

ELC 231: Introduction to Language and Linguistics

Introduction to Phonology

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Core Subdomains

Linguistics: The study of Language

- Phonetics
- Phonology
- Morphology
- Syntax
- Semantics
- Pragmatics

Core Subdomains: Phonetics

Linguistics: The study of Language

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Core Subdomains: Phonology

Linguistics: The study of Language

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A language consists of

- (i) A structured collection of sounds Phonetic Inventory
 - (ii) A repository of meaning Semantic Ontology
 - (iii) Rules about how these elements combine (i.e., "GRAMMAR")
 - sounds into complex sounds
 - sound and meanings into $\langle \text{sound}, \text{meaning} \rangle$ pairs
 - morphemes into words
 - words into phrases and sentences
 - simple morpheme meanings into complex meanings
 - complex meanings with context

Core Subdomains: Phonology

Phonology: The study of the organization and patterning speech sounds

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1 DISCRETENESS as a DESIGN FEATURE

Discrete VS Continuous Phenomena

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Discrete VS Continuous Phenomena

2 Categories of Speech Sounds: CONTRAST as the key concept

- PHONEMES
- ALLOPHONES
- FREE VARIANTS

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2 Categories of Speech Sounds: CONTRAST as the key concept

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- ALLOPHONES
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3 Diagnostics for Categorizing Speech Sounds

- **Phonemes:** MINIMAL PAIRS
- **Allophones:** COMPLEMENTARY DISTRIBUTION

REVIEW: Voicing and Aspiration

Ladefoged (2001)

Speech sounds can be categorized according to

VOICING - i.e., whether the vocal folds are vibrating

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VOICING - i.e., whether the vocal folds are vibrating

- **VOICED** (vibrating vocal folds)

{ b, d, g, z, v, m, n, a, i , u, e, o, dʒ, ð, , ... }

- **VOICELESS** (open vocal folds)

{ p, t, k, s, ʃ, f, tʃ, θ, ... }

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- **ASPIRATED** (puff of air)

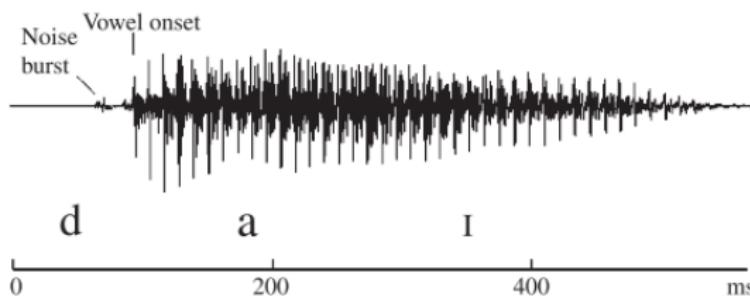
{ p^h, t^h, k^h }

- **UNASPIRATED** (no puff of air)

{ p, t, k }

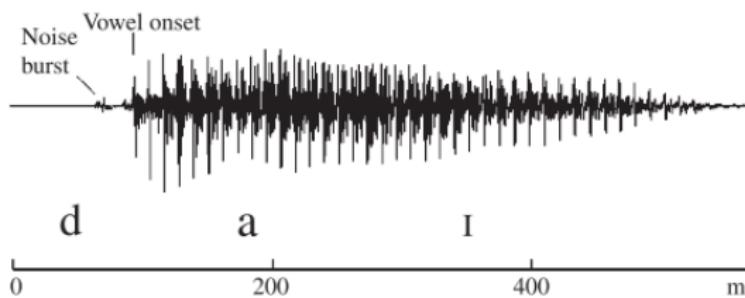
The Acoustic Correlate of Voice and Aspiration

Q: What's the acoustic correlate of aspiration?



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The Acoustic Correlate of Voice and Aspiration

Lisker & Abramson (1964)

Q: What's the acoustic correlate of aspiration?

Voice Onset Time (VOT):

A period of voicelessness between the release burst and the beginning of voicing from the vowel

- (i) Cantonese [p] VOT = 9 ms (average)
- (ii) Cantonese [p^h] VOT = 77 ms (average)

The Acoustic Correlate of Voice and Aspiration

Lisker & Abramson (1964)

Q: What's the acoustic correlate of voicing?

Voice Onset Time (VOT):

A period of voicelessness between the release burst and the beginning of voicing from the vowel

- (i) Hungarian [p] VOT = 2 ms (average)
- (ii) Hungarian [b] VOT = -90 ms (average)

The Acoustic Correlate of Voice and Aspiration

Lisker & Abramson (1964)

Q: What's the acoustic correlate of voicing/aspiration?

Voice Onset Time (VOT):

A period of voicelessness between the release burst and the beginning of voicing from the vowel

- (i) English [b] VOT = -101 ms (average)¹
- (ii) English [p^h] VOT = 58 ms (average)

¹Some speakers pronounce this as [p]. L&A 1964 list this with a VOT of 1ms

The Acoustic Correlate of Voice and Aspiration

Lisker & Abramson (1964)

Q: What's the acoustic correlate of voicing/aspiration?

Voice Onset Time (VOT):

A period of voicelessness between the release burst and the beginning of voicing from the vowel

- (i) Thai [b] VOT = -97 ms (average)
- (ii) Thai [p] VOT = 6 ms (average)
- (iii) Thai [p^h] VOT = 64 ms (average)

Question: How do we perceive intermediate VOTs?

Aspiration's acoustic correlate is **VOICE ONSET TIME (VOT)**

- (i) **[p]** VOT \approx 6 ms
- (ii) **[p^h]** VOT \approx 64 ms

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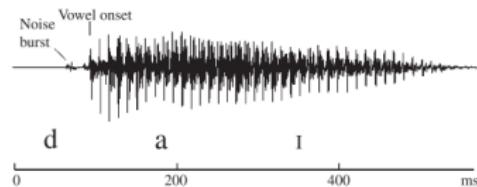
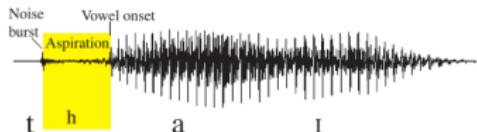
- **Q: How do we perceive intermediate VOTs?**

eg., VOT = 11 ms, 12 ms, 13 ms...20 ms, 25 ms...30 ms...etc

Question: How do we perceive intermediate VOTs?

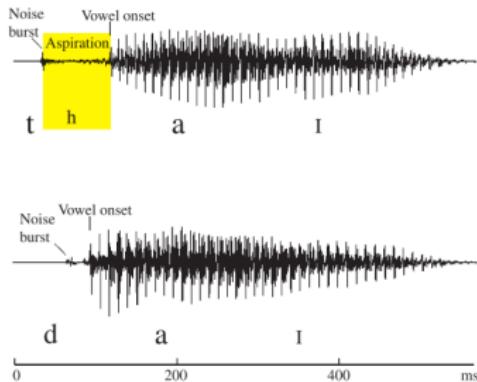
Experiment: Length of VOT as the Independent Variable

1. Record examples of [pa] and [$p^h a$]



Question: How do we perceive intermediate VOTs?

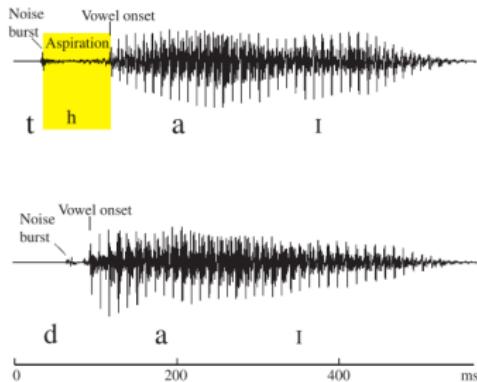
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Experiment: Length of VOT as the Independent Variable



1. Record examples of [pa] and [$p^h a$]
2. Digitally manipulate the length of the VOTs to create a continuum of recordings from [pa] to [$p^h a$]
3. Ask participants to listen to the stimuli and identify them as either [pa] or [$p^h a$]
(dependent variable)

Question: How do we perceive intermediate VOTs?

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VOT is measured in time, and time is a continuum...

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... so maybe we perceive VOT along a continuum (continuously)

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- HYPOTHESIS 1: CONTINUOUS PERCEPTION

We perceive intermediate VOTs along a continuum

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- **How do we perceive intermediate VOTs ?**

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- **HYPOTHESIS 1: CONTINUOUS PERCEPTION**

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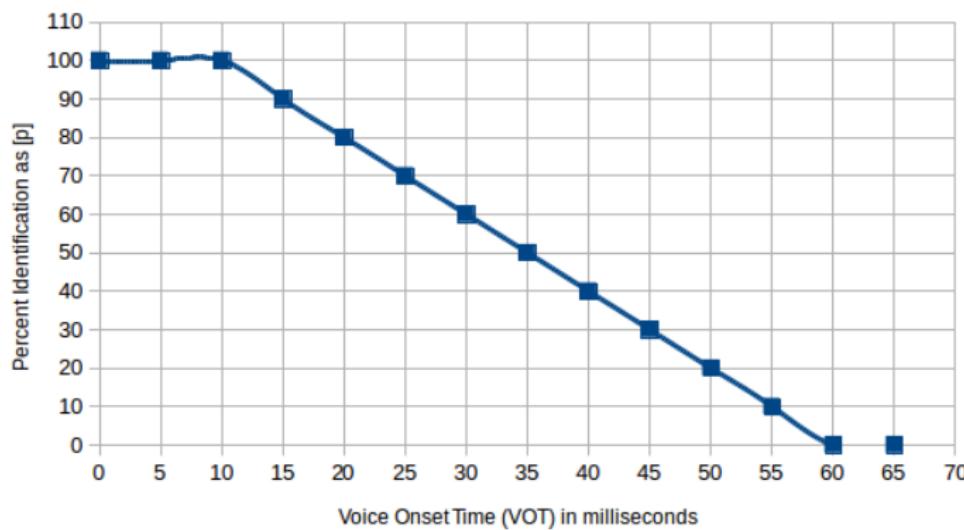
- **Prediction:** LINEAR relationship between VOT and identification

Question: How do we perceive intermediate VOTs?

HYPOTHESIS 1: Continuous Perception

Predicted Results: VOT and Identification as [p]

Predicted Linear Relationship



Question: How do we perceive intermediate VOTs?

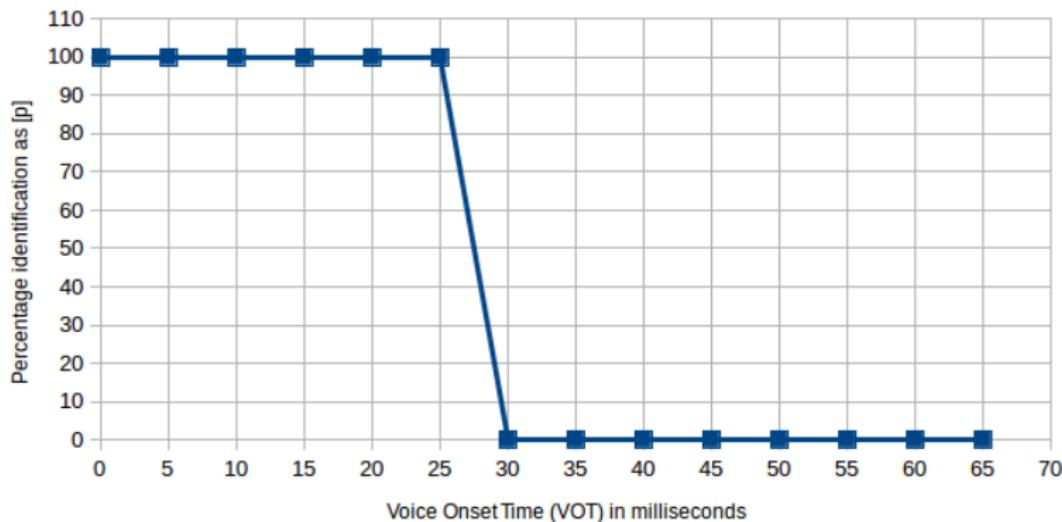
- **Observation:** THIS IS NOT WHAT HAPPENS

Question: How do we perceive intermediate VOTs?

ACTUAL RESULTS: Categorical Perception

Results: VOT and Identification of [p]

Non-Linear Relationship



Question: How do we perceive intermediate VOTs?

- **Observation:** Categorical Perception in Language

Aspiration/Voicing: [p] vs [b] and [p] vs [p^h]

Place of Articulation: [b] vs [d] vs [g]

Tone: H vs M vs L

Question: How do we perceive intermediate VOTs?

- **Observation:** Categorical Perception in Language

Aspiration/Voicing: [p] vs [b] and [p] vs [p^h]

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The acoustic signals distinguishing these sounds vary along a continuum...

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Place of Articulation: [b] vs [d] vs [g]

Tone: H vs M vs L

The acoustic signals distinguishing these sounds vary along a continuum...

...but we perceive the signals as CATEGORICALLY DISCRETE sounds

Question: How do we perceive intermediate VOTs?

- I.e., the building blocks of language are

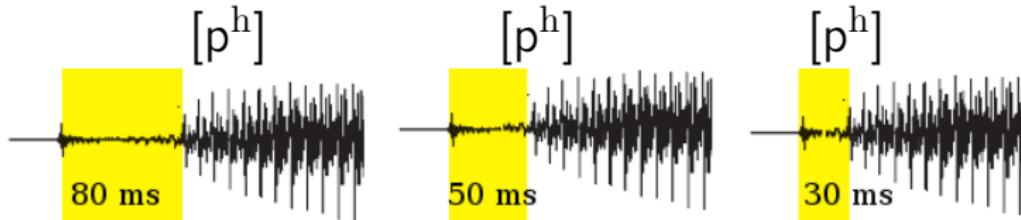
ABSTRACT SOUND CATEGORIES:

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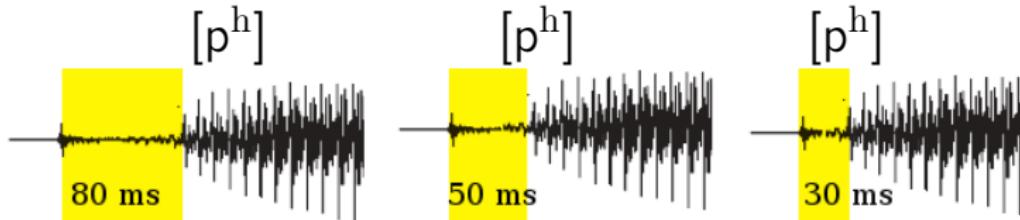


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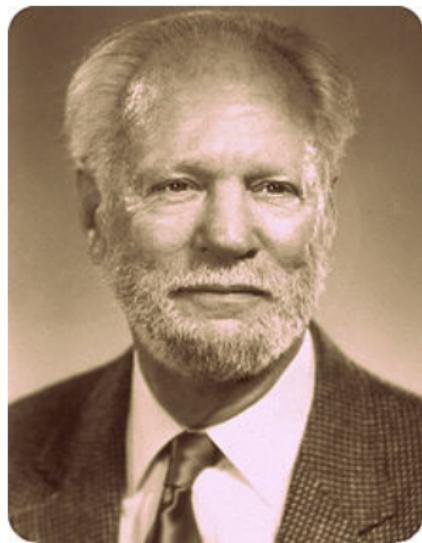


→ Many different physical manifestations of sounds map onto
one mental representation/category of a sound

Recall: Hockett's Design Features of Language

Q: What properties does LANGUAGE have?

i.e., what counts as a LANGUAGE (vs communication system)?



Charles F. Hockett (1916-2000) proposed several **criteria** that a communication system must have in order to count as a language

Hockett's Design Features of Language

Hockett (1959)

Q: What properties does LANGUAGE have?

i.e., what counts as a LANGUAGE (vs communication system)?



Hockett's Design Features

- 1 Discreteness
- 2 Semanticity
- 3 Arbitrariness
- 4 Productivity
- 5 Prevarication
- 6 Duality of Patterning
- 7 Displacement
- 8 ...

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Hockett's Design Features

DISCRETENESS

Language as a system is made up of discrete, categorical units; these units are perceived categorically, and not continuously.

Hockett's Design Features: Discreteness

Hockett (1959)

DISCRETE/CATEGORICAL vs CONTINUOUS Signal Systems

Are these discrete or continuous signal systems?

Hockett's Design Features: Discreteness

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DISCRETE/CATEGORICAL vs CONTINUOUS Signal Systems

Are these discrete or continuous signal systems?

1. Analog Clock (communicates time)

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2. Digital Clock (communicates time)

Hockett's Design Features: Discreteness

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DISCRETE/CATEGORICAL vs CONTINUOUS Signal Systems

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4. Light switch (communicates amount of light)

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DISCRETE/CATEGORICAL vs CONTINUOUS Signal Systems

Are these discrete or continuous signal systems?

1. Analog Clock (communicates time)
2. Digital Clock (communicates time)
3. Bulb Thermometer (communicates temperature)
4. Light switch (communicates amount of light)
5. Light Dimmer Switch/Dial (communicates amount of light)

The key notion of CONTRAST: Distinctive Sounds

Observation: Language organizes sounds into different **CATEGORIES**,

e.g., [p] vs [p^h], [g] vs [ŋ], [b] vs [d]

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- Q: What does language USE these different sound categories for?

- (1) a. [sa~~k~~] “sock”
b. [sa~~ŋ~~] “song”

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- A: Different sound segments can be used to DISTINGUISH/CONTRAST MEANING

The key notion of a PHONEME: Distinctive Sounds

Definition: PHONEME

A **PHONEME** is an abstract, unanalyzeable segment of language that can be used to distinguish meaning

Phonemes are:

The key notion of a PHONEME: Distinctive Sounds

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Phonemes are:

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(as opposed to physical manifestations of sounds)

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- 2 **CONTRASTIVE/DISTINCTIVE:** its presence/absence changes meaning

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Phonemes are:

- 1 **ABSTRACT CATEGORIES:** Mental representations of sounds
(as opposed to physical manifestations of sounds)
- 2 **CONTRASTIVE/DISTINCTIVE:** its presence/absence changes meaning
- 3 **UNANALYZEABLE:** No subpart of the segment can distinguish meaning

The key notion of a PHONEME: Distinctive Sounds

Example of a **PHONEME**

The key notion of a PHONEME: Distinctive Sounds

Example of a **PHONEME**

- Consider the following pair of words which differ only in one sound:

- (2) a. [si] "sea"
b. [sin] "scene"

The key notion of a PHONEME: Distinctive Sounds

Example of a **PHONEME**

- Consider the following pair of words which differ only in one sound:

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The key notion of a PHONEME: Distinctive Sounds

Example of a **PHONEME**

- Consider the following pair of words which differ only in one sound:

- (2) a. [si] "sea"
b. [sin] "scene"

- The presence/absence of [n] affects the meaning of the word
- This **MINIMAL PAIR** shows that [n] is a phoneme in English

The key notion of a PHONEME: Distinctive Sounds

Definition: MINIMAL PAIR

A **MINIMAL PAIR** is a pair of words^a that

- i) differ *minimally* in form, and
- ii) have different meanings

^awe'll modify this definition as the course progresses

The key notion of a PHONEME: Distinctive Sounds

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- Phonological minimal pairs differ by only one **PHONEME**
- **NEAR MINIMAL PAIRS:** Differ only in two sound segments
(and have different meanings) eg., [næp] "nap" and [mæt] "mat"

The key notion of a PHONEME: Distinctive Sounds

CONTRAST IN PLACE OF ARTICULATION

Nasal MINIMAL PAIRS in Cantonese:

- (3) a. [ma:i⁵] "buy" VS [na:i⁵] "milk" Bilabial VS Alveolar
- b. [ŋa:⁴] "teeth" VS [na:⁴] "take" Velar VS Alveolar
- c. [ŋeu⁴] "ox/cow" VS [meu⁴] "scheme/plot" Velar VS Bilabial

Note: 5 indicates a low rising tone, 4 indicates a low falling tone

The key notion of a PHONEME: Distinctive Sounds

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Note: 5 indicates a low rising tone, 4 indicates a low falling tone

Exercise: Find similar POA minimal pairs in English and/or Thai
 → Show that the words differ in (i) one segment, and (ii) meaning

The key notion of a PHONEME: Distinctive Sounds

CONTRAST IN PLACE OF ARTICULATION

Nasal MINIMAL PAIR in French:

- (4) a. [aŋo] *agneau* "lamb" palatal nasal
b. [aṇo] *anneau* "ring" alveolar nasal
c. *[aŋɔ] * = not found in the language velar nasal

The key notion of a PHONEME: Distinctive Sounds

CONTRAST IN PLACE OF ARTICULATION

Nasal MINIMAL PAIR in French:

- (4) a. [aŋo] *agneau* "lamb" palatal nasal
b. [ano] *anneau* "ring" alveolar nasal
c. *[aŋo] * = not found in the language velar nasal

- **Observation:** Different languages contrast different segments:
 - eg., Cantonese distinguishes [n] vs [ŋ]; French does not
 - eg., French distinguishes [n] vs [ɲ]; Cantonese does not

The key notion of a PHONEME: Distinctive Sounds

CONTRAST IN MANNER OF ARTICULATION

(Denti-)Alveolar MINIMAL PAIRS in French:

- (5) a. [t^hu] *tous* "all" Voiceless stop
b. [du] *doux* "sweet" Voiced stop
c. [nu] *nous* "we" Voiceless stop
d. [su] *sous* "under" Voiceless fricative
e. [zu] *zoo* "zoo" Voiced Fricative

The key notion of a PHONEME: Distinctive Sounds

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Exercise: Find similar minimal pairs in English and/or Thai

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The key notion of a PHONEME: Distinctive Sounds

Observation: Languages vary in the sound contrasts they contain

Three ways a language can lack certain contrasts:

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Three ways a language can lack certain contrasts:

- 1 Lack of Variation

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- 1 **Lack of Variation**
- 2 Free Variation
- 3 Allophonic Variation

No Contrast: Lack of Variation

LACK OF VARIATION High Round Vowels in English

No Contrast: Lack of Variation

LACK OF VARIATION High Round Vowels in English

- French contrasts [y] and [u]
- (6) French Minimal Pair
- | | |
|--|------------------------|
| a. [vy] <i>vue</i> “view” | High Front Round Vowel |
| b. [vu] <i>vous</i> “you _{PL/SG.formal} ” | High Back Round Vowel |

No Contrast: Lack of Variation

LACK OF VARIATION High Round Vowels in English

- French contrasts [y] and [u]

(6) French Minimal Pair

- a. [vy] *vue* "view" High Front Round Vowel
 - b. [vu] *vous* "you_{PL/SG.formal}" High Back Round Vowel

- English lacks words with [y] entirely!

i.e., English lacks variation between [y] and [u]

This means English lacks contrast between [i] and [y]

No Contrast: Lack of Variation

LACK OF VARIATION Dental Fricatives in Cantonese

No Contrast: Lack of Variation

LACK OF VARIATION Dental Fricatives in Cantonese

- English contrasts [θ] and [f]
- (7) English Minimal Pair
- a. [θɪŋk] *think* “to form a thought in your mind”
 - b. [fɪŋk] *fink* “someone who informs the police about criminal activity (negative connotation)”

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(7) English Minimal Pair

- [θɪŋk] *think* “to form a thought in your mind”
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- Cantonese lacks words with [θ] entirely!

i.e., Cantonese lacks variation between [θ] and [f]

This means Cantonese lacks contrast between [θ] and [f]

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- 1 Lack of Variation
- 2 **Free Variation**
- 3 Allophonic Variation

No Contrast: Free Variation

FREE VARIATION IN HONG KONG CANTONESE: [n] VS [l]

- (8) a. [nei⁵] ~ [lei⁵] “you”
- b. [nəm⁴] ~ [ləm⁴] “think”
- c. [noi⁶] ~ [loi⁶] “endure/long time”

²This is the result of a phonemic merger of /l/ and /n/

No Contrast: Free Variation

FREE VARIATION IN HONG KONG CANTONESE: [n] VS [l]

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- b. [nəm⁴] ~ [ləm⁴] "think"
- c. [noi⁶] ~ [loi⁶] "endure/long time"
-
- Both sounds ([n], [l]) occur in the language....

²This is the result of a phonemic merger of /l/ and /n/

No Contrast: Free Variation

FREE VARIATION IN HONG KONG CANTONESE: [n] VS [l]

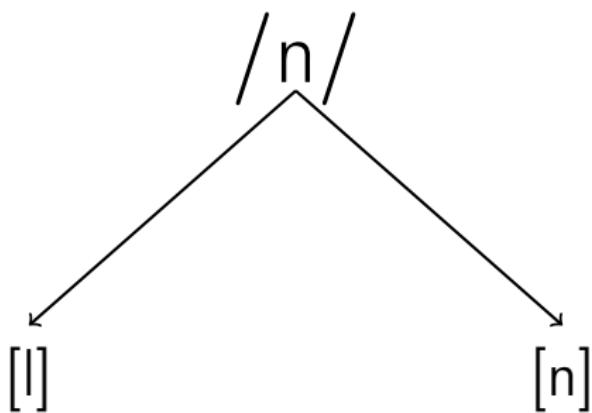
- (8) a. [nei⁵] ~ [lei⁵] "you"
b. [nəm⁴] ~ [ləm⁴] "think"
c. [noi⁶] ~ [loi⁶] "endure/long time"

- Both sounds ([n], [l]) occur in the language....
- ...but swapping the sounds does not affect the meaning²

²This is the result of a phonemic merger of /l/ and /n/

No Contrast: Free Variation

FREE VARIATION IN HONG KONG CANTONESE: [n] VS [l]



- [n] and [l] are phonetic free variants of the underlying phoneme /n/

No Contrast: Free Variation in Northern Paiute (Thornes (2003))

FREE VARIATION IN NORTHERN PAIUTE: Lenis Consonants

- (9) a. [t̪βá] ~ [t̪bá] ~ [t̪pá] “pine nut”
b. [kar̪í] ~ [kad̪í] ~ [kat̪í] “sit”
c. [n̪iɣá] ~ [n̪iɡá] ~ [n̪iká] “dance”

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- Voiced continuants ([β, r, ɣ]), voiced stops ([b, d, g]) and voiceless stops ([p, t, k]) all occur in the language...

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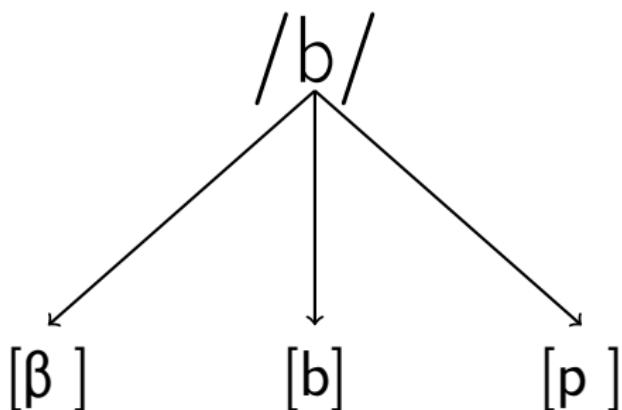
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- Voiced continuants ([β, r, γ]), voiced stops ([b, d, g]) and voiceless stops ([p, t, k]) all occur in the language...
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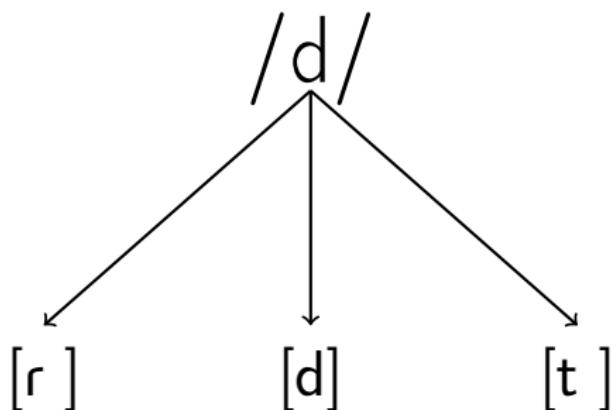
FREE VARIATION IN NORTHERN PAIUTE: { β , b, p }



- { β , b, p } are phonetic free variants of the underlying phoneme /b/

No Contrast: Free Variation

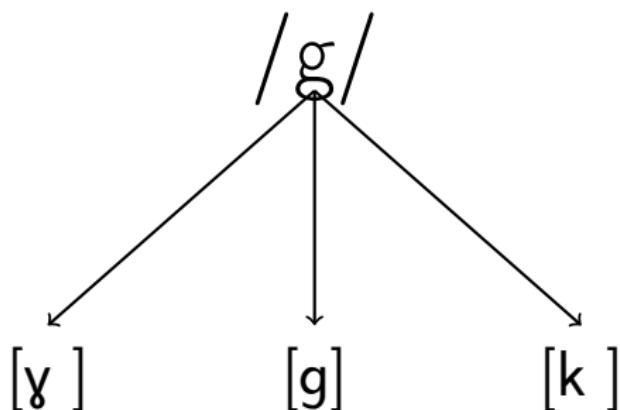
FREE VARIATION IN NORTHERN PAIUTE: { r, d, t }



- { r, d, t } are phonetic free variants of the underlying phoneme /d/

No Contrast: Free Variation

FREE VARIATION IN NORTHERN PAIUTE: { γ, g, k }



- { γ, g, k } are phonetic free variants of the underlying phoneme /g/

No Contrast: Free Variation

Context-Free Phonological Re-Write Rules

We can represent FREE VARIATION

using CONTEXT-FREE REWRITE RULES:

No Contrast: Free Variation

Context-Free Phonological Re-Write Rules

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using CONTEXT-FREE REWRITE RULES:

- Cantonese: /n/ → [n, l]

No Contrast: Free Variation

Context-Free Phonological Re-Write Rules

We can represent FREE VARIATION

using CONTEXT-FREE REWRITE RULES:

- Cantonese: /n/ → [n, l]

- Northern Paiute:

/b/ → [β, b, p]

/d/ → [ɾ, d, t]

/g/ → [ɣ, g, k]

The key notion of a PHONEME: Distinctive Sounds

Observation: Languages vary in the sound contrasts they contain

Three ways a language can lack certain contrasts:

- 1 Lack of Variation
- 2 **Free Variation**
- 3 Allophonic Variation

The key notion of a PHONEME: Distinctive Sounds

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No Contrast: Allophonic Variation

ALLOPHONIC VARIATION IN N. AMERICAN ENGLISH: { *n*, *ն* }

- (10) a. [ʌn̥jən] “onion”
 b. [dʒuնjər] “junior”
 c. [kʰæləfɔրնjə] “California”
 d. [spæնjəl] “Spaniel”

- (11) a. [juնət] “unit”
 b. [fəni] “funny”
 c. [æn̥iməl] “animal”
 d. [ɪn̥ɪʃəl] “initial”

No Contrast: Allophonic Variation

ALLOPHONIC VARIATION IN N. AMERICAN ENGLISH: { n, ɳ }

- | | |
|--|---|
| (10) a. [ʌɳjən] "onion"
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|--|---|

- The alveolar nasal ([n]) and palatal nasal ([ɳ])
both occur in the language...

No Contrast: Allophonic Variation

ALLOPHONIC VARIATION IN N. AMERICAN ENGLISH: { *n*, *ŋ* }

- | | | | |
|------|---------------------------------|------|-------------------------|
| (12) | a. *[ʌn̩jən] "onion" | (13) | a. *[juŋ̩ət] "unit" |
| | b. *[dʒuŋ̩n̩jər] "junior" | | b. *[fəŋ̩i] "funny" |
| | c. *[kʰæləfɔrŋ̩jə] "California" | | c. *[æŋ̩ɪməl] "animal" |
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- But ([*n*]) and ([*ŋ*]) are not in free variation...

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| d. *[spæŋ̩jəl] "Spaniel" | d. *[ɪŋ̩ɪʃəl] "initial" |

- But ([*n*]) and ([*ŋ*]) are not in free variation...
- Swapping the sounds results in *unnatural sounding English*
 - not an attested pronunciation (as with **FREE VARIATION**), **and**
 - not minimal pairs (as with **CONTRASTIVE PHONEMES**)

No Contrast: Allophonic Variation

ALLOPHONIC VARIATION IN N. AMERICAN ENGLISH: { *n*, *ն* }

- | | |
|--|---------------------------------|
| (14) a. [ʌ <i>n</i> jən] "onion" | (15) a. [ju <i>n</i> ət] "unit" |
| b. [dʒu <i>n</i> jər] "junior" | b. [fəni] "funny" |
| c. [kʰæləfɔr <i>n</i> jə] "California" | c. [æn <i>ɪ</i> məl] "animal" |
| d. [spæ <i>n</i> jəl] "Spaniel" | d. [<i>n</i> ɪʃəl] "initial" |

- Q: Can you see a pattern in where [i] and [n] occur?

No Contrast: Allophonic Variation

ALLOPHONIC VARIATION IN N. AMERICAN ENGLISH: { *n*, *ŋ* }

- | | |
|--|------------------------|
| (16) a. [ʌŋjən] "onion" | (17) a. [juŋət] "unit" |
| b. [dʒuŋjər] "junior" | b. [fəni] "funny" |
| c. [k ^h æləfɔrŋjə] "California" | c. [ænɪməl] "animal" |
| d. [spæŋjəl] "Spaniel" | d. [ɪnɪʃəl] "initial" |

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No Contrast: Allophonic Variation

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- | | |
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|---|--|

- Q: Can you see a pattern in where [n] and [ŋ] occur?

- Observation:

The palatal nasal [ŋ] always occurs right before the palatal glide [j], and the alveolar nasal [n] never occurs in that position.

No Contrast: Allophonic Variation

ALLOPHONIC VARIATION IN N. AMERICAN ENGLISH: { *j̃*, *n* }

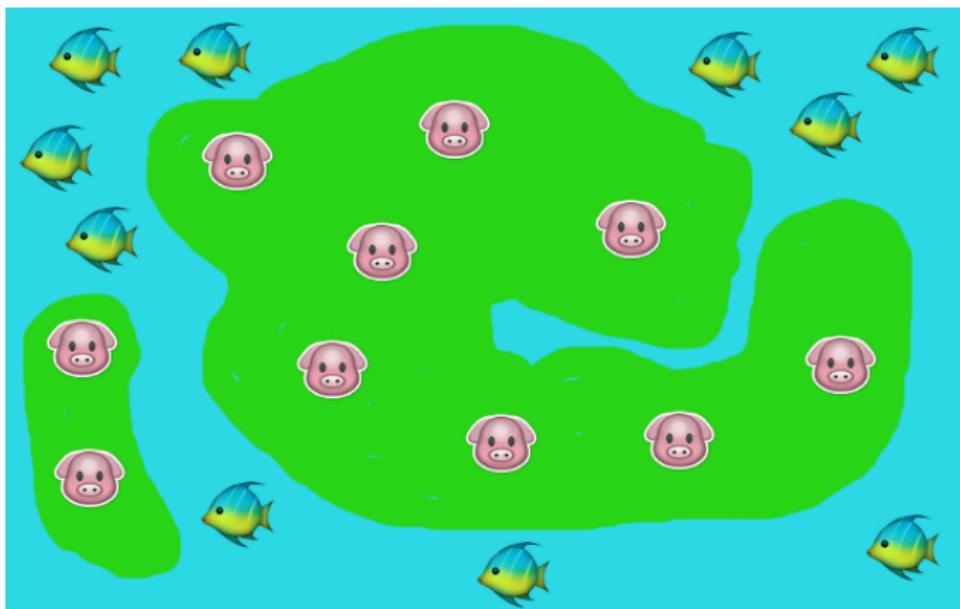
- | | |
|-------------------------------|------------------------|
| (18) a. [ʌj̃ən] "onion" | (19) a. [juŋət] "unit" |
| b. [dʒuŋjər] "junior" | b. [fəni] "funny" |
| c. [kʰæləfɔrj̃ə] "California" | c. [æníməl] "animal" |
| d. [spæŋj̃əl] "Spaniel" | d. [ɪnɪʃəl] "initial" |

● Observation:

The palatal nasal [*j̃*] always occurs right before the palatal glide [*j*], and the alveolar nasal [*n*] never occurs in that position.

→ This sort of pattern is a **COMPLEMENTARY DISTRIBUTION**

Complementary Distribution: Fish and Pigs



Fully Overlapping Distribution: Alligators and Turtles



Partially Overlapping Distribution: Alligators and Octopuses



No Contrast: Allophonic Variation

Definition: COMPLEMENTARY DISTRIBUTION

Two sounds, X and Y, are in **COMPLEMENTARY DISTRIBUTION** if they only occur in **COMPLEMENTARY** (i.e., non-overlapping) environments

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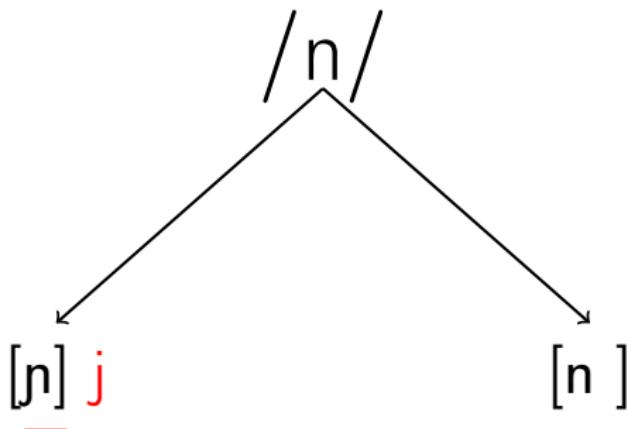
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 - eg., *the palatal nasal [n] always occurs right before the palatal glide [j], and the alveolar nasal [n] never occurs in that position*
- We say [n] and [n̪] are in **COMPLEMENTARY DISTRIBUTION**

No Contrast: Allophonic Variation

ALLOPHONIC VARIATION IN ENGLISH: { j , n }



- { j , n } are allophonic variants of the underlying phoneme /n/
i.e., { j , n } are ALLOPHONES of a single underlying phoneme

No Contrast: Allophonic Variation

Definition: Allophones

Two sounds, X and Y, are ALLOPHONES of a single underlying phoneme if

- (i) they are non-contrastive (i.e., there are no MINIMAL PAIRS)
- (ii) they occur in COMPLEMENTARY DISTRIBUTION

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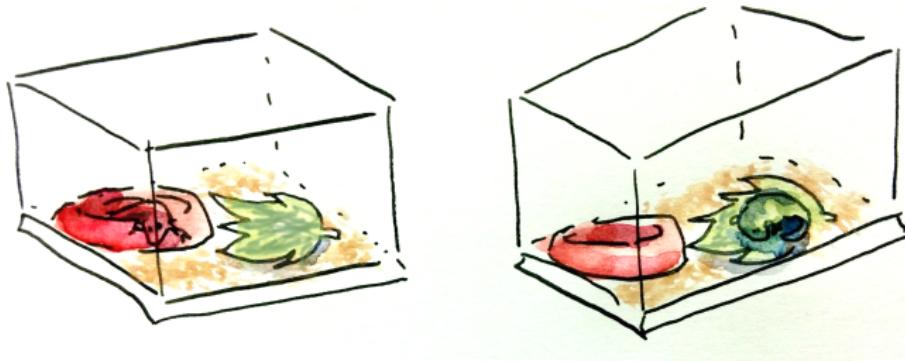
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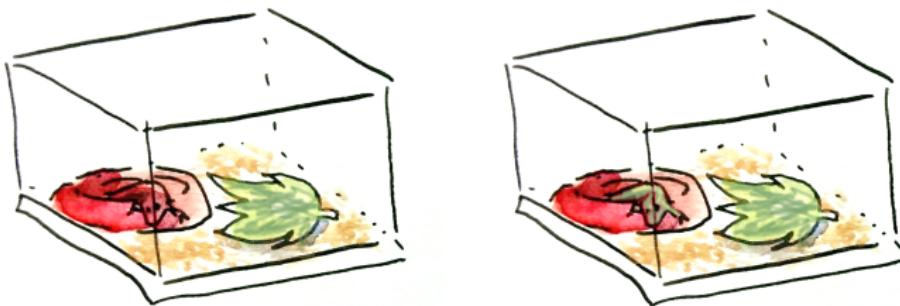
- i.e., X and Y never occur in the same environment
 - eg., *the palatal nasal [ɲ] always occurs right before the palatal glide [j], and the alveolar nasal [n] never occurs in that position*
- [ɲ] and [n] are in ALLOPHONES of the same underlying phoneme

No Contrast: Allophonic Variation



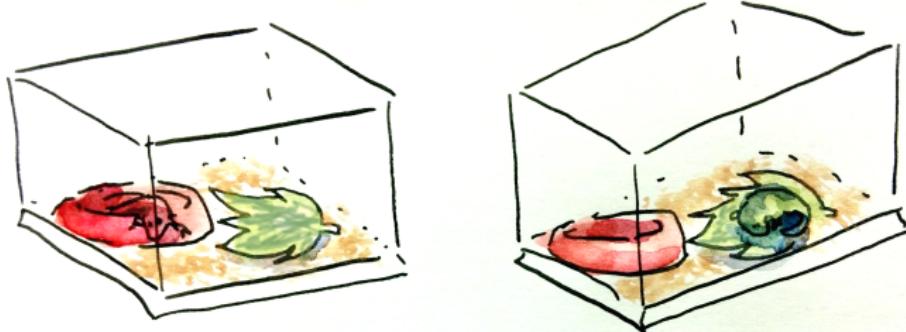
Analogy: Are there two distinct lizards,
or just two surface variations of a single lizard?

No Contrast: Allophonic Variation



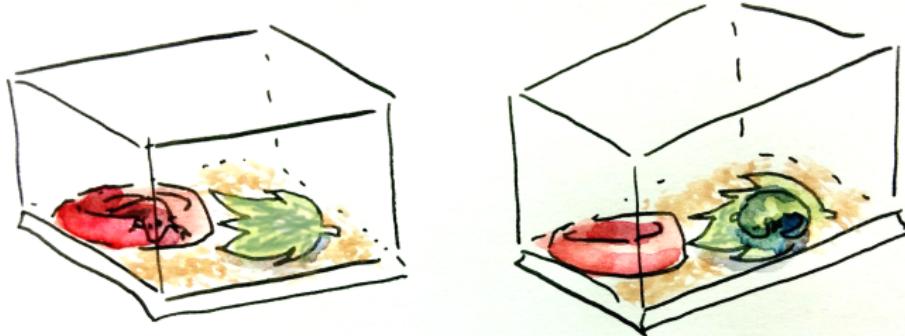
Analogy: If you encounter a MINIMAL PAIR like this,
then they're probably different lizards

No Contrast: Allophonic Variation



Analogy: But if you only ever see a **red lizard** in the **red bowl**,
and a **green lizard** on the **green leaf**...
...they're probably the same underlying lizard

No Contrast: Allophonic Variation



Analogy: If you only ever see **sound X** in **context A**,
and **sound Y** in **context B** (where context A and B don't overlap)...
...they're probably the same underlying phoneme

No Contrast: Allophonic Variation

Context-Sensitive Phonological Re-Write Rules

We can represent ALLOPHONIC VARIATION

using CONTEXT-SENSITIVE REWRITE RULES:

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- English:

$/n/ \rightarrow [n]/__j$
 $/n/ \rightarrow [n]$ elsewhere

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- English:

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 $/n/ \rightarrow [n]$ elsewhere

- $/__j$ represents the phonological CONTEXT the rule applies in

Interim Summary: Main Theoretical Concepts Today

- CATEGORICAL PERCEPTION
- DISCRETENESS (as a Design Feature of Language)
- CONTRASTIVE PHONEMES
- MINIMAL PAIRS
- FREE VARIATION/FREE VARIANTS
- ALLOPHONIC VARIATION/ALLOPHONES
- COMPLEMENTARY DISTRIBUTION

Q: What is Linguistics?

- LINGUISTICS is the systematic study of LANGUAGE
- Taking a SCIENTIFIC APPROACH to studying language:
 - 1 OBSERVE some language phenomena, and ask a QUESTION
 - 2 Make a HYPOTHESIS about the phenomena
 - 3 Test the PREDICTIONS that your hypothesis makes
 - 4 Revise your hypothesis
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What is the distribution of sound X (and sound Y)?

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Prediction: They are in **complementary distribution**

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$/X/ \rightarrow [Y] / i \underline{}$

$/X/ \rightarrow [X]$ elsewhere

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/X/ → [X] elsewhere

Prediction: You will never find [Y] unless it is preceded by [i]

e.g., never in word-initial position, after consonants, after other vowels

Case Study: Cantonese Diphthongs

1. [gʌw³] "enough"
2. [gaw³] "teach"
3. [tʃʌw³] "stinky"
4. [tʃaw²] "stir-fried"
5. [maj⁵] "buy"
6. [mʌj⁵] "rice (uncooked)"
7. [saj³] "excessive"
8. [sʌj³] "small"

[Q:] Are [aw] and [ʌw] separate phonemes, or allophones?

[Q:] Are [aj] and [ʌj] separate phonemes, or allophones?

(The numbers indicate tones, 1=high level, 2=high rising, 3=mid level, 4=low falling, 5=low rising, 6=low level)

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Case Study: Cantonese Diphthongs

- | | |
|--------------------------------------|--|
| 1. [gʌw ³] "enough" | 5. [maj ⁵] "buy" |
| 2. [gaw ³] "teach" | 6. [mʌj ⁵] "rice (uncooked)" |
| 3. [tʃʌw ³] "stinky" | 7. [saj ³] "excessive" |
| 4. [tʃaw ²] "stir-fried" | 8. [sʌj ³] "small" |

[Q:] Are [aw] and [ʌw] **separate phonemes**, or allophones?

[Q:] Are [aj] and [ʌj] **separate phonemes**, or allophones?

(The numbers indicate tones, 1=high level, 2=high rising, 3=mid level, 4=low falling, 5=low rising, 6=low level)

Case Study: Cantonese Diphthongs

1. [g¹w³] "enough"
2. [gaw³] "teach"
3. [tʃ¹w³] "stinky"
4. [tʃaw²] "stir-fried"
5. [maj⁵] "buy"
6. [mʌj⁵] "rice (uncooked)"
7. [saj³] "excessive"
8. [sʌj³] "small"

[Q:] Are [aw] and [¹w] **separate phonemes**, or allophones?

[Q:] Are [aj] and [¹j] **separate phonemes**, or allophones?

→ **The minimal pairs are evidence that these are pairs of distinct phonemes.**

Case Study: Japanese Fricatives

1. [sakana] "fish"
2. [aʃita] "tomorrow"
3. [sukɔʃi] "little bit"
4. [senaka] "back"
5. [soko] "there"
6. [asa] "morning"
7. [ʃigoto] "work"
8. [tesuto] "test"
9. [ʃiawase] "happy"
10. [soʃite] "then"

[Q:] Are [s] and [ʃ] separate phonemes, or **allophones** of a single phoneme?

How to Approach This Type of Problem

[Q:] Are [s] and [ʃ] separate phonemes, or allophones?

1. [sakana] "fish"
2. [aʃita] "tomorrow"
3. [sukoʃi] "little bit"
4. [senaka] "back"
5. [soko] "there"
6. [asa] "morning"
7. [ʃigoto] "work"
8. [tesuto] "test"
9. [ʃiawase] "happy"
10. [soʃite] "then"

Step 1: Look for minimal pairs (evidence of phonemes)

- none in this data set.

Step 2: Try to establish complementary distribution (evidence of allophony)

Determining Allophony

Finding Complementary Distribution

Step 2: Try to establish complementary distribution

Determining Allophony

Finding Complementary Distribution

Step 2: Try to establish complementary distribution

2a: Make a chart of where [s] occurs vs where [ʃ] occurs

Determining Allophony

Finding Complementary Distribution

Step 2: Try to establish complementary distribution

2a: Make a chart of where [s] occurs vs where [ʃ] occurs

Environments where [s] occurs	Environments where [ʃ] occurs
#_akana	a_it
#_ukoʃi	suko_i
#_enaka	suko_i
#_oko	#_iawase
a_a	so_it
te_uto	#_igoto
ʃiawa_e	
#_oʃite	

Determining Allophony

Finding Complementary Distribution

Step 2: Try to establish complementary distribution

2a: Make a chart of where [s] occurs vs where [ʃ] occurs

2b: Try to generalize over the environments for each sound

Environments where [s] occurs	Environments where [ʃ] occurs
#_akana	a_it
#_ukoʃi	suko_i
#_enaka	suko_i
#_oko	#_iawase
a_a	so_it
te_uto	#_igoto
ʃiawa_e	
#_oʃite	

Determining Allophony

Finding Complementary Distribution

Step 2: Try to establish complementary distribution

2a: Make a chart of where [s] occurs vs where [ʃ] occurs

2b: Try to generalize over the environments for each sound

Environments where [s] occurs	Environments where [ʃ] occurs
#_akana	a_it
#_ukoʃi	suko_i
#_enaka	suko_i
#_oko	#_iawase
a_a	so_it
te_uto	#_igoto
ʃiawa_e	_i
#_oʃite _a, _u, _e, _o	

Determining Allophony

Finding Complementary Distribution

Environments where [s] occurs	Environments where [ʃ] occurs
#_akana	a_itा
#_ukoʃi	suko_i
#_enaka	suko_i
#_oko	#_iawase
a_a	so_ite
te_uto	#_igoto
ʃiawa_e	_i
#_oʃite _a, _u, _e, _o	

Generalization: [ʃ] occurs when preceding [i], [s] occurs otherwise

Determining Allophony

Finding Complementary Distribution

Environments where [s] occurs	Environments where [ʃ] occurs
#_akana	a_itा
#_ukoʃi	suko_i
#_enaka	suko_i
#_oko	#_iawase
a_a	so_ite
te_uto	#_igoto
ʃiawa_e	_i
#_oʃite _a, _u, _e, _o	_i

Generalization: [ʃ] occurs when preceding [i], [s] occurs otherwise

This suggests that [s] and [ʃ] are allophones of the same phoneme

Determining Allophony

Finding Complementary Distribution

Environments where [s] occurs	Environments where [ʃ] occurs
#_akana	a_ita
#_ukoʃi	suko_i
#_enaka	suko_i
#_oko	#_iawase
a_a	so_ite
te_uto	#_igoto
ʃiawa_e	
#_oʃite	_i
_a, _u, _e, _o	

Generalization: [ʃ] occurs when preceding [i], [s] occurs otherwise

This suggests that [s] and [ʃ] are allophones of the same phoneme

s → ſ / _ i (s becomes ſ when preceding [i])

Case Study: Canadian English I

1. [k^hʌwtʃ] "couch"
2. [t^hawn] "town"
3. [braw] "brow"
4. [ʌwt] "out"
5. [əlawz] "allows"
6. [lawd] "loud"
7. [p^hʌwt] "pout"
8. [ərəwnd] "around"
9. [hʌws] "house_N"
10. [mʌwθ] "mouth_N"

[Q:] Are [aw] and [ʌw] separate phonemes, or allophones?

Case Study: Canadian English II

1. [k^hʌjt] "kite"
2. [t^hajm] "time"
3. [baj] "buy"
4. [bʌjt] "bite"
5. [lajz] "lies"
6. [lajd] "lied"
7. [p^hʌjp] "pipe"
8. [rajnd] "rind"
9. [mʌjs] "mice"
10. [mʌjt] "might"

[Q:] Are [aj] and [ʌj] separate phonemes, or allophones?

Next Time: Introduction to Semantics and Morphology

① Homework: Allophones VS Phonemes Problem Set

- Start working on the problems now, in groups
- Due next week - hand in one per group
- (Put everyone's names and student numbers on the assignment)

② Instagram Homework:

Find and post a Phonological Minimal Pair ³

³But it's like Scategories - if someone else has already posted that minimal pair, you need to find a different one for it to count!

References I

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