Phonemics

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- Phonemics is a theory of categorization of sounds in a language. Each language has, or displays, a large set of sounds.
- These sounds are grouped into closely related families of sounds; each such "family" acts as a single unit from a phonemic point of view. We call these families "phonemes," and in some respects we are more aware of these phonemes than we are of the very sounds themselves. A word can be viewed as a sequence of sounds, or as a sequence of phonemes. Neither view is more correct; they are at different levels of abstraction.
- The different sounds that comprise (or realize) a phoneme do not always appear in the same "environment": the "environment" of a sound is the sound to its left and to its right (that's a first approximation of the definition).

- The goal is to minimize the number of phonemes, by showing (for example) that two sounds are part of the same phoneme, and we do that by showing that the two appear in *complementary distribution*: that is, that there is no overlap in the contexts in which the two appear, and we can henceforth predict, given a location in an utterance, which of the two sounds *could* appear there.
- The difference between the two sounds, in this sense, is *predictable*: if you know the principles by which the sounds (called the *allophones*) of a phoneme are distributed, then you can simplify (or compress) your notational system: you can indicate just the name of (or symbol for) the phoneme.
- *Which* sound realizes the phoneme in a given word will be determined, or predicted, by the principles of the distribution of that phoneme's allophones.

A phonemic analysis is a process that takes as its input either (1) a set of utterances, transcribed phonetically or (2) a speaker of a language, and produces a set of symbols which represent distinct phonemes. There are 7 further conditions:

- The set must be minimal, in the sense that there may be no smaller set of phonemes that satisfies the conditions for phonemic analysis.
- It must be possible to represent every utterance of the language as a string of phonemes.
- It must be possible to represent every utterance of the language as a string of phones, where phones are the symbols used in the phonetic transcription.
- In the description of a particular utterance, there must be a one-to-one relationship between the phonemes in (2) and the phones in (1) (between the "tokens," not the types).

- It must be possible to establish rules of allophony: these rules specify the correspondences between the two levels of representation mentioned in (4). In particular, a rule of allophony says, "Phoneme M is realized as Phone P in context C", where context C says what sounds are present to the left or right (or both) of Phone P.
  A phonemic analysis always takes the form:

Phoneme	Phone	Context
/p/	[q]	A_B
	[r]	C_
	[s]	elsewhere

  where the underscore marks the focus of the environment we are considering.
- Uniqueness: A phonemic analysis must provide a unique phonemic representation for any given phonetic representation.
  Typographical convention: phonemes are placed inside slashes /phonemes/, and phones at the phonetic level are placed within square brackets: [phones].

I-Raising: /ay/ is realized as [ʌy] when followed by a voiceless obstruent (*ptksf*) in the same word, otherwise it is realized as [ay]. A rule of allophony always ends with the statement, "otherwise it is realized as. . ." - if only because that is the simplest way to state it (i.e., one realization can be stated without specifying the context).

What does a symbol mean?

- Philosophy #1: A phonetic symbol is understood to represent a specific linguistic sound. A phonemic symbol has meaning only insofar as it relates to specific phones. The particular symbol used has essentially no other significance. The mean lies in the correspondence rules (rules of allophony).
- Philosophy #2: Human beings are extraordinarily good at discovering the phonemic relationships (allophony rules) that structure language, and the realization that is given in the "otherwise" formulation of the allophony rule is the (psychologically) real sound-image that comprises the phoneme. Phonemic analysis is primarily practical: it is meant to be practiced.

In practice, students are taught to look at all pairs of sounds that are similar and to test whether these two sounds are in an allophonic relationship (i.e., whether they might be realizations of the same phoneme). This requires one to learn what it means for two sounds to be similar (of course, one could simply consider all pairs of sounds....). Next, one (successively, iteratively) looks at each pair of sounds, and asks whether that pair might be realizations of the same phoneme.

The best test of whether two phones might be realizations of the same phoneme is the minimal pair test: if we can find two words that are different words and which are identical, except that one contains phone P, and the other contains phone Q in the same position, then the two constitute a minimal pair with regard to the pair P and Q, and P and Q cannot be allophones of the same phoneme.

- ɪ and ɛ in English: *pit* and *pet* are different words; hence these two sounds cannot be allophones of the same phoneme.
- Similarly, *i* and ɪ exist in English, and *pit* and *Pete* (or *peat*) are minimal pairs with these sounds (hence, they cannot be allophones in Englifsh).
- By contrast, these last two sounds occur in Canadian French, where no such minimal pairs exist (and they can be analyzed as allophones of a single phoneme).

If we cannot find any minimal pairs distinguishing two phones P and Q, then we can look for a principle that will specify a context in which one of them is used (with the other used "elsewhere"). If we can find such a principle, then we have established that the two are allophones of a single phoneme. (Convince yourself that this is techically always possible if the corpus is finite.)

- There is another possibility that phonemic theory allows which we have not discussed: two phones P and Q which are realizations of the same phoneme M may be in free variation (in some context, or in all contexts): a word containing the sound P may be changed by replacing P by Q, and the result is another acceptable pronunciation of the same word.
- Notice that both the statement of free variation and the definition of minimal pair requires being able to know whether two words are the same or different.

- Bottom-up philosophy: phonemics is deeply rooted in a conception of analysis beginning with the phonetic, followed by analysis at the phonemic, followed by analysis of morphemes, and so on. This bottom-up philosophy can be interpreted as scientific methodology or as psychological theory about human speakers - or both. If it is taken as a theory about language users, it is a theory of language hearers rather than speakers. (Why?)
- I said above that with a finite corpus and no minimal pairs for sounds P and Q, it is always possible in principle to establish a phoneme that is realized as P and Q. But it is generally understood that the principles of allophony must have some phonological simplicity or naturalness to them.
- This was generally understood to mean, in addition, that the phones P and Q must not be too different phonetically, but that phrase was never successfully defined. Phonemicists all knew that some such clause was necessary to prevent an analysis in which [h] and the velar nasal are allophones of the same phoneme. (Why?)

Bottom-up, hearer-oriented analysis

Hearers have access to the string of phones representing an utterance. Do they have access to the presence of word-boundaries separating these words? Is this an empirical question? - that is, is it possible that some languages provide phonetic cues to word-boundaries, and others do not? This is important, because if allophony does not have access to word-boundaries, what do we do with the phonetic realization of high time? Which realization of the vowel of high do we find? Why not the other?

Generative phonology: speaker-oriented analysis

The speaker knows where the word-boundaries are, and what phonemes are being uttered, so let the conditioning on phoneme-realization be dependent on what is known to the speaker, not just on what the hearer will be able to hear. A cognitive analysis of what an adult, competent speaker does is not modeled by a linguist's discovery procedures (though a child's acquisition may be).

Phoneme	Phone	Examples	
/aj/	[aj]	bide	[bajd]
		guide	[gajd]
		tribe	[trajb]
		aisle	[ajl]
		smile	[smajl]
		mime	[majm]
		mine	[majn]
		buy	[baj]
		try	[traj]
	[ʌj]	bite	[bʌjt]
		kite	[kʌjt]
		tripe	[trʌjp]
		type	[tʌjp]
		like	[lʌjk]
		Mike	[mʌjk]
		knife	[nʌjf]
		nice	[nʌjs]
		slice	[slʌjs]

Phoneme	Phone	Context
/aj/	[ʌj]	_[voiceless obstruent]
	[aj]	elsewhere

Phoneme	Phone	Examples	
/æ/	[æ]	cap	[kæp]
		cat	[kæp]
		pack	[pæk]
		nap	[næp]
		Nat	[Næt]
		knack	[næk]
		gap	[gæp]
		bat	[bæt]
		back	[bæk]
		bang	[bæŋ]
		sang	[sæŋ]
		gang	[gæŋ]
	[$e^{ə}$]	Sam	[s$e^{ə}$m]
		tan	[t$e^{ə}$n]
		Nam	[n$e^{ə}$m]
		Nan	[n$e^{ə}$n]
		dam	[d$e^{ə}$m]
		Dan	[d$e^{ə}$n]

Phoneme	Phone	Context
/æ/	[$e^{\ə}$]	_{m,n}
	[æ]	elsewhere

Cashinahua, Panoan (Peru, Brazil).

paka	bamboo	[mɨsu]	swollen hand
taka	liver	mɨʃu	dark, black
kaka	type of basket	[bɨtu]	spotted face
baka	fish	[bɨʦu]	to be squeezed
daka	to rest	[bisu]	face
ʦaka	to kill	[kuʧa]	tpe of arrow
ʧaka	bad	[kuʃa]	to hit
maka	rat	[naka]	to chew
tapa	floor	[taβa]	washboard
tama	peanut	[tawa]	sugar cane
bɨru	eye	[kuja]	to have pus
kana	type of macaw	[hana]	type of bird
isi]	unending	[isa]	bird (generic)
isu	spider monkey	[isɨ]	head painting
dani]	body hair	[baɾi]	sun
ba	friend	[naβu]	people

bf iwɨriwɨ	bring quickly!	[dasiβi]	all
darɨ	medicinal plant	[bɨnu]	duck-like bird
ʃana	type of fruit	sɨpi	weaving design
hɨpɨ	type of palm	janɨ	quickly

	Labial	Alveolar	(Alveo-)palatal	Velar/Glottal
Plosive voiceless	p	t		k
Plosive voiced	b	d		g
Affricate		ʦ	ʧ	
Fricative	β	s	ʃ	h
Nasal	m	n		
Flap		ɾ		
Glide	w		j	

Table: Cashinahua consonants

	Front	Central	Back
Close	i	ɨ	u
Open		a	

Table: Cashinahua vowels

b	β	d	ɾ
_ɨtu	ta_a	_aka	bɨ_u
_aka	na_u	_ani	ba_i
_ɨtsu	dasi_ i	_ asibi	iwɨ_iwɨ
_ɨsu		_aɾi	da_ i
_aɾi			
_a			
_ ɨnu			

Table: Voiced obstruents in Cashinahua

Two analyses are possible:

Phoneme	Phone	Context
/b/	[b]	#_
	[β]	elsewhere

Phoneme	Phone	Context
/b/	[β]	V_ V
	[b]	elsewhere

Likewise, here is one of two possible analyses:

Phoneme	Phone	Context
/d/	[d]	#_
	[ɾ]	elsewhere

	gloss		gloss
pata	mat	ŋgyunu	you fell
tatah	father	sis	meat
$t^{y}ɨt^{y}ɨy$	little	šohšahu	they cooked it
cima	calabash	kama	cornfield
cehcu	he cut it	nas	earth
kunu	he fell	ñanah	his mother
kenba	he sees	kaŋ	jaguar
myaŋdamu	you came	liŋba	he slashes
ʔɨŋd^{y}opya	he is sleepy	win	face
ñǰehcu	you cut brush		

Table: Zoque words

Voiceless plosives	p	t,c	t^y, č	k	
Voiced plosives	b	d, dz	d^y, ǰ	g	
Fricatives		s	š		
Nasals	m	n	ñ	ŋ	
Liquids		l,r			
Glides	w		y		ʔ, h

Table: Zoque consonant inventory

Phoneme	Phone	Context
/p/	[b]	[nasal]_
	[p]	elsewhere

Phoneme	Phone	Context
/t/	[d]	[nasal]_
	[t]	elsewhere

Phonemic analysis: pure categorization of sounds (phones) into groups, or sets, of sounds (phonemes). The name we give to a set of sounds should not be confused with the name of a sound.
Generative view of phonology: There is a basic sound-shape of each morpheme. It can be modified by phonological rules; these rules are typically triggered by certain ("undesirable," in a language-particular sense) phonological sequence: e.g., German does not tolerate word-final voiced obstruents; it has a rule that makes word-final voiced obstruents voiceless.
This is not intended to be interpreted as a statement about the history of a language. But the conceptual origins of the idea are there, in the historical linguistics, and the observed directional changes are usually the effect of an observable sound change (a historical fact).
Reasons for directionality:

1. It gives a natural account for why there is typically an "elsewhere" condition in the realization of an underlying sound (phoneme).
2. Rule ordering: one rule must apply before another, in some

cases.

3. Feeding orders. One rule creates a sound that was not present underlyingly, and then that sound triggers a rule, affecting (typically) a different sound.
4. Counter-feeding orders. Rule A modifies segments of type X, but some Xs do not undergo that rule; these Xs are created by Rule B. Rule B is ordered before rule A. (Or: they apply simultaneously? Not countenanced in generative phonology.)
5. Also bleeding and counter-bleeding orders.
6. Neutralizations in some cases are inherently directional, or asymmetrical. Neutralization can be identified in either a purely phonological way, or in what we will eventually call a morphophonemic way.

With directionality come *rules*: and with rules, come *features*. A rule takes the form: $A \rightarrow B / C\_D$. Here, A, C, and D are (normally) sets of features, which function to define a set of segments. If A is is +sonorant, then it covers any segment which is +sonorant (i.e., all sonorants!). B describes the feature values that the input segment should take on by the effect of the rule.

In some respects, a rule such as this can be compared to a statement that a phoneme /A/ is realized as [B] in the environment C_D. It can also be viewed as a statement that the sequence *CAD* is not permitted in the language, and when circumstances give rise to that sequence, the *A* is changed to *B* (or rather, the feature-specifications given in *B* are imposed on *A*).

Features: motivation is (1) how to express the change effected by a rule; (2) how to express which segments undergo a change; and (3) what the environment (or context) is for the rule. All of these typically can be expressed by features.

[voiced obstruent] $\longrightarrow$ [-continuant] / V_V.