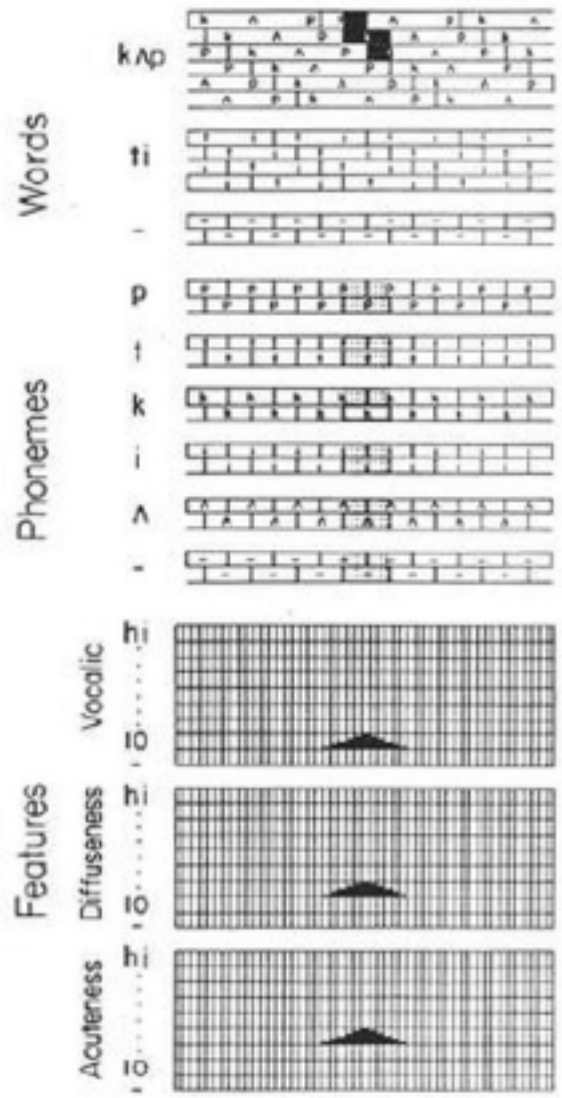
Stimulus ambiguous between “to” and “the” -
Decrease sound energy of onset, sounds like “th”

Percent
Identifications
as “the”



Sound energy (db) attentuation-
Greater attentuation sounds like “th”

Elman and McClelland
Trace Model



How do children learn to segment words?

Statistical Learning by 8-Month-Old Infants

Saffran, Aslin, Newport (1996)

Infants heard 2 min of continuous speech -
4 three-syllable nonsense “words” - e.g. “bidaku” “padoti”
Randomly ordered

“bidakupadotigolabubidaku…..”

“bi<u>daku</u>padotigolabubidaku…..”

Transitional probabilities:

Within “word” (daku) - 1.00
Between “word” (tigol) - .33

Infant listening times:

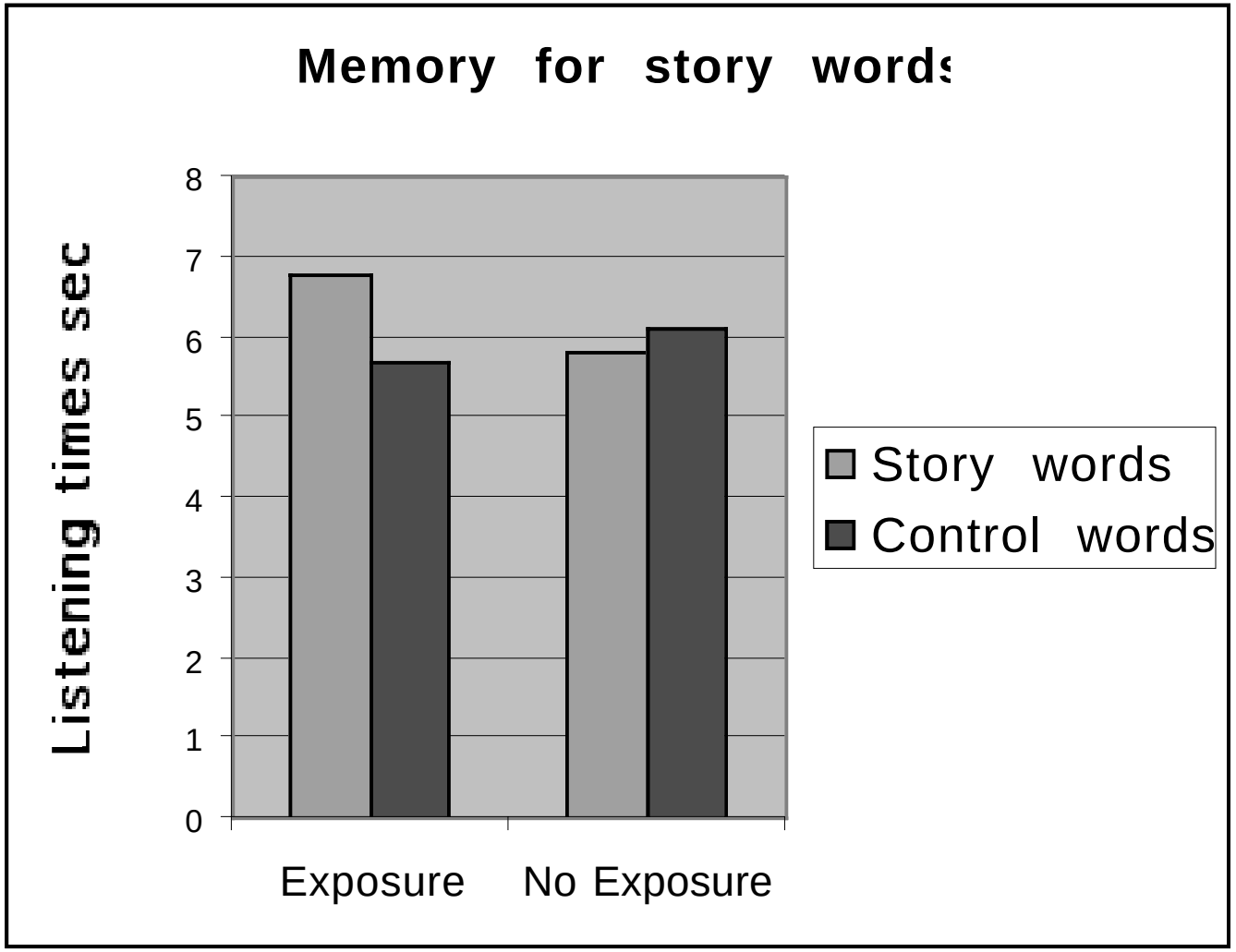
“Words”	**6.8 sec**
Other	**7.6 sec**

Long-Term Learning of Words
Jusczyk & Hohne (1997)

8 mo old infants
10 times in 2 weeks hear 30 minutes of speech - three stories for children

Test: two weeks later, head-turn preference procedure used
Lists of words common in stories or matched words not presented

Control condition: no exposure to stories, same test


Memory for story words
Listening times sec
8
7
6
5
4
3
2
1
0
Exposure
No Exposure
Story words
Control words