

Psych 156A/ Ling 150: Acquisition of Language II

Lecture 4 Extra Material Sounds of Words

More about contrastive sounds

There are a number of acoustically salient features for sounds. All it takes for sounds to be contrastive is for them to have "opposite" values for one feature.

Example:

English sounds "k" and "g" differ only with respect to voicing. They are pretty much identical on all other features. Many contrastive sounds in English use the voicing feature as the relevant feature of contrast (p/b, t/d, s/z, etc.). However, there are other features that are used as well (air flow, manner of articulation, etc.).

Task for the child: Figure out which features are used contrastively by the language. Contrastive sounds for the language will usually vary with respect to one of those features.

Experimental Study: Dietrich, Swingley & Werker (2007)

Testing children's perception of contrastive sounds

Dutch and English contrastive features differ.

In English, the length of the vowel is not contrastive

"cat" = "caat"

In Dutch, the length of the vowel is contrastive

"cat" ≠ "caat"

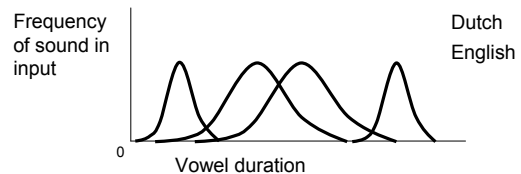
(Japanese also uses this feature)



Does the data distribution show this?

Dutch and English vowel sounds in the native language environment also seem to differ

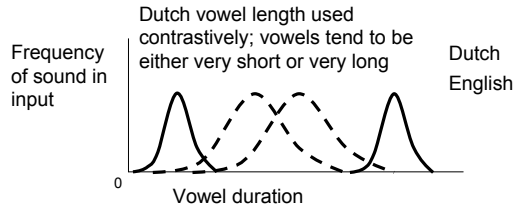
"...studies suggest that differences between the long and short vowels of Dutch are larger than any analogous differences for English."



Does the data distribution show this?

Dutch and English vowel sounds in the native language environment also seem to differ

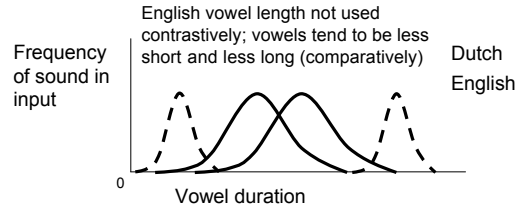
“...studies suggest that differences between the long and short vowels of Dutch are larger than any analogous differences for English.”



Does the data distribution show this?

Dutch and English vowel sounds in the native language environment also seem to differ

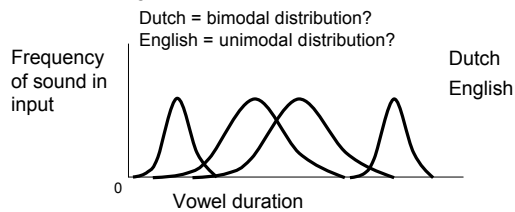
“...studies suggest that differences between the long and short vowels of Dutch are larger than any analogous differences for English.”



Does the data distribution show this?

Dutch and English vowel sounds in the native language environment also seem to differ

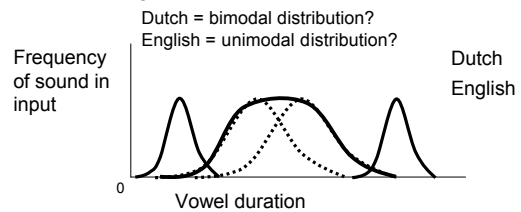
“...studies suggest that differences between the long and short vowels of Dutch are larger than any analogous differences for English.”



Does the data distribution show this?

Dutch and English vowel sounds in the native language environment also seem to differ

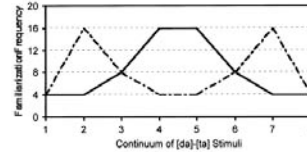
“...studies suggest that differences between the long and short vowels of Dutch are larger than any analogous differences for English.”



Learning from real data distributions

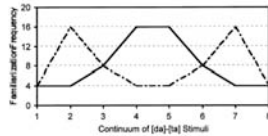
How do we know that children are sensitive to distributional information?

Maye, Werker, & Gerken (2002)



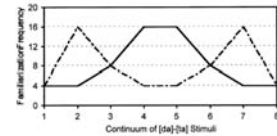
Created synthetic sounds ranging from [da] to [ta].

Maye, Werker, & Gerken (2002)



- Familiarized 6 to 8-month-old infants to one of two sets
 - Bimodal Set: Sounds on the ends near [da] and [ta].
 - Unimodal Set: Sounds in the middle.
- Test preference for:
 - 3 6 3 6... (Alternating) vs. 3 3 3 3... (Non-alternating) stimuli

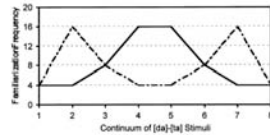
Maye, Werker, & Gerken (2002)



	3 6 3 6 ...		3 3 3 3
	Alternating trials (s)		Non-Alternating trials (s)
6 months Unimodal	4.85 (0.47)	=	4.53 (0.51)
8 months Unimodal	4.98 (0.63)	=	5.20 (0.56)
6 months Bimodal	5.66 (0.44)	<	6.41 (0.32)
8 months Bimodal	5.45 (0.52)	<	6.15 (0.56)

Maye, Werker, & Gerken (2002)

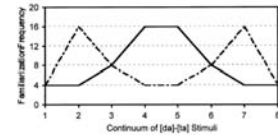
Infants trained on the Bimodal had a novelty preference for non-alternating trials. They learned to expect alteration, and were surprised by non-alteration.



	3 6 3 6 ... Alternating trials (s)		3 3 3 3 Non-Alternating trials (s)
6 months Unimodal	4.85 (0.47)	=	4.53 (0.51)
8 months Unimodal	4.98 (0.63)	=	5.20 (0.56)
6 months Bimodal	5.66 (0.44)	<	6.41 (0.32)
8 months Bimodal	5.45 (0.52)	<	6.15 (0.56)

Maye, Werker, & Gerken (2002)

Infants trained on the Unimodal did not prefer/disprefer one over the other. They did not seem to learn any expectation.

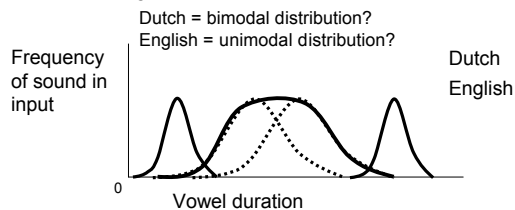


	3 6 3 6 ... Alternating trials (s)		3 3 3 3 Non-Alternating trials (s)
6 months Unimodal	4.85 (0.47)	=	4.53 (0.51)
8 months Unimodal	4.98 (0.63)	=	5.20 (0.56)
6 months Bimodal	5.66 (0.44)	<	6.41 (0.32)
8 months Bimodal	5.45 (0.52)	<	6.15 (0.56)

Back to Dietrich, Swingle, & Werker (2007)

Dutch and English vowel sounds in the native language environment also seem to differ

“...studies suggest that differences between the long and short vowels of Dutch are larger than any analogous differences for English.”



Back to Dietrich, Swingle, & Werker (2007)

Prediction if children are sensitive to this distribution

Dutch children interpret vowel duration as a meaningful contrast because the distribution is more bimodal

Implication: Change to vowel duration = new word

English children should not interpret vowel duration as a meaningful contrast because the distribution is more unimodal

Implication: Change to vowel duration = same word as before

Dietrich, Swingley, & Werker (2007)

Tests with 18-month-old children who know some words (and so have figured out the meaningful sounds in their language)



"Switch" Procedure: measures looking time

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

Habituation



Test

Same:
look at the *tam*!



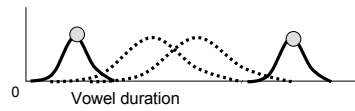
Switch:
look at the *taam*!



Dietrich, Swingley, & Werker (2007)

Experiment 1: Testing English and Dutch kids on Dutch vowel durations

Frequency of sound in input



Dutch kids

5.04 sec 9.23 sec

difference

English kids

6.66 sec 7.15 sec

no difference

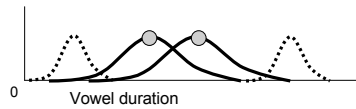
Test



Dietrich, Swingley, & Werker (2007)

Experiment 1: Testing English and Dutch kids on English vowel durations

Frequency of sound in input



Dutch kids

5.92 sec 8.16 sec

difference

English kids

7.34 sec 8.04 sec

no difference

Test

Same:
look at the *tam*!



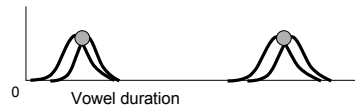
Switch:
look at the *taam*!



Dietrich, Swingley, & Werker (2007)

Experiment 1: Testing English and Dutch kids on vowel quality contrast (a/e)

Frequency of sound in input



Dutch kids

4.08 sec 5.72 sec

difference

English kids

6.31 sec 9.31 sec

difference

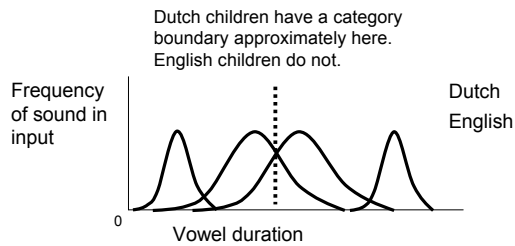
Test

(This is a control condition to make sure English kids can do the task when the sound is contrastive for them)



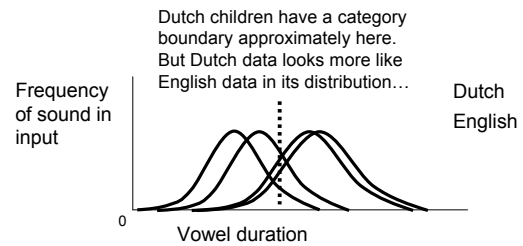
Dietrich, Swingley, & Werker (2007)

Implications of experiments 1, 2, and 3: Dutch children recognize vowel duration as contrastive for their language while English children do not. This can only be due to the data encountered by each set of children in their language.



Dietrich, Swingley, & Werker (2007)

One small caveat: It turns out that Dutch vowel duration data isn't as bimodally distributed as previously believed. So, the Dutch data probably isn't as informative to Dutch children by itself...Dutch children must also use other cues in the data. (Research still under way to identify those cues and how children use them.)



Discovering contrastive sounds: What's the point of it again?

The idea is that once children discover the meaningful sounds in their language, they can begin to figure out what the words are.



Ex: An English child will know that "cat" and "caat" are the same word (and should have the same meaning).

As adults, we can look at a language and figure out what the contrastive sounds are by looking at what changes a word's meaning. But children can't do this - they figure out the contrastive sounds *before* they figure out words and word meanings.