Ling 240

Phonetics & Phonology

Agenda

- Articulatory processes: Sounds are pronounced differently in different environments
- Using diacritics to represent other features of phones (narrow transcription)
- phones vs. phonemes
- Phonological analyses

English [p] vs. Spanish [p]

English		Spanish	
pin	[p^h]	poco	[p]
pool	[p^h]	peso	[p]
pace	[p^h]	papa	[p]
pill	[p^h]		

English [t] vs. Spanish [t]

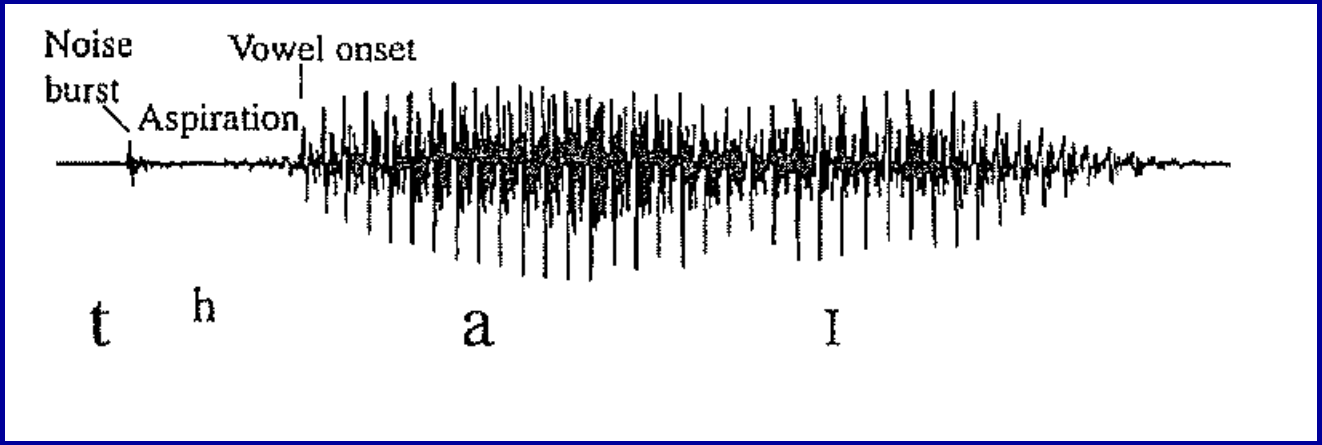
English		Spanish	
tool	[t^h]	todo	[t]
tea	[t^h]	te	[t]

Aspiration

Aspiration:

Period of voicelessness after release of the stop (before the following vowel)

Aspiration



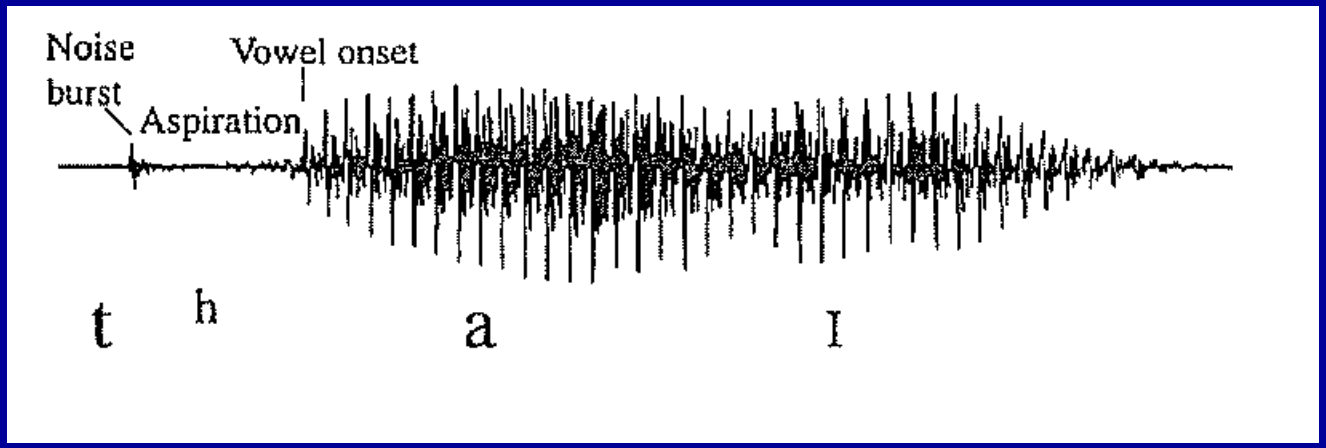
Aspiration

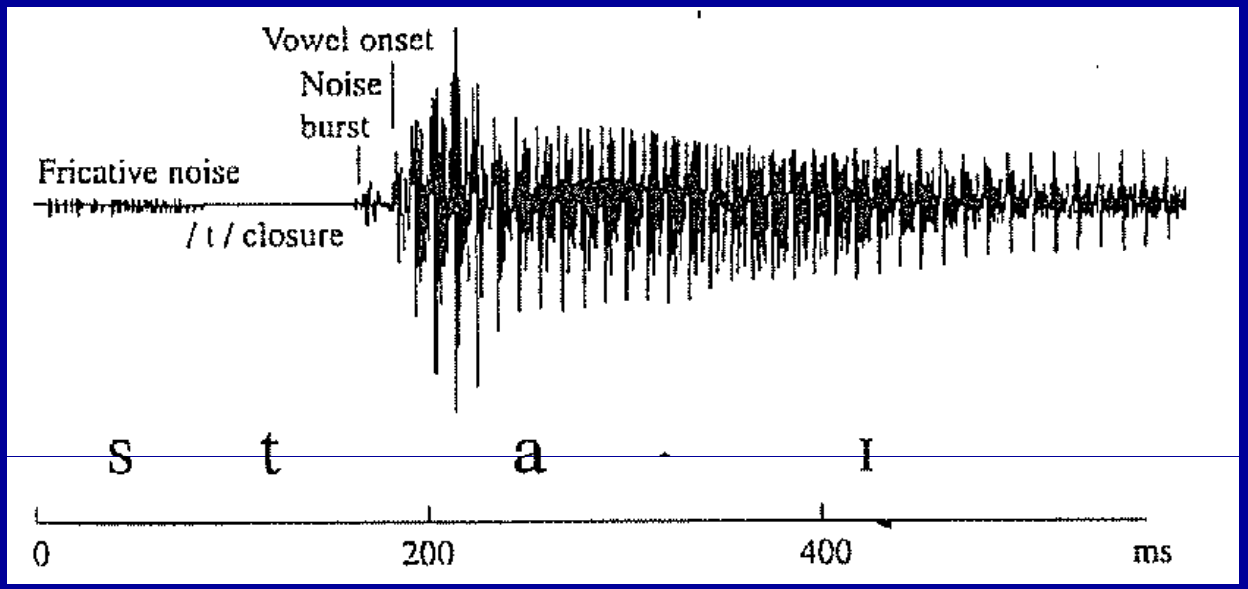
pin spin tip

Aspiration

tall	stall	bit
note	notation	attack

Aspiration


Noise
burst
Vowel onset
Aspiration
t
h
a
I


Vowel onset
Noise
burst
Fricative noise
/ t / closure
s
t
a
I
0
200
400
ms

Aspiration

[p], [t], [k]

(6) The consonants of English classified by voicing, place of articulation, and manner of articulation.

Manner of Articulation \ Place of Articulation	Bilabial		Labio-dental		Inter-dental		Alveolar		Palatal		Velar		Glottal	
Stop	p	b					t	d			k	g	ʔ	
Fricative			f	v	θ	ð	s	z	ʃ	ʒ			h	
Affricate									tʃ	dʒ				
Flap								ɾ						
Nasal		m						n				ŋ		
Lateral Liquid								l						
Retroflex Liquid								ɹ						
Glide	w̥	w								j				

State of the Glottis: Voiceless | Voiced

(Narrow) Transcription

time

tree

pot

stop

water

button

Did you transcribe them like this?

t̲ime	[taɪm]
t̲ree	[tri]
pot̲	[pɑt]
st̲op	[stɑp]
wat̲er	[wɑtər]
but̲ton	[bʌtən]

The “t” is pronounced differently in each word

time	[tʰɑɪm]
tree	[tʃri]
pot	[pʰɑt˺]
stop	[stɑp]
water	[wɑɾər]
button	[bəʔən]

The “t” is pronounced differently in each word

time	[tʰɑɪm]	aspirated
tree	[tʃri]	palatalized
pot	[pʰɑt˺]	unreleased
stop	[stɑp]	unaspirated
water	[wɑɾər]	flap (voiced)
button	[bəʔən]	glottal stop

Why are they all spelled with a “t”?

How do we store the pronunciations of "water" and "button"?

[wɑɾər] or [wɑtər]

[bəʔən] [bətən]

Hypothesis A: [wɑɾər] must be stored as a special pronunciation of “water”

Hypothesis B: the pronunciation of “t” as [ɾ] is derived by a rule

Is the pronunciation predictable?

[t^h]	[ɾ]	[ʔ]
time	water	button
top	little	kitten
table	butter	carton
	notable	

Patterns

[tʰ] occurs at the beginning of stressed syllables.

[ɾ] occurs between two vowels

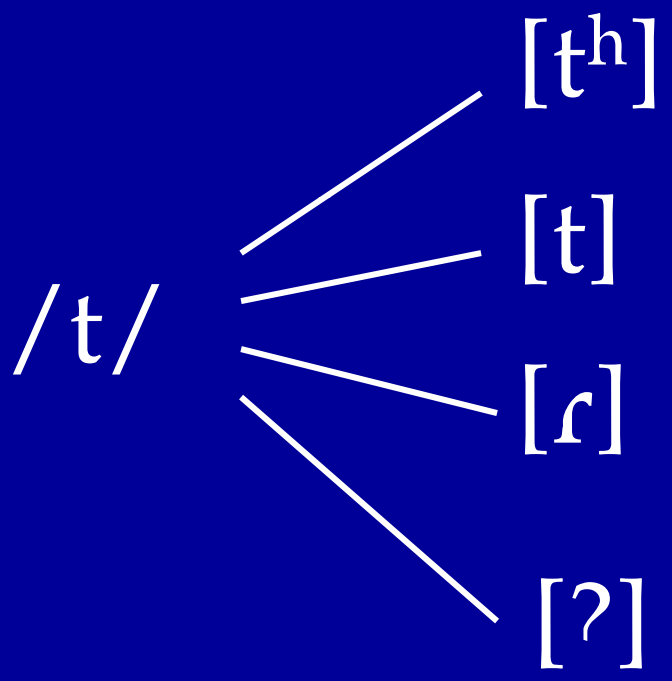
[ʔ] occurs in the middle of words before a syllabic nasal.

Articulatory Processes

- Sounds are pronounced differently in different *environments*

These are RULES in mental grammar

Different pronunciations of /t/ in English



Rules

the sound /t/ changes to [ʔ] before a syllabic nasal

/t/ → [ʔ] / _ ən

Rules

the sound /t/ changes to [ɾ] between two vowels

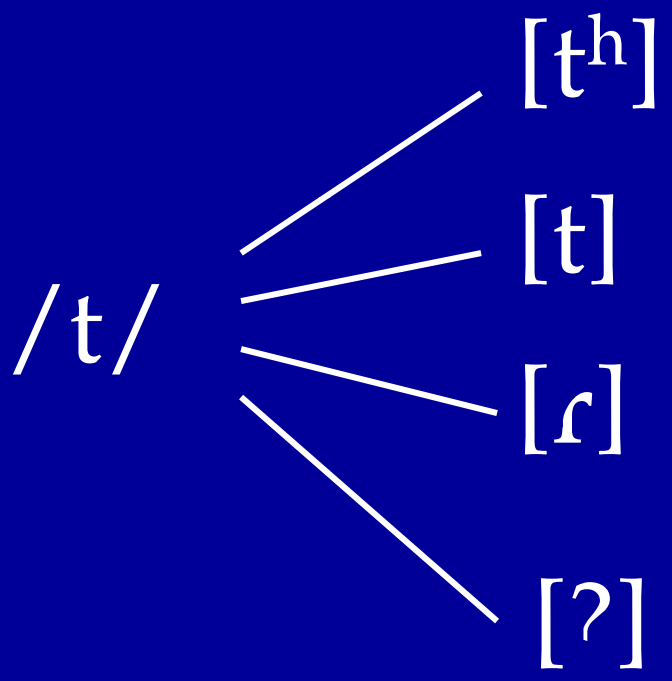
/t/ → [ɾ] / V _ V

Rules

the sound /t/ changes to [ɾ]
between two vowels

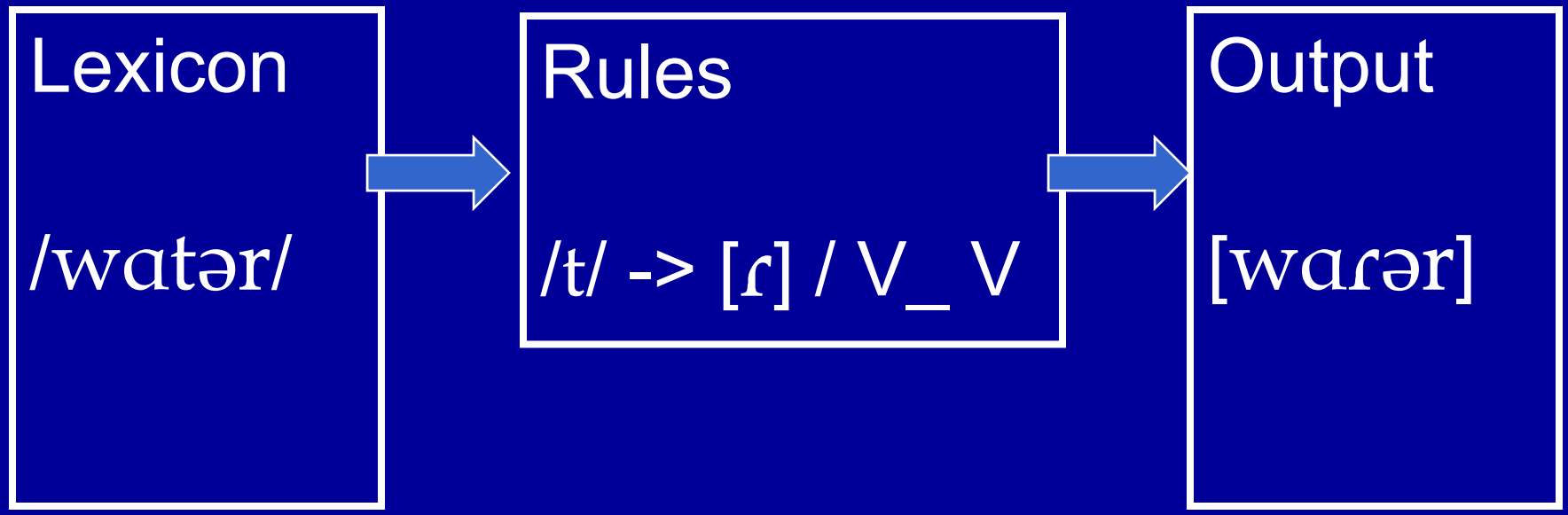
NOTE:
these are NOT rules about spelling

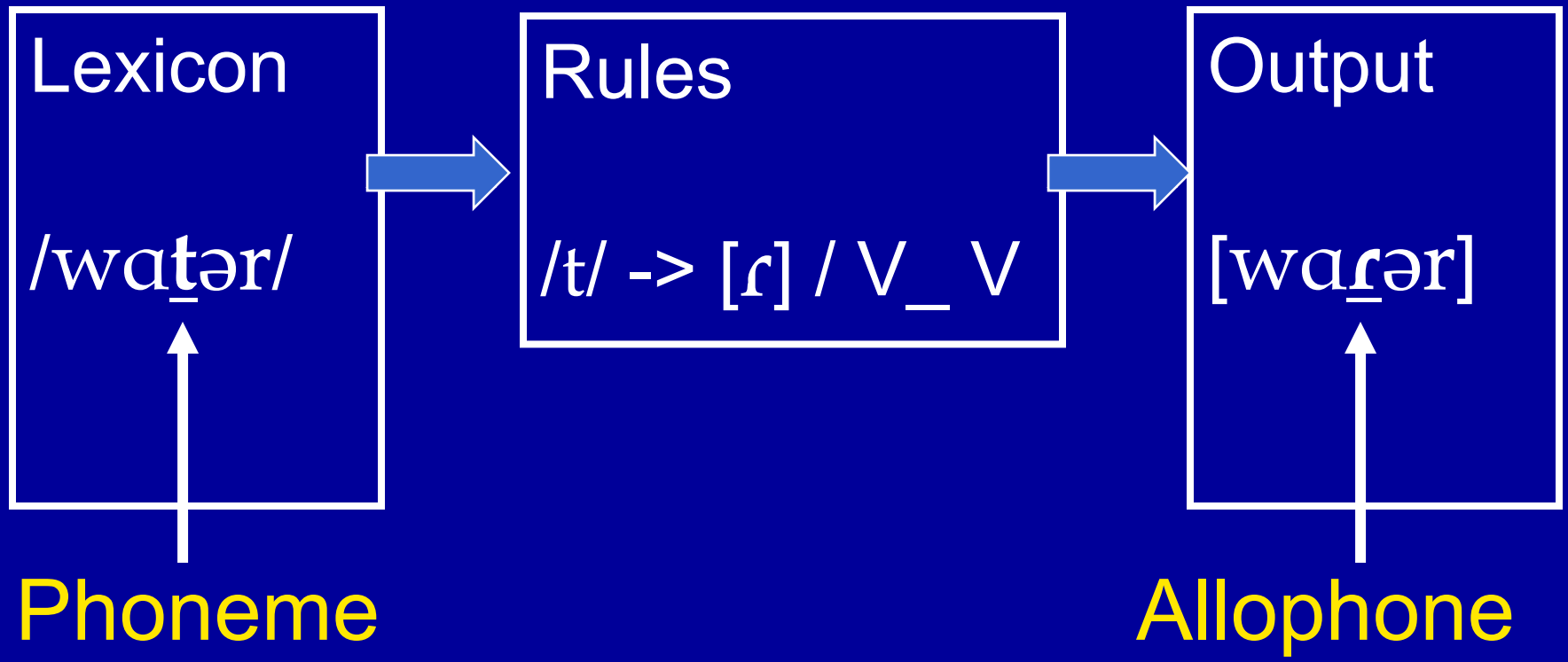
In what sense are these all the same “sound”??



The way words are stored in the Mental Lexicon

time	/taɪm/
tree	/tri/
pot	/pɑt/
stop	/stɑp/
water	/wɑtər/
button	/bʌtən/


Lexicon
/wɑtər/
Rules
/t/ -> [ɾ] / V_ V
Output
[wɑɾər]


Lexicon
/wɑt̲ər/
Rules
/t/ -> [ɾ] / V_ V
Output
[wɑɾ̲ər]
Phoneme
Allophone

Phoneme

- the abstract representation of a sound.
- the way the sound is stored in word in the mental lexicon

Allophone

- how the sound is actually produced in a given environment
- an instance of a phoneme

Articulatory Processes

- Sounds are pronounced differently in different *environments*

These are RULES in mental grammar

environment =

the phonological context of a sound

- position in the word
- neighboring sounds

Articulatory Processes are RULES

Not just automatic reflexes of the vocal tract

How do we know?

Articulatory Processes are RULES

Not just automatic reflexes of the vocal tract

How do we know?

Evidence: Different processes in different languages

e.g., “cotton” is not pronounced with [ʔ] in some dialects

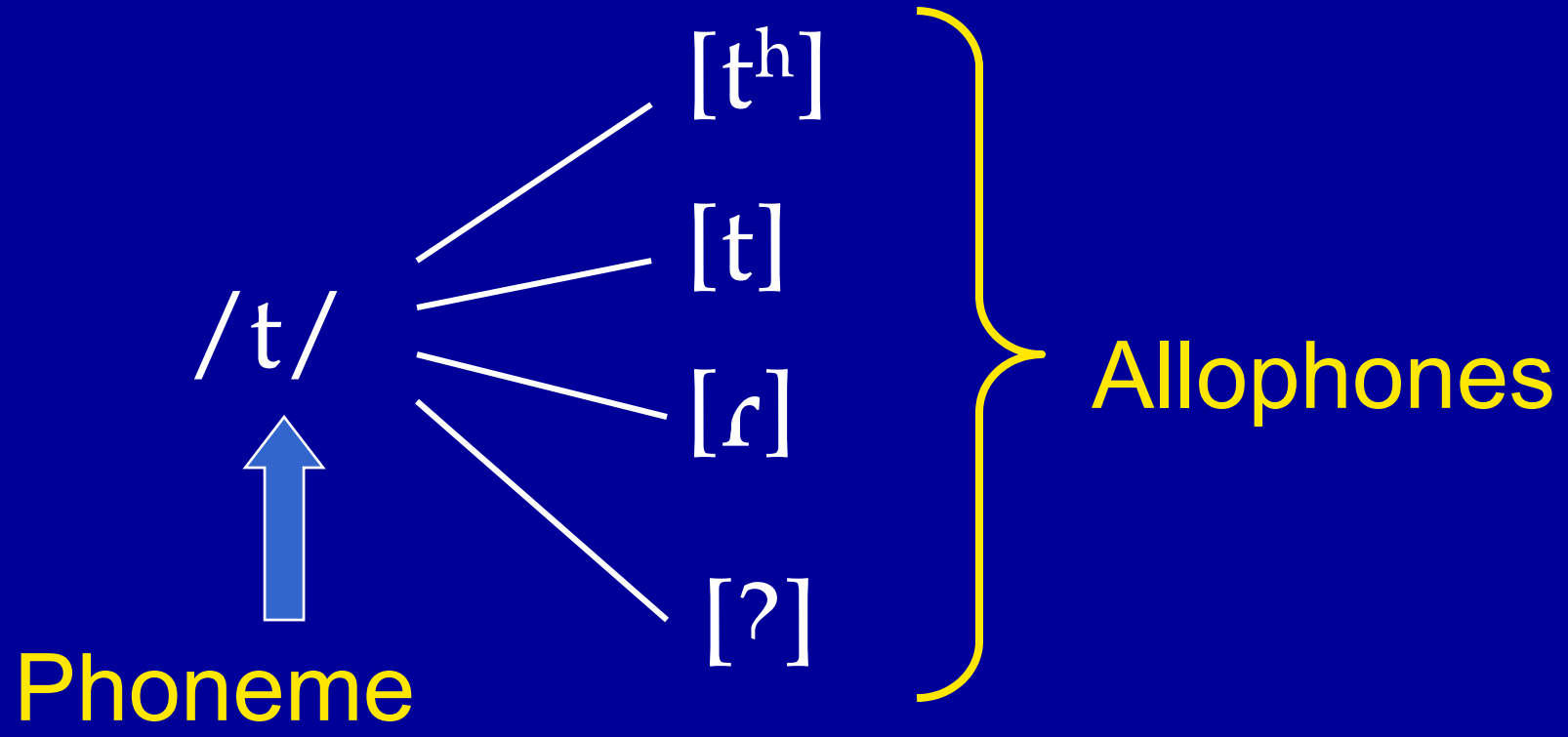
Summarizing so far…

There are RULES in mental grammar that determine the pronunciations of sounds

Building a Grammar

What is stored:		What we hear:
Lexicon		Output
/tɑɪm/	RULES	[tʰɑɪm]
/tri/		[tʃri]
/pɑt/		[pʰɑt˺]
/stɑp/		[stɑp]
/wɑtər/		[wɑɾər]
/bʌtən/		[bəʔən]

Different pronunciations of /t/ in English



Inventory of Phonemes

- Are [p] and [b] different phonemes in English?
- Two steps in finding out the phonemic status of sounds

Inventory of Phonemes

First step: look for *minimal pairs*

- if difference between sounds causes a difference in meaning => *contrastive*

=> different phonemes

Inventory of Phonemes

- Are [p] and [b] different phonemes in English?

pin vs. bin [pɪn] vs. [bɪn]

tap vs. tab [tæp] vs. [tæb]

→ **contrastive distribution**

Conclusion:

/p/ and /b/ are separate phonemes

In contrast…

[wɑɾər]

[wɑtər]

… no difference in meaning

[t^h] and [t] are **allophones** of /t/

Why?

- Lexicon – collection of Sound+Meaning pairs
- Sound information in lexical items is encoded in terms of **phonemes**
- That's why only **phonemes** affect meanings

Quick summary: Minimal pairs

- [mæp] vs. [næp]
- If a sound is used *contrastively* to create different meanings, then that sound is a *phoneme* of that language.

- [pʰɑt] vs. [pɑt]
- [pʰ] and [p] are in *complementary distribution* (cf. free variation *leap*)

Inventory of Phonemes

Second step:

If no minimal pairs, look for a pattern

(distribution of the two sounds)

- What environments does sound X occur in?
- What environments does sound Y occur in?

Exercise: making generalizations about the environments

can /k(æ)n/

I can ask	[ɑɪ kn æsk]
I can see	[ɑɪ kn si]
I can bake	[ɑɪ km beɪk]
I can play	[ɑɪ km pleɪ]
I can go	[ɑɪ kŋ goʊ]
I can gather	[ɑɪ kŋ gæðəɹ]

Generalizations

[m] occurs before a bilabial consonant

[ŋ] occurs before a velar consonant

[n] occurs everywhere else (elsewhere)

→ **Complementary distribution**

Generalizations => Rules

/n/ becomes [m] before a bilabial consonant

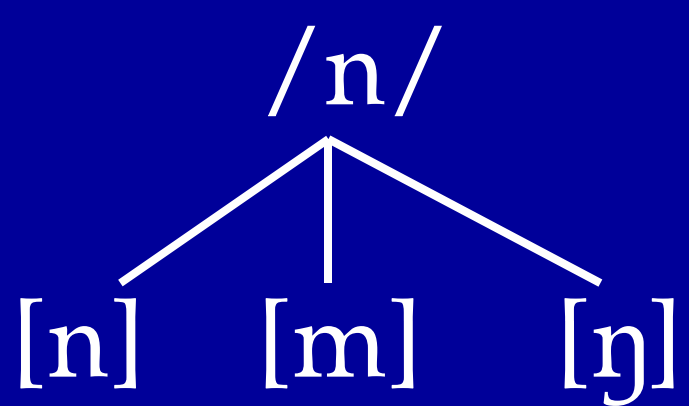
/n/ becomes [ŋ] before a velar consonant

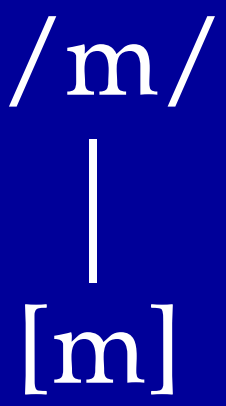
elsewhere /n/ is pronounced [n]

But don’t [m] and [n] belong to separate phonemes in English?

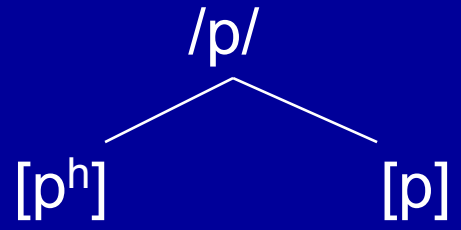
- How can you show that [m] and [n] are separate phonemes?

[m] and [n]





Quick summary: Allophones



a) ***Superman and Clark Kent***

How do we know that they are actually the same person?
→ They can NEVER occur in the same environment at the same time.

b) ***Ice, water, steam:***

Are all H_2O but have a different manifestation depending on the environment they occur in:

< 0 C	→ occurs as ice
> 0 C and < 100 C	→ occurs as water
> 100 C	→ occurs as steam

Now apply the same process to determine the grammars of other languages

Example

If we find a Minimal Pair, then the phones that differentiate them are **phonemes** in the language under investigation.

a) iglumut (to a house)
b) ukiaq (late fall)
c) aiviq (walrus)
d) aniguvit (if you leave)
e) aglu (seal's breathing hole)
f) iglumit (from a house)
g) anigavit (because you leave)
h) pinna (that one up there)
i) ani (female's brother)
j) iglu (snow house)
k) panna (that place up there)
l) aivuq (she goes home)
m) ini (place, spot)
n) ukiuq (winter)

Inuktitut

Minimal Pairs:

iglum**u**t	-	iglum**i**t
uki**a**q	-	uki**u**q
aiv**i**q	-	aiv**u**q
anig**u**vit	-	anig**a**vit
aglu	-	**i**glu
p**i**nna	-	p**a**nna
ani	-	**i**ni

So what can we conclude about phonemes in Inuktitut?

Inuktitut

Minimal Pairs:

iglum**u**t	-	iglum**i**t
uki**a**q	-	uki**u**q
aiv**i**q	-	aiv**u**q
anig**u**vit	-	anig**a**vit
aglu	-	**i**glu
p**i**nna	-	p**a**nna
ani	-	**i**ni

So what can we conclude about phonemes in Inuktitut?

[u] – [i]
[a] – [u] ⟩ form contrastive pairs
[a] – [i]

⇒ _____

Inuktitut

Minimal Pairs:

iglum**u**t	-	iglum**i**t
uki**a**q	-	uki**u**q
aiv**i**q	-	aiv**u**q
anig**u**vit	-	anig**a**vit
aglu	-	**i**glu
p**i**nna	-	p**a**nna
ani	-	**i**ni

So what can we conclude about phonemes in Inuktitut?

[u] – [i]
[a] – [u] ⟩ form contrastive pairs
[a] – [i]

⇒ these are phonemes in Inuktitut

Exercise on stating generalization

Natural class

Exercise: making generalizations about the environments

can /k(æ)n/

I can ask	[ɑɪ kn æsk]
I can see	[ɑɪ kn si]
I can bake	[ɑɪ km beɪk]
I can play	[ɑɪ km pleɪ]
I can go	[ɑɪ kŋ ɡoʊ]
I can gather	[ɑɪ kŋ ɡæðəɹ]

Generalizations => Rules

/n/ becomes [m] before a bilabial consonant

/n/ becomes [ŋ] before a velar consonant

elsewhere /n/ is pronounced [n]

Generalizations => Rules

/n/ becomes [m] before a bilabial consonant

/n/ → [m] / ___ (bi)labial consonant

/n/ becomes [ŋ] before a velar consonant

/n/ → [ŋ] / ___ velar consonant

elsewhere /n/ is pronounced [n]

/n/ → [n] / elsewhere

More data…

- hat trick [hæt tɹɪk]
- hit batsman [hɪp bætsmən]
- night class [nɑɪk klæs]

- bad dream [bæd dɹim]
- head band [hɛb bænd]
- bad guy [bæg gɑɪ]

Generalizations on /n/ => Rules

/n/ → [m] / ___ (bi)labial consonant

/n/ → [ŋ] / ___ velar consonant

/n/ → [n] / elsewhere

These rules apply to /t/ and /d/! Can you write the rules?

rules

- /n/ → [m] / ___ (bi)labial consonant
  /n/ → [ŋ] / ___ velar consonant
  /n/ → [n] / elsewhere
- /t/ → [p] / ___ (bi)labial consonant
  /t/ → [k] / ___ velar consonant
  /t/ → [t] / elsewhere
- /d/ → [b] / ___ (bi)labial consonant
  /d/ → [g] / ___ velar consonant
  /d/ → [d] / elsewhere

Back to features…

- /n/ = voiced, alveolar nasal (stop)
- /t/ = voiceless, alveolar stop
- /d/ = voiced, alveolar stop

Back to features…

- /n/ = voiced, **alveolar** nasal **(stop)**
- /t/ = voiceless, **alveolar stop**
- /d/ = voiced, **alveolar stop**

- **Are there any other alveolar stops in English?**

(6) The consonants of English classified by voicing, place of articulation, and manner of articulation.

Manner of Articulation \ Place of Articulation	Bilabial		Labio-dental		Inter-dental		Alveolar		Palatal		Velar		Glottal	
Stop	p	b					t	d			k	g	ʔ	
Fricative			f	v	θ	ð	s	z	ʃ	ʒ			h	
Affricate									tʃ	dʒ				
Flap								ɾ						
Nasal		m						n				ŋ		
Lateral Liquid								l						
Retroflex Liquid								ɹ						
Glide	w̥	w								j				

State of the Glottis: Voiceless | Voiced

- /n/, /t/ and /d/ form a **Natural Class** of alveolar stop.

Exercise

- Which phones belong to the following natural classes?
  - High vowels
  - back vowels
  - voiceless fricatives
  - voiced bilabial
  - Labial consonants

New classes

- **obstruents** – produced with an obstruction of the airflow
  - stop, fricative, affricates
- **sonorants** – produced with a relatively open passage
  - nasals, liquids, glides, and vowels

labial obstruents [p, f, b, v]

labial sonorants [m, w]

So, what kind of rules are there?

Assimilation

- /n/ → [m] / ___ (bi)labial consonant
- /n/ → [ŋ] / ___ velar consonant
- /n/ → [n] / elsewhere

- **What feature assimilates?**

Dissimilation

Greek

/epta/ → [efta]

/ktizma/ → [xtizma]

What dissimilates here?

Insertion

- Schwa insertion in English

Plural forms of…

fox, ditch, bush, orange, maze

Insertion

- Vowel insertion in loan words in Japanese

  e.g. McDonald's

  (cf. phonotactic constraints)

Deletion

- /h/ - deletion

He handed her his hat.

Exercises

For tomorrow

- LF Phonology 3.5
- Read Werker (I'll email you the paper)