

LING 450/550

18 Phonology

Basic Phonology

ALTERNATIONS, RULES, FEATURES, NATURAL CLASSES

(A REFRESHER)

SUGGESTED: REVIEW: *LANGUAGE FILES* CH. 3

Phonology Terms (Review)

Sounds are *contrastive* if interchanging them changes meaning

- *Minimal pair/set*: words that differ by a single contrastive sound (phoneme)

Phoneme: mental representation of a set of non-contrastive sounds with an unpredictable distribution

- *Contrastive distribution*: when sounds (phonemes) occur in the same phonetic environment (i.e. to form minimal pairs/sets), they are in an unpredictable distribution and change meaning

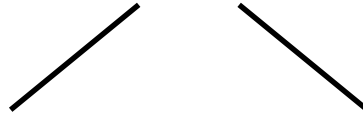
Allophones: non-contrastive realizations of a phoneme with predictable distributions based on phonetic/phonological environment (context)

- *Complementary distribution*: when sounds (allophones) never occur in the same environment, they have a predictable, non-overlapping distribution determined by context and describable by phonological rules

Analogy of allophones and complementary distribution



/Kal-El/



[Superman]

[Clark Kent]

(emergencies)

(elsewhere)



Alternations

A single phoneme may be *realized* (produced) as a variety of different allophones. Allophonic variation is called *alternation*.

Alternations are systematic variations in the pronunciation of a phoneme and can be described by sets of rules that change a phoneme into a particular allophone depending on its *environment* (what sounds are around it, whether it receives stress or not, etc).

Example:

- /t/ in “team” is pronounced with aspiration but /t/ in “lit” is not; the /t/ in “steam” also lacks aspiration. In fact, /t/ is *aspirated* (produced with aspiration) in only two environments in English: as the first sound in a word (e.g., the /t/ in “team”), or as the first sound of a syllable with emphasis (stress) (e.g., the first /t/ in “interrogate”).

English

“team” 

“steam” 

“(s)team” 

<http://archive.phonetics.ucla.edu/>

Phonological Rules

Alternations can be described by sets of phonological rules that describe the environments or conditions under which a given allophone surfaces.

- Example:
 - /t/ → [t^h] at the beginning of words or stressed syllables
 - /t/ → [ɾ] between (stressed & unstressed) vowels
 - /t/ → [ʔ] before /n/
 - /t/ → [t] elsewhere

Sometimes several phonemes undergo similar alternations:

/p t k/ → [p^h t^h k^h] at the beginning of words or stressed syllables

Describing sounds in terms of *features* can make it easier to describe such patterns.

Phonological Features

Phonological features (sometimes called *distinctive features*) allow us to describe phonemes or phones as combinations of characteristics.

The way sounds are described in the IPA chart is a feature system; e.g., for consonants:

- [place] has 12 values
- [voicing] has 4 values (voiceless, breathy, modal, creaky)
- [manner] has 6 values (stop, fric, affr, approx, flap, trill)
 - To distinguish /ɹ/ from /l/ you must either split [manner: approx] into “central” and “lateral” or add a fourth feature [± lateral].
 - Likewise, either split [manner: stop] into “oral” and “nasal” or add a binary feature [± nasal].
 - What about aspiration? or unreleased stops? or the distinction between “dental” and “interdental”?

Phonological Features (cont.)

Distinctive features can be *auditory* (describe how a segment sounds) or *articulatory* (describe how a segment is produced), though current phonological theory tends to emphasize articulatory features.

The feature system used in this class (from Hayes 2009) uses pseudo-binary features (either +, – or “0” meaning “unvalued”).

Example:

- The voiced bilabial stop /b/ can be described as the conjunction of features [+consonantal, +voice, +labial].
- /b/ is [0tense] (unvalued for the [tense] feature; the [tense] feature only applies to the consonants [j w ʍ ɥ] and non-low vowels).

Phonological Features (cont.)

Phonological features also provide a way of organizing the phonemes of a language into hierarchical groups.

- Example: the words “pie” “tie” “kite” “fight” “thigh” “sigh” “shy” “high” all begin with *voiceless consonants*: /p t k f θ s ʃ h/. Those phonemes can be grouped together as all having the same *voicing* feature: [–voice].

In this way, phonological features serve a dual purpose. In one sense, they are *smaller conceptual units* than phonemes because they represent only *part* of a phoneme’s articulation.

In another sense, features describe *higher-level categories* of sounds than phonemes do, because they can be used to pick out classes of phonemes.

Natural Classes

Phonemes that share many feature values tend to undergo similar alternations in similar environments. Groups of phonemes which share sufficient feature values to have similar alternations are referred to as *natural classes*.

Example:

- the consonants /p t k/ are *aspirated* at the beginnings of the words “pie” “tie” “chi”...
- but are *unaspirated* in “spy” “sty” “sky”...
- and are (often) *unreleased* word-finally, as in “lip” “lit” “lick”.
- Thus /p t k/ undergo similar alternations in similar environments, and therefore they form a natural class of *voiceless stops* described by the feature values [+consonantal –continuant –voice].

Coarticulation

In human speech, adjacent sounds are always slightly overlapped because we physically can't separate the articulations completely. Because of this, some articulations are altered to become more like adjacent articulations. This process is called *coarticulation*.

Coarticulation is most notable for causing changes in *place of articulation*. Example:

- in “tenth” the alveolar nasal /n/ becomes dental [n̪]
- in “inconsiderate” the alveolar nasal /n/ becomes a velar nasal [ŋ]

Types of Coarticulation

Anticipatory coarticulation: a consonant takes on one or more features of a sound that follows it. Example:

- in “wealth,” alveolar /l/ becomes dental [ɭ] before the dental /θ/

Preservative coarticulation: a consonant takes on one or more features of a sound that preceded it. Example:

- in “play,” voiced /l/ becomes voiceless [ɭ̥] after the voiceless /p/

Coarticulation underlies many of the common alternations we will see in this course.

Phonemic Analysis

ALLOPHONIC VARIATIONS AND PHONOLOGICAL RULES

READ: HAYES 2

SUGGESTED (OPTIONAL): READ: HAYES 3

HW: PHONEMIC ANALYSIS

Phonology Defined

Phonology is the study of *sound systems* in language. This includes:

- describing what sets of phones native speakers think of as “the same sound” (*phoneme*);
- describing the ways neighboring sounds influence each other, and the rules that determine which version (*allophone*) of an underlying sound is realized in a certain environment;
- describing the permissible sequences of sounds in a language (*phonotactics*).

Phonemes and Minimal Pairs

The first stage in a phonological analysis of a language is accurately describing the set of *contrasts*. Contrastive sounds serve to differentiate words in a language.

Sounds that contrast belong to different *phonemes*. Two words that differ by a single contrastive sound (phoneme) are called a *minimal pair*. Larger groups of words that all differ by a single phoneme are called *minimal sets*.

A single phoneme may be pronounced in a variety of ways that don't change the meanings of words. These non-contrastive variant sounds are called *allophones*.

Alternations

A single phoneme may be *realized* (produced) as a variety of different allophones. Allophonic variation is called *alternation*.

Alternations are systematic variations in the pronunciation of a phoneme, and can be described by sets of rules that change a phoneme into a particular allophone depending on its *environment* (what sounds are around it, whether it receives stress or not, etc).

Example:

- /p/ in “pie” is pronounced with aspiration but /p/ in “lip” is not; the /p/ in “spy” also lacks aspiration. In fact, /p/ is *aspirated* (produced with aspiration) in only two environments in English: as the first sound in a word (e.g., the /p/ in “pie”), or as the first sound of a syllable with emphasis (stress) (e.g., the /p/ in “impressed”).

Practice

1. Farsi (Indo-European; Iran)

ærtɛʃ 'army'
farsi 'Persian'
berid 'go'
ahɑɾ 'starch'
ris 'beard'
tʃɑɾ 'four'

darid 'you have'
tʃɛɾɑ 'why'
ɑhɑɾi 'starched'
rah 'road'
hæɾntowɾ 'however'
ruz 'day'

behtæɾ 'better'
biræŋg 'pale'
ʃiɾ 'lion'

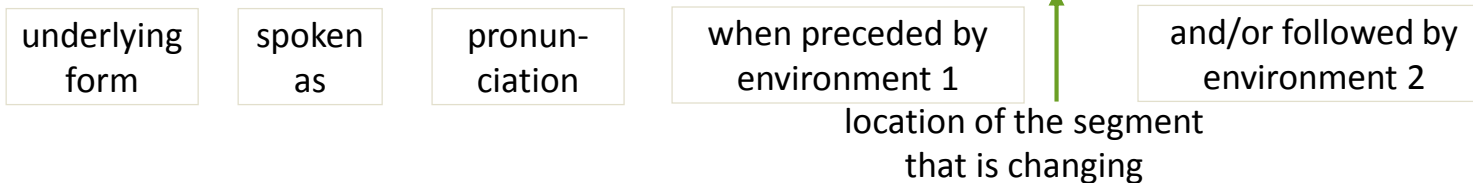
What is the distribution of [r], [ɾ] and [ɹ]? Are they three separate phonemes or allophones of one phoneme?

Phonological Rule Notation

- To describe allophonic alternations, phonologists write *phonological rules* that capture the important features of the linguistic environment that trigger the alternation.

- The standard syntax for phonological rules is:

/phoneme/ → [phone] / (environment1) _____ (environment2)



Example: *“/p/ becomes aspirated at the beginning of words”*

/p/ → [p^h] / [word ____

Note that if only one environment triggers the alternation, then only one environment is specified in the rule. “[word” indicates the beginning of a word; “#” is another common way to indicate this.

Phonological Rule Notation: Disjunctive Environments

- Recall however that /p/ becomes aspirated not only at the beginnings of words, but also at the onset of stressed syllables (e.g., “impress” [ɪmˈpʰɹɛs]).
- One way to handle this would be to write a rule describing multiple disjunctive environments that trigger the same change. This can be done with a “curly bracket”:

Example: *“/p/ becomes aspirated at the beginning of words or at the onset of stressed syllables”*

/p/ → [p^h] / { [word ____
[syllable ____ [+stress]

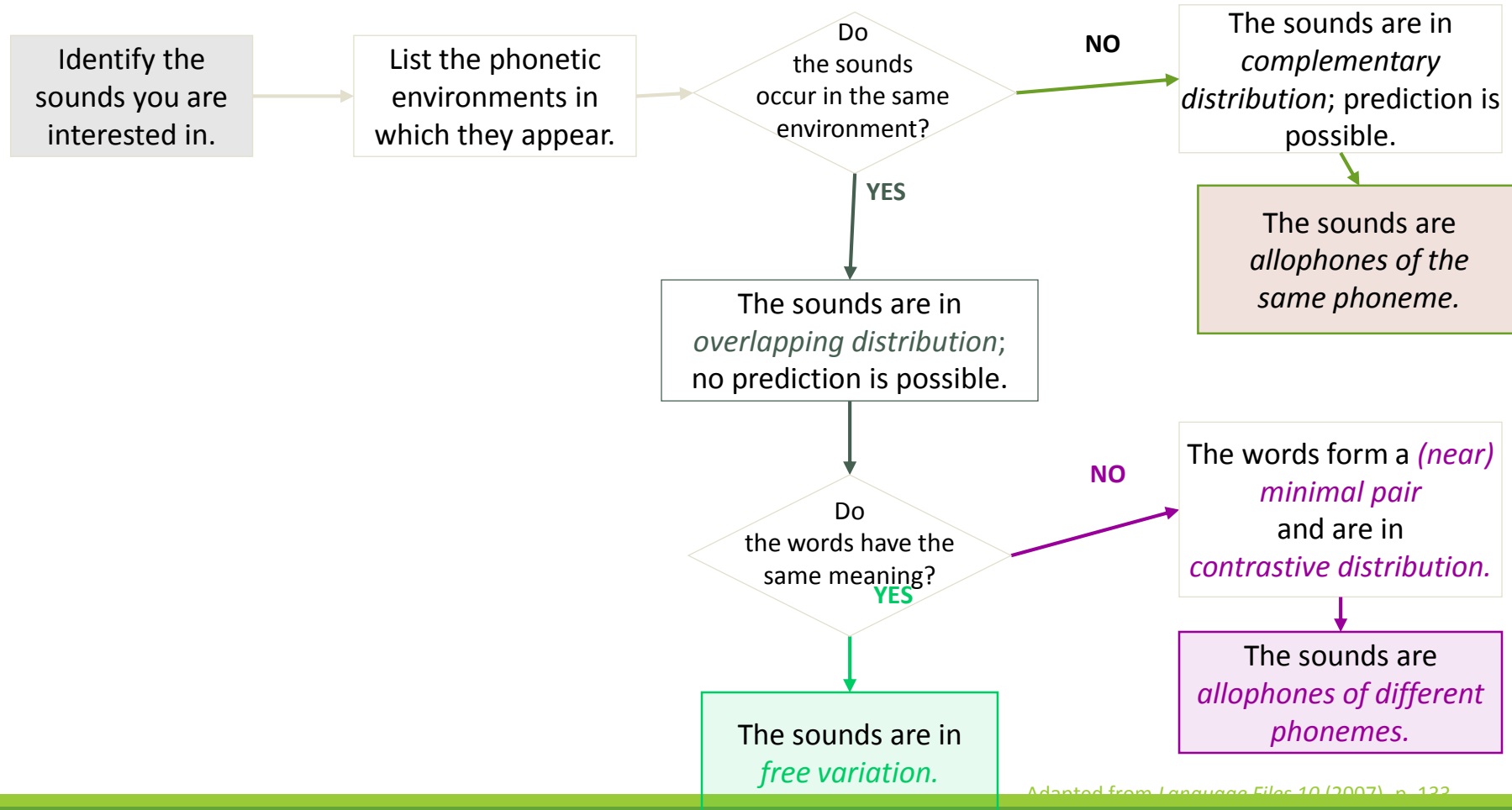
Phonological Rule Notation: Segments vs. Features

A further refinement comes when we recall that aspiration happens to other voiceless stops besides /p/. Rather than writing separate rules for /p/, /t/, and /k/, we can write a single rule to describe all three alternations. This is done using phonological features.

Example: *“voiceless stops are aspirated when they are syllable initial and precede a stressed vowel.”*

$$\begin{bmatrix} -\text{continuant} \\ -\text{voice} \end{bmatrix} \rightarrow [+ \text{spreadglottis}] / \left[\begin{array}{c} \text{syllable} \text{ --- } \begin{bmatrix} + \text{syllabic} \\ + \text{stress} \end{bmatrix} \end{array} \right]$$

Solving Phonology Problems: Flowchart



Adapted from *Language Files 10* (2007), p. 122

Sample Phonology Problem: Spanish

1. What are we interested in? [d] vs [ð]

Write out the environments in which the sounds occur.

Data

drama	“drama”
dolor	“pain”
dime	“tell me”
kaða	“each”
laðo	“side”
oðio	“hatred”
komiða	“food”
anda	“scram”
sweldo	“salary”
durar	“to last”
toldo	“curtain”
falda	“skirt”

2. Look at the environments. The sound are in _____ distribution

3. Since the sounds are in this distribution, they are likely:

- a) allophones of the same underlying phoneme, or
- b) two different phonemes.

4. Write the rule:

Sample Phonology Problem: Spanish

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Environments

[d]	[ð]
#__r	a__a
#__o	a__o
#__i	o__i
#__u	i__a
n__a	
l__o	
l__a	

2. Look at the environments. The sounds are in complementary

[d] never occurs after a vowel

[ð] always occurs after a vowel

Note that although [ð] always occurs between vowels in this data set, the following vowel is not conditioning the change, since [d] can be followed by vowels too (e.g., [anda]).

3. Since the sounds are in this distribution, they are likely:

a) allophones of the same underlying phoneme, or

b) two different phonemes.

4. Write the rule: $/d/ \rightarrow [\ð] / v_ __$

Exploration: Phonetics & Phonology Interface

1. Explore the Journal of Laboratory Phonology:

<https://www.journal-labphon.org/>

2. Keeping in mind the phonetics and phonology interface, choose a few articles to scan that might help illustrate this.

3. Scan the articles for ways in which phonetic and phonological theories and methodologies are used together to investigate questions of interest. **Note:** the goal is not to read and understand the articles completely, but to see how phonetic research can involve phonology and vice versa.

4. What are some examples you found?

Reminders

Have a great Thanksgiving Holiday!

For Monday Hayes Ch. 4

For Monday: HW 14