



24.901/931, 2026

Introduction to Phonology

Introductions

- Amy Li ['eimi 'li]
- Donca Steriade ['dõŋka ,steri'ade]

Class work for next week

- Read: chapters 1-2 Ladefoged & Johnson 2015
(Canvas Module 2: Articulatory Phonetics)
- Problem set 1: due Tuesday, before class.
- Collaboration: check out our policy in the course description
 - ➡ work together to find the solution
 - ➡ work alone to write it up
- Assistance: we entertain questions about problem sets, we post Q&As to Canvas.

Section, optional

- Amy will run a section.
- It will reinforce main points in lecture and readings;
will give you extra practice and opportunity to explore more topics;
prepare upcoming assignments;
give feedback on graded assignments and exams.
- **Help set it up it:** answer her message with your scheduling info.

What phonologists do

The object of study

- The knowledge behind speech production/perception
- A hypothesis about its components:

Lexicon: a list of memorized units

Underlying Representations (URs).

Grammar: mechanisms that map URs to *utterances*
or *Surface Representations* (SRs).

SR $\neq$ UR.

Inferences

- Contents of lexicon and rule system can't be directly observed.
We make inferences by comparing alternative hypotheses about them.
- Today: examine inferences about a grammar generating *alternations*,
= changes in the shape of morphemes, in different contexts
- Some points previewed:
 - (i) lots of hypothetical grammars can model the observed alternations
 - (ii) learners/analysts evaluate hypotheses about URs and rules jointly
 - (iii) a standard that decides between them is absent from the overt data.
 - (iv) learners seem to have access to it.

An English alternation: $n \sim m \sim \eta \sim \mathfrak{m}$

<i>inaudible</i>	<i>impossible</i>	<i>incorrect</i>	<i>infamous</i>	<i>intangible</i>
[ɪn'ɔdəbəl]	[ɪm'pɔsəbəl]	[ɪŋkə'rekt]	['ɪnfəməs]	[ɪn'tændʒəbəl]

Other words with same prefix

<i>inexplicable</i>	<i>imbalance</i>	<i>ingratitude</i>	<i>invisible</i>	<i>independent</i>
[ɪn-]	[ɪm-]	[ɪŋ-]	[ɪɱ-]	[ɪn-]

Other prefixes: *en-*, *con-* (*contest*, *combust*, *co*[ŋ]*glomerate*); *un-* with slight differences

<i>enable</i>	<i>embody</i>	<i>engross</i>	<i>envision</i>	<i>endanger</i>
[ɪn- ~ εn]	[ɪm- ~ εm-]	[ɪŋ- ~ εŋ-]	[ɪɱ- ~ εɱ-]	[ɪn- ~ εn-]

The unanalyzable word hypothesis

- Maybe *impossible*, *incredible*, *intangible*, *invisible* are learned as simple roots.
- If no prefix, no prefix alternation. Then no clear evidence of a rule.
- *iN-corrodible?* *iN-conducive?* *iN-cohesive?*
- *iN-punitive?* *iN-placentate?* *iN-prescribable?* *iN-polarizable?*
- *iN-organizable?* *iN-diffusible?*
- Back to the prefix idea.

Hypotheses about UR of the neg. prefix (*iN-*)

		<i>inaudible</i>	<i>impossible</i>	<i>incorrect</i>	<i>infamous</i>	<i>intangible</i>
	SRs:	[ɪn'ɔdəbəl]	[ɪm'pɑsəbəl]	[ɪŋkə'ɹɛkt]	['ɪŋfəməs]	[ɪn'tændʒɪbəl]
H1.	UR	/ɪn-'ɔdəbəl/	/ɪm-'pɑsəbəl/	/ɪŋ-kə'ɹɛkt/	/'ɪŋ-fəməs/	/ɪn-'tændʒɪbəl/

H1: Each prefix alternant is separately listed in the speakers' mental lexicon, like *go* + *went*, *we* + *us*

Does H1 need rules?

Any other H beyond H1?

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H1.	UR	/ɪn-'ɒdəbl̩/	/ɪm-'pəsəbl̩/	/ɪŋ-kə'ɹɛkt/	/'ɪŋ-fəməs/	/ɪn-'tændʒɪbl̩/	Rule(s)?
H2.	UR	/ɪn-'ɒdəbl̩/	/ɪn-'pəsəbl̩/	/ɪn-kə'ɹɛkt/	/'ɪn-fəməs/	/ɪn-'tændʒɪbl̩/	Rule(s)?

H2: There's only one UR for the prefix, /ɪn/

Any other H beyond H1, 2?

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H2.	UR	/ɪn-'ɔdəbl/	/ɪn-'pasəbl/	/ɪn-kə'ɹɛkt/	/'ɪn-fəməs/	/ɪn-'tændʒɪbl/	Rule(s)?
H3.	UR	/ɪm-'ɔdəbl/	/ɪm-'pasəbl/	/ɪm-kə'ɹɛkt/	/'ɪm-fəməs/	/ɪm-'tændʒɪbl/	Rule(s)?

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H3.	UR	/ɪm-'ɒdəbl/	/ɪm-'pəsəbl/	/ɪm-kə'ɹɛkt/	/'ɪm-fəməs/	/ɪm-'tændʒɪbl/	Rule(s)?
H4.	UR	/ɪŋ-'ɒdəbl/	/ɪŋ-'pəsəbl/	/ɪŋ-kə'ɹɛkt/	/'ɪŋ-fəməs/	/ɪŋ-'tændʒɪbl/	Rule(s)?

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H5.	UR	/ɪŋ-'ɒdəbl̩/	/ɪŋ-'pəsəbl̩/	/ɪŋ-kə'ɹɛkt/	/'ɪŋ-fəməs/	/ɪŋ-'tændʒɪbl̩/	Rule(s)?

+ many more hypotheses

equivalent options for the other prefix alternations

	URs	Rules?
H1	in, im, in̩, im̩...	

Try: $x/_y =$ 'x must occur only before y',
 $x =$ a morpheme alternant

$x/_y =$ 'x must occur only before y'

	URs	Rules?
H1	$in, im, in, im \dots$	(i) $in/_V, t, d;$ (ii) $im/_p, (b), m;$ (iii) $in/_k, g;$ (iv) $im/_f, v$

$a \rightarrow b / _c$ = 'a becomes b before c'

	URs	Rules
H1	m, ɱ, ɱ̥, ɱ̥̥...	(i) m / _V, t, d; (ii) ɱ / _p, (b), m; (iii) ɱ̥ / _k, g; (iv) ɱ̥̥ / _f, v
H2	m	Each of H2-5 requires a different rule of form $N \rightarrow N' / _X$ N = the nasal we assign to the UR N' = the modified N we observe on the surface 'N becomes N' before X'
H3	ɱ	
H4	ɱ̥	
H5	ɱ̥̥	

A hypothesis in 3 parts

- (i) Suppose one of H2-5 is ‘right’ – it’s what learners adopt.
- (ii) Suppose the rule of *the right H is general*: applicable to any NX.

The other Hs generate observed *prefix* N-alternations, but don’t generalize.

- Then the basis for choosing between H1-H5: generality $\approx$ simplicity:

The preferred H derives prefix alternations as consequences of something needed independently of prefixes. The grammar of the general rule is simpler: it doesn’t need to say anything about the prefixes.

- (iii) Suppose learners look for this kind of simpler grammar.
If they have a choice, they choose that.

Predictions of the simplicity hypothesis

- If a rule $N \rightarrow N' / _X$ changes some NXs, those NXs won't surface.
These will be *gaps in SRs*: the NX sequences that the rule has changed.
A general rule will yield such gaps in all morphemes/morph combinations.

H2: its rule eliminates any nX, if X = bilabial Cs, velar Cs, labiodental Cs.
If H2 is right, and its rule is general, **np, nb, nm, nk, ng, nf, nv** should not occur

H3: its rule eliminates any mX, if X = velar, labiodental, alveolar and any mV
If H3 is right, **mk, mg, mf, mv, mt, md, mV** should be out

H4: its rule eliminates any ηX, if X = labial, labiodental, alveolar and any ηV
If H3 is right, **ηp, ηb, ηf, ηv ηt, ηd, ηV** should be out

The equivalent for H5

Summary

H2: predicts **np, nb, nm, nk, ng, nf, nv** do not occur

H3: predicts **mt, md, mn, mk, mg, mf, mv, mV** do not occur

H4: predicts **ηt, ηd, ηn, ηp, ηb, ηm, ηf, ηv, ηV** do not occur

H5: predicts **ηt, ηd, ηn, ηp, ηb, ηm, ηk, ηg, ηV** do not occur

Testing the Hs (searches in Oxford English Dict. online, simple words)

H2: **np, nb, nm, nk, ng, nf, nv** do not occur

☞ Some predictions check out: **np, nb, nm** unattested except in complex words.

☞ Some don't: **nf, nk, nf** are found in spelling, but H2 has a defense: _____

H3: **mt, md, mn, mk, mg, mf, mv, mV** do not occur

☞ Some predictions check out: ***mk, *mg** unattested/rare, exc. complex words.

☞ Major wrong prediction: ***mV** is fine. **H3 can't be general.**

☞ Also wrong: ***mt, *md** are fine (*femto-*, *humdrum*).

H4: **ɲt, ɲd, ɲn, ɲp, ɲb, ɲm, ɲf, ɲv, ɲV** do not occur

☞ Most predictions check out

☞ Except ***ɲm** (*angma* [ɛɲmə]) and ***ɲV** (*Hingham* [hɪɲəm]).

Also, a simpler hypothesis is possible that erases this advantage of H4. _____

H5: **ɱt, ɱd, ɱn, ɱp, ɱb, ɱm, ɱk, ɱg, ɱV** do not occur

☞ Most predictions check out

But another simple hypothesis eliminates H5's advantage. _____

Summary

- H2 favors prefix URs /ɪn/, /ɛn/, /kɔn/ etc. over other choice of N
- H2 is superior to others: it uses a simpler grammar, with a general rule needed in all English nC sequences
- But H2 is attractive only if learners also use this standard of simplicity in choosing between grammars.
- There's likely no overt evidence for this standard in overt linguistic data. But maybe learners use it nonetheless.

Preliminary evidence speakers converge on H2

Is this utterance ambiguous?

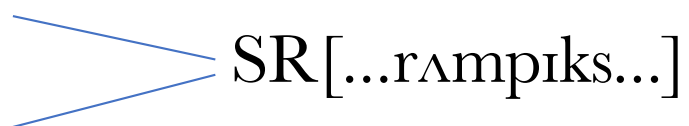
[əkwɪkrʌmpɪksjuʌp]

Gaskell and Marslen-Wilson 2001

UR₁ /...rʌm pɪks.../

UR₂ /...rʌn pɪks.../

SR[...rʌmpɪks...]



If you said /run/ is an option,
what was the reasoning?

Lots of ambiguous utterances

- | | |
|---|-----------------------------|
| a. The manager was at the phone packaging department | [fəʊn p...] ~ [fəʊm p...] |
| b. The manager was at the foam packaging department | [fəʊm p...] |
| | |
| a. An article about the bride made the local paper | [braɪd m...] ~ [braɪb m...] |
| b. An article about the bribe made the local paper | [braɪb m...] |
| | |
| a. They got the lead covered immediately | [led k...] ~ [leg k...] |
| b. They got the leg covered immediately | [leg k...] |

Lots of ambiguous utterances

a. She threw the **bean** promptly on the ground.

[bɪn p...] ~ [bɪm p...]

b. She threw the **beam** promptly on the ground.

[bɪm p...]

a. It was a rather **worn** blanket.

[wɔrn b...] ~ [wɔrm b...]

b. It was a rather **warm** blanket.

[wɔrm b...]

a. Unfortunately, the **ban** caused havoc.

[bæn k...] ~ [bæŋ k...]

b. Unfortunately, the **bang** caused havoc.

[bæŋ k...]

a. The role of the **gun** peddlers has never been in doubt.

[gʌn p...] ~ [gʌm p...]

b. The role of the **gum** peddlers has never been in doubt.

[gʌm p...]

Different Ns in different contexts

alveolar n	_Vs	en-act	en-able
	_h	en-hance	en-harmonic
	_alveolar Cs	e[nt]angle	e[nd]ure
dental ɲ^*	_dental Cs	e[$\text{ɲ}\theta$]rone	e[$\text{ɲ}\theta$]rall
labial m	_ bilabial Cs	e[mp]ower	e[mb]ody
labiodental ɱ^*	_ labiodentals	e[ɱv]ision	e[ɱf]eeble
velar ŋ^*	_ velars	e[ŋk]ounter	e[ŋg]rave

* Assimilation is optional

Place assimilation

Place: point in the vocal tract where an obstruction is formed

E.g.: place of *p*, *b* is *bilabial*; place of *t*, *d* is *alveolar*.

m, *p*, *b* have the same place; it's different from *n*, *t*, *d*, *s*, *θ*, *l* etc.

Assimilation: speech sounds that differ in a property P become identical for P

E.g.: *np* → *mp*: *n* assimilates to *p* in place

Place assimilation: assimilation in place properties, or *place features*

Place assimilation in compounds and phrases*

alveolar n	_Vs	ten ads
	_h	ten hats
	_alveolar Cs	ten days
dental ŋ	_dental Cs	te[$\text{ŋ}\theta$]eories
labial m	_ bilabial Cs	te[mp]ounds
labiodental ɱ	_ labiodentals	te[ɱf]aces
velar ŋ	_ velars	te[ŋk]inds

* Assimilation is optional in all these cases

Not all English Cs assimilate

•

velar ŋ

_Vs

si[ŋ] a song

_alveolar Cs

si[ŋ] ten, *si[n t]en

_dental Cs

si[ŋ ð]is, *si[n ð]is

_bilabial Cs

si[ŋ p]oorly *si[mp]oorly

_labiodentals

si[ŋ f]ive, *si[mf]ive

_velars

si[ŋ k]arols

Not all English Cs assimilate

•

	_Vs	[neim] a song
	_alveolar Cs	[neim] ten, *[neint]en
bilabial m	_dental Cs	[neimð]is, *[neim̥ð]is
	_ bilabial Cs	[neim] poorly
	_ velars	[neim] games, *[neimɣ]ames

Word internal unassimilated mC

- Unchanged [md] in *rimmed*, *combed* etc. *[nd]
- Unchanged [mt] in *Amtrack*, *femto-*, *[nt]
- Unchanged [mθ] in *warmth*, *[nθ]

But no *unassimilated* np, nb

- No [np], [nb] morpheme internally
- No words like **linp* **sanbo*

Thus far

- English place assimilation targets only *alveolar* consonants.
- It can apply to oral alveolar stops, in faster, casual speech
(*bride made* → *bri[b] made*)
- It's most likely to apply to *alveolar nasals in the same word*
unassimilated *bri[d m]ade*, *A[tk]ins* are ok
unassimilated **linp* **inpossible* not ok
- Plus further restrictions.

Writing the place assimilation rule: a first pass

- $\rightarrow$ = 'becomes', 'changes into'
- $A \rightarrow B / C_D$ A = *target*; B = the *modified A*, or *output* of the rule.
- $/C_D$ = in the *context of C_D*, after C and before D
- $n \rightarrow m / _ \{p, b\}$
‘Any n becomes an m (bilabial), before p, b (also bilabial)’.
- $n \rightarrow m / _ \{p, b\}; n \rightarrow \eta / _ \{k, g\}; n \rightarrow \eta / _ \{f, v\};$
‘Any n becomes’?

Variables over feature values

alveolar nasal $\rightarrow$ bilabial/_bilabial
 $\rightarrow$ labiodental/_labiodental
 $\rightarrow$ velar/_velar

alveolar nasal $\rightarrow$ α place/ _ consonant, α place
 α = variable over all values of the place property
place = {bilabial, dental, alveolar, palatal, velar}

To be continued Thursday

Appendix 1

Gaskell & Marslen-Wilson's 2001 results

Prime	Stimulus	Reaction Time (ms)	Error rate
... <i>run</i> does ...	<i>run</i>	513 (25)	2.5
... <i>rum</i> picks...	<i>rum</i>	512 (26)	1.6
... <i>rum</i> picks...	<i>run</i>	522 (16)	4.0
... <i>run</i> does...	<i>rum</i>	561 (2)	11.0
Control	<i>run</i>	538	4.2
	<i>rum</i>	563	5.3

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