

Variation and Phonological Theory: An Introduction
Arto Anttila
January 4, 2005

(1) Some pre-theoretical notions:

- VARIATION = one meaning, many forms, e.g. *cost*~*cos'* 'cost'. The converse of variation is AMBIGUITY.
- Variation WITHIN vs. ACROSS individuals: the same individual uses different forms at different times vs. different individuals use different forms.
- EXTERNAL vs. INTERNAL conditioning: the use of variants is a function of sex, age, style, register, social class, etc. (sociolinguistics) vs. the use of variants is a function of phonology, morphology, syntax, semantics, and the lexicon.
- ALTERNATION vs. VARIATION: The choice between variants is vs. is not fully determined by the context. Example: *permít* (verb) vs. *pérmit* (noun) is an instance of alternation, not variation. However, *ímport*~*impórt* (verb) and *détail*~*detáil* (noun) (Merriam-Webster, <http://www.m-w.com/cgi-bin/dictionary>) qualify as variation. Diachronically, the boundary between variation and alternation is in constant flux.

1 Two examples of internal conditioning

- (2) English *t,d*-deletion, e.g. *cost me*~*cos' me*.
- (3) *t,d*-deletion rate: the following segment effect (Celeste S., Philadelphia, word-final clusters only). Figures from Labov 1997.

FOLLOWING SEGMENT		FOLLOWING SEGMENT	
stop	78 %	/l/	40 %
/w/	68 %	pause	17 %
fricative	65 %	vowel	16 %
nasal	57 %	/r/	7 %
/h/	45 %	/y/	5 %

- (4) *t,d*-deletion rate: the morphological effect. Figures from Guy 1994.

MORPHOLOGY	Guy 1991b	Santa Ana 1992
Monomorphemes (<i>cost</i>)	38.1 %	57.9 %
Irregular past (<i>lost</i>)	33.9 %	40.7 %
Regular past (<i>tossed</i>)	16.0 %	25.7 %

- (5) Colloquial Helsinki Finnish vowel coalescence (Paunonen 1995, Anttila in press).

má.ke.a~má.kee ‘sweet’
 lá.si.-a~lá.sii ‘glass-PAR(TITIVE)’

Rule: $V_1.V_2 \rightarrow V_1$: where V_1, V_2 are unstressed and V_2 is [+low]

- (6) OH: Millasii ihmisii siel käy judoomassa?
 /millas-i-a/, /ihmis-i-ä/, /judoa-ma-ssa/
What sort of people practise judo there?
 JS: Siel käy iha, nuoria ja vanhojaki.
 /nuor-i-a/
Some are really young, but there are old people too.
 OH: Miehiä naisia?
 /mieh-i-ä/, /nais-i-a/
Men? Women?
 JS: Joo miehii ja naisia.
 /mieh-i-ä/, /nais-i-a/
Yes, men and women.
- (7) a. Coalescence is favored in mid-low sequences (/ea/, /oa/, /öä/) and disfavored in high-low sequences (/ia/, /ua/, /yä/) (Paunonen 1995).
 b. Coalescence is favored in derived environments and disfavored in roots (Anttila in press).
 c. Coalescence is favored in adjectives and disfavored in nouns (Anttila in press).

- (8) Vowel coalescence rate by environment (based on 126 speakers, approximately 13,000 coalescence environments).

			/ea/	/ia/	EXAMPLES
a.	Noun	Root	14.8%	0%	hopea, rasia
	Noun	Derived	41.0%	20.0%	suome-a, lasi-a
	Adjective	Root	72.4%	0%	makea, kauhia
	Adjective	Derived	–	30.2%	–, uus-i-a
			Derived	Root	
b.	Noun	/ia/	20.0%	0%	lasi-a, rasia
	Noun	/ea/	41.0%	14.8%	suome-a, hopea
	Adjective	/ia/	30.2%	0%	uus-i-a, kauhia
	Adjective	/ea/	–	72.4%	–, makea
			Adjective	Noun	
c.	Root	/ia/	0%	0%	kauhia, rasia
	Root	/ea/	72.4%	14.8%	makea, hopea
	Derived	/ia/	30.2%	20.0%	uus-i-a, lasi-a
	Derived	/ea/	–	41.0%	–, suome-a

hopea ‘silver’, *rasia* ‘box’, *makea* ‘sweet’, *kauhia* ‘terrible’, *suome-a* ‘Finnish-PAR’, *lasi-a* ‘glass-PAR’, *uus-i-a* ‘new-PL-PAR’.

- (9) The vowel effect in different age groups:

			OLD		MIDDLE-AGED		YOUNG	
noun	within m.	EA	3.3%	(1/30)	18.2%	(4/22)	50%	(4/8)
		IA	0%	(0/337)	0%	(0/263)	0%	(0/247)
noun	across m.	EA	24.3%	(65/267)	30.5%	(60/197)	67.2%	(168/250)
		IA	7.8%	(147/1,886)	11.4%	(182/1,597)	43.5%	(685/1,576)
adj	within m.	EA	49.3%	(242/491)	64.9%	(334/515)	93.0%	(687/739)
		IA	0%	(0/80)	0%	(0/100)	0%	(0/81)
adj	across m.	EA	–	–	–	–	–	–
		IA	9.6%	(146/1,519)	16.8%	(220/1,308)	64.2%	(923/1,437)

- (10) The morpheme boundary effect in different age groups:

			OLD	MIDDLE-AGED	YOUNG
noun	EA	across m.	24.3% (65/267)	30.5% (60/197)	67.2% (168/250)
		within m.	3.3% (1/30)	18.2% (4/22)	50% (4/8)
noun	IA	across m.	7.8% (147/1,886)	11.4% (182/1,597)	43.5% (685/1,576)
		within m.	0% (0/337)	0% (0/263)	0% (0/247)
adj	EA	across m.	–	–	–
		within m.	49.3% (242/491)	64.9% (334/515)	93.0% (687/739)
adj	IA	across m.	9.6% (146/1,519)	16.8% (220/1,308)	64.2% (923/1,437)
		within m.	0% (0/80)	0% (0/100)	0% (0/81)

- (11) The part-of-speech effect in different age groups:

			OLD	MIDDLE-AGED	YOUNG
within m.	EA	adj	49.3% (242/491)	64.9% (334/515)	93.0% (687/739)
		noun	3.3% (1/30)	18.2% (4/22)	50% (4/8)
within m.	IA	adj	0% (0/80)	0% (0/100)	0% (0/81)
		noun	0% (0/337)	0% (0/263)	0% (0/247)
across m.	EA	adj	–	–	–
		noun	24.3% (65/267)	30.5% (60/197)	67.2% (168/250)
across m.	IA	adj	9.6% (146/1,519)	16.8% (220/1,308)	64.2% (923/1,437)
		noun	7.8% (147/1,886)	11.4% (182/1,597)	43.5% (685/1,576)

2 What should a phonological theory of variation explain?

- THE LOCUS OF VARIATION. Why does variation occur in just this environment? For example, why does English *t/d*-deletion occur in complex codas, but not in complex onsets (*train*~**rain*, *star*~**sar*)?
- THE SHAPES OF VARIANTS. What determines the phonological shapes of the variants? For example, why are complex codas resolved by *t/d*-deletion instead of vowel epenthesis (*lost*~**los*[ə]*t*) or fricative deletion (*lost*~**lot*)?
- THE DEGREES OF VARIATION. How can we explain quantitative effects that reflect syllable structure, segment quality, vowel height, morphological constituency, part of speech, etc? For example, why is *t/d*-deletion more common before consonants than before vowels, more common after *s* (*cost*) than after *f* (*lift*), and more common in roots (*cost*) than affixes (*tossed*)?

- UNIVERSALS AND LANGUAGE-PARTICULARS OF VARIATION. Why are some aspects of variation invariant across dialects, but others vary from dialect to dialect? For example, in all dialects, *t/d*-deletion is more common before consonants than before vowels. In some dialects, *t/d*-deletion is more common before pauses than before vowels; in other dialects we find the opposite pattern.
- MARKEDNESS. How are the loci and degrees of variation related to the cross-linguistic issues of naturalness or markedness?
- INTERFACES. How do phonological, morphological and lexical factors interact in variation (morphological and lexical conditioning)?
- EXTERNAL FACTORS. How do internal factors interface with external factors in variation?
- LANGUAGE CHANGE. Why do some cases of variation linger for centuries without very much change, while others move, quickly or slowly, towards a categorical resolution? (Lieberman 1994:1).

3 Variation in standard OT

3.1 Tied violations

- (12) Two or more candidates incur exactly the same violations with respect to all the constraints in the grammar.
- (13) Example: Variable stress in Walmatjari (Hudson and Richards 1969, Hammond 1994)
- In all two-syllable words, main stress falls on the first syllable.
 - In words with three syllables, main stress may fall on the first or second syllable, with most words showing variable pronunciation.
 - In words with four syllables, main stress may fall on the first or second syllable, with some words showing variable pronunciation.
- (14) a. yápa ‘child’
pálma ‘creek’
b. máṅalu~maṅálu ‘we (pl. excl.)-him’
yútanti~yutánti ‘sit’
c. páljmanàna~paljmánana ‘touching’
ṭuṅmanàna~ṭuṅmánana ‘burying’

(15) Constraints:

- a. TROCH Feet are left-headed (trochaic).
- b. FTBIN Feet are binary.
- c. *LAPSE No sequences of two unfooted syllables.

(16) Disyllables: No variation

	/yapa/	TROCH	FTBIN	*LAPSE
a.	yapa			*!
b.	⇒ (yápa)			
c.	ya(pá)		*!	
d.	(yá)(pá)		*!*	
e.	(yapá)	*!		

(17) Trisyllables: Variation

	/yutanti/	TROCH	FTBIN	*LAPSE
a.	yutanti			*!*
b.	⇒ (yútan)ti			
c.	⇒ yu(tánti)			
d.	yutan(tí)		*!	*
e.	(yú)(tánti)		*!	
f.	(yú)tan(tí)		*!*	
g.	yu(tán)(tí)		*!*	
h.	(yú)(tán)(tí)		*!***	
i.	yu(tantí)	*!		

(18) Problems:

- Identical violation profiles seem difficult to achieve.
- No way of modelling degrees of variation.

3.2 Pseudo-optionality

(19) Each variant is a different lexical entry (variation as linguistic free will).

(20) Colloquial Helsinki Finnish

- a. /makea/ 'sweet'
- b. /makee/ 'sweet, colloquial, most typically uttered by a young working-class female'

(21) Problems:

- If variation is reducible to optionality at the point of lexical insertion, then it is not clear how phonological effects (locus and degrees of variation) can be modelled.
- The “meaning difference” of type *makea* vs. *makee* are thoroughly systematic, recurring in hundreds of lexical items, and thus do not support positing distinct lexical entries.

4 The Multiple Grammars Theory

4.1 The idea

(22) Variation arises from the competition of distinct grammatical systems within an individual, see e.g. Kiparsky 1993, Kroch 1989, Kroch 1994.

(23) That an individual can simultaneously possess several grammars is uncontroversial in multilingualism, but how far can we go?

- (a) different languages, different grammars
- (b) different dialects (of the same language), different grammars?
- (c) different styles/registers, different grammars??
- (d) “free” variation, different grammars???

(24) More importantly, how can we even begin to address this question? “The grammar of a language is a specific constraint ranking. [...] The ranking in a particular language is, in theory, a total ordering of a set of universal constraints.” (McCarthy 2002:6) The problem: Notions like “language”, “dialect”, etc. are not well-defined, or given in nature.

(25) How to proceed?

- Adopt an explicit theory of grammar.
- Combine this theory with the Multiple Grammars Theory.
- Work out the predictions in special cases.
- Check whether these predictions are empirically supported.

(26) In working with the Multiple Grammars Theory, we need to answer three questions:

- (a) What are the possible grammars?
- (b) What types of variation are predicted by combining possible grammars?
- (c) How well do the predicted types of variation match the attested types?

(27) Example:

INPUT	TABLEAU	OUTPUT
a. /mist/	ONSET \gg *CxCoD \gg MAX(C)	[mis]
b. /mist/	ONSET \gg MAX(C) \gg *CxCoD	[mist]
c. /mist/	MAX(C) \gg ONSET \gg *CxCoD	[mist]

(28) A QUANTITATIVE INTERPRETATION OF MULTIPLE GRAMMARS. The number of grammars that generate a particular output is proportional to the relative frequency of this output.

(29) Common objections to the Multiple Grammars Theory:

- The number of grammars per individual becomes implausibly large (Reynolds 1994, Guy 1997).
- Overgeneration: If any combination of tableaux is a possible grammar, we run the risk that any kind of variation, including any kind of frequencies, can be modelled.

4.2 English *t/d*-deletion (based on Kiparsky 1993)

(30) Assumption (following Liberman 1994): Define a grammar as a set of input/output pairs where for every input there is some fixed output.

(31) Inputs and outputs:

Inputs: /cost##V/, /cost##C/
 Outputs: [cost.X], [cos.tX], [cos.X]

(32) The nine possible grammars (the naïve model). Some of the predicted dialects are linguistically plausible, others are not.

	<i>/cost##V/</i>	<i>/cost##C/</i>	
1.	<i>cost.V</i>	<i>cost.C</i>	complex coda, complex coda
2.	<i>cost.V</i>	<i>cos.tC</i>	complex coda, resyllabification
3.	<i>cost.V</i>	<i>cos.C</i>	complex coda, <i>t</i> -deletion
4.	<i>cos.tV</i>	<i>cost.C</i>	resyllabification, complex coda
5.	<i>cos.tV</i>	<i>cos.tC</i>	resyllabification, resyllabification
6.	<i>cos.tV</i>	<i>cos.C</i>	resyllabification, <i>t</i> -deletion
7.	<i>cos.V</i>	<i>cost.C</i>	<i>t</i> -deletion, complex coda
8.	<i>cos.V</i>	<i>cos.tC</i>	<i>t</i> -deletion, resyllabification
9.	<i>cos.V</i>	<i>cos.C</i>	<i>t</i> -deletion, <i>t</i> -deletion

(33) Enrich the model by the following constraints:

- *CXCOD No coda clusters.
- *CXONS No onset clusters.
- ONSET Onsets are required.
- MAX(*t*) No *t*-deletion.
- ALIGN Morpheme and syllable boundaries coincide.

(34) Given these five constraints, Optimality Theory and the Multiple Grammars Theory, what patterns are predicted? Options:

- We continue to predict all the nine logically possible patterns.
- Some of the nine logically possible patterns are excluded. Three scenarios: (i) The model rules out all the linguistically unnatural (hence unattested) patterns, and keeps all the natural (including attested) patterns; (ii) The resulting pattern is more or less random; (iii) The model rules out all the right patterns and keeps all the wrong ones.

(35) To figure out the predictions, we must take all the possible tableaux and apply them to all the possible inputs:

- Five constraints can be ranked in $5! = 5 \times 4 \times 3 \times 2 \times 1 = 120$ possible ways (FACTORIAL TYPOLOGY).
- Two inputs: */cost##V/* (the pre-vocalic environment) and */cost##C/* (the pre-consonantal environment).
- Result: We must check 240 tableaux.

(36) A sample tableau. “.” = syllable boundary, | = morpheme boundary

	/cost## V/	*CxONS	*CxCOD	ONSET	ALIGN	MAX(t)
1a.	cost .V		*!	*		
1b.	cos .V			*!		*
1c.	⇒ cost.t V				*	
	/cost## C/					
2a.	cost .C		*!			
2b.	⇒ cos .C					*
2c.	cost.t C	*!			*	

(37) The overall result. [See Assignment 1]

	/cost## V/	/cost## C/	
1.	cost.V	cost.C	complex coda, complex coda
4.	cos.tV	cost.C	resyllabification, complex coda
5.	cos.tV	cos.tC	resyllabification, resyllabification
6.	cos.tV	cos.C	resyllabification, <i>t</i> -deletion
9.	cos.V	cos.C	<i>t</i> -deletion, <i>t</i> -deletion

(38) The number of tableaux predicting each output

	_V	_C	_V%	_C%
resyllabification	70	20	58%	17%
complex coda	25	50	21%	42%
<i>t</i> -deletion	25	50	21%	42%

(39) Some predictions that should hold true in all dialects:

- (a) The frequency of preconsonantal deletion is at least as high as the frequency of prevocalic deletion (universal).
- (b) The frequency of prevocalic resyllabification is at least as high as the frequency of preconsonantal resyllabification (universal).
- (c) The frequency of preconsonantal complex coda is at least as high as the frequency of prevocalic complex coda (universal).

(40) Note that these predictions will hold no matter how many grammars an individual has, even if we allow multiple copies of the same grammar. The Multiple Grammars Theory seems pretty restrictive. [See Assignment 2]

(41) Some excluded dialects:

- Dialect 8: pre-vocalic deletion (*cos.Anna*) and pre-consonantal resyllabification (*cos.tme*).
- Dialects with invariant pre-vocalic deletion (*cos.Anna*) and variable pre-consonantal deletion (*cos.me*~*cost.me* or *cos.me*~*cos.tme*).
- Dialects where deletion is more frequent pre-vocalically than pre-consonantly.

(42) A remaining odd prediction: The model predicts variable dialects without a consonant/vowel asymmetry. Such a dialect can be obtained by combining tableaux of types 1, 5 and 9.

(43) Incorporating morphological effects:

		*CxCOD _{root}	*CxCOD _{stem}	*CxCOD _{word}
1a.	cost	*	*	*
1b.	cos			
2a.	los+t		*	*
2b.	los			
3a.	toss#t			*
3b.	toss			

(44) How to refute the Multiple Grammars Theory:

- Show that the model is too powerful, i.e. demonstrate that the model predicts systematically unattested types of variation.
- Show that the model is too weak, i.e. document cases of variation that cannot be captured in the Multiple Grammars Theory under reasonable linguistic assumptions.

5 Partially ordered grammars

5.1 English *r*

(45) Eastern Massachusetts dialect (McCarthy 1993)

	SPAR, TUNER, YOU'RE	SPA, TUNA, YAW
(a)	The spa< r > seems to be broken. He put the tune< r > down. You'< r >e somewhat older.	The spa seems to be broken. He put the tuna down. The boat tends to yaw some.
(b)	The spar is broken. He put the tuner away. You're a little older.	The spa[r] is broken. He put the tuna[r] away. The boat'll yaw[r] a little.

<**r**> = *r* has been deleted.

[**r**] = *r* has been inserted.

(46) The basic generalizations:

- (a) *r* is deleted before a consonant (*tune*<**r**> *down*)
r is retained before a vowel (*tuner away*)
- (b) *r* is inserted before a vowel (*tuna*[**r**] *away*)
r is not inserted before a consonant (*tuna down*).

(47) More generally: [r] is favored before a vowel (retained, inserted), but disfavored before a consonant (deleted, not inserted).

(48) Even more generally: English likes onsets and dislikes codas. In fact, this seems universally true.

(49) Three dialects (Trudgill and Hannah 1985)

<i>far behind</i>	<i>saw it</i>	Ireland, Scotland, Canada, US Mid West
<i>fa</i> < <i>r</i> > <i>behind</i>	<i>saw it</i>	South Africa, US South East
<i>fa</i> < <i>r</i> > <i>behind</i>	<i>saw</i> [<i>r</i>] <i>it</i>	East New England, Southern England, Australia, NZ
<i>far behind</i>	<i>saw</i> [<i>r</i>] <i>it</i>	no such dialects

(50)

	Dialect A	FAITH	*CODA	ONSET
a. ⇒	Wanda left			
	Wanda[r] left	*!	*	
b. ⇒	Homer left		*	
	Home< r > left	*!		
c. ⇒	Wanda arrived			*
	Wanda[r] arrived	*!		
d. ⇒	Homer arrived			
	Home< r > arrived	*!		*

Dialect B		*CODA	FAITH	ONSET
a.	⇒ Wanda left			
	Wanda[r] left	*!	*	
b.	Homer left	*!		
	⇒ Home<r> left		*	
c.	⇒ Wanda arrived			*
	Wanda[r] arrived		*!	
d.	⇒ Homer arrived			
	Home<r> arrived		*!	*

Dialect C		*CODA	ONSET	FAITH
a.	⇒ Wanda left			
	Wanda[r] left	*!		*
b.	Homer left	*!		
	⇒ Home<r> left			*
c.	Wanda arrived		*!	
	⇒ Wanda[r] arrived			*
d.	⇒ Homer arrived			
	Home<r> arrived		*!	*

(51) A totally ranked grammar:

Ranking: (a) *CODA ≫ ONSET (b) *CODA ≫ FAITH (c) ONSET ≫ FAITH

Tableau:

*CODA	ONSET	FAITH
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(52) A partially ranked grammar:

Ranking: (a) *CODA ≫ ONSET (b) *CODA ≫ FAITH

Tableaux:

*CODA	ONSET	FAITH
*CODA	FAITH	ONSET

(53) Another partially ranked grammar:

Ranking: *CODA ≫ ONSET

Tableaux:

*CODA	ONSET	FAITH
*CODA	FAITH	ONSET
FAITH	*CODA	ONSET

(54) Yet another partially ranked grammar:

Ranking: \emptyset

Tableaux:

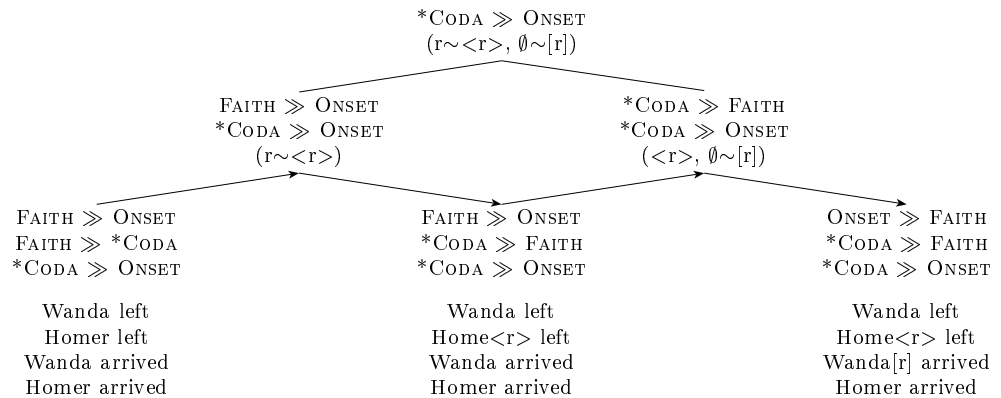
*CODA	ONSET	FAITH
*CODA	FAITH	ONSET
FAITH	*CODA	ONSET
FAITH	ONSET	*CODA
ONSET	*CODA	FAITH
ONSET	FAITH	*CODA

(55) A non-grammar (dialect mixture, but a possible grammar under the Multiple Grammars Theory)

Tableaux:

*CODA	ONSET	FAITH
FAITH	*CODA	ONSET

(56)



(57)

CANDIDATE	WINS IN	RESULT
Wanda left	3 tableaux	no insertion before C
Wanda[r] left	0 tableaux	
Homer left	1 tableau	variable deletion before C
Home<r> left	2 tableaux	
Wanda arrived	2 tableaux	variable insertion before V
Wanda[r] arrived	1 tableau	
Homer arrived	3 tableaux	no deletion before V
Home<r> arrived	0 tableaux	

(58) Quantitative predictions:

- (a) Dialect A+B: Deletion, $p = 1/2$.
- (b) Dialect B+C: Insertion, $p = 1/2$.
- (c) Dialect A+B+C: Deletion, $p = 2/3$; insertion, $p = 1/3$.

(59) Six subjects from Dorchester (Adams 1999)

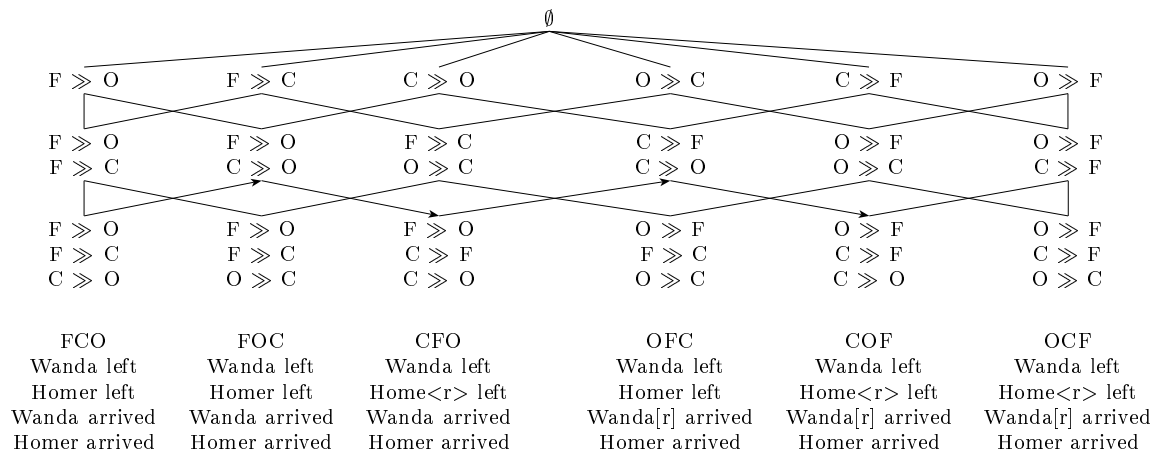
	CASUAL	CAREFUL	FORMAL	TOTAL
(a) V<r>##C	86% (195/227)	83% (306/367)	52% (62/120)	79% (563/714)
(b) V[r]##V	27% (12/44)	24% (17/71)	7% (3/42)	20% (32/157)
(c) V<r>##V (!)	25% (2/8)	19% (3/16)	8% (2/24)	15% (7/48)

Total corpus: Deletion before consonant (V<r>##C) 79%, insertion before vowel (V[r]##V) 20%. Note: Only 3 out of 6 subjects had both deletion and insertion.

(60) Excluded dialects:

- (a) Dialects with intrusive-*r* but no *r*-deletion.
- (b) Dialects where intrusive-*r* has a higher probability than *r*-deletion.
- (c) Dialects with intrusive-*r* before a consonant (*Wanda[r] left).
- (d) Dialects where linking-*r* is deleted before a vowel (*Home<r> arrived).

(61) A grammar lattice for three constraints:



(62) Observations:

- Eight invariant dialects, eleven variation dialects.
- English is at *CODA \gg ONSET (top row, third node from left).
- Dialects (60ab) which were excluded under *CODA \gg ONSET are now predicted. The novel dialect type (insertion, no deletion) is the leaf OFC. The absence of this dialect is an accidental gap.
- Dialects (60cd) are still not generated by any ranking, i.e. they are excluded on universal grounds.

(63) Assignments:

(a) Use OTSoft (Hayes et al. 2003) to check that the typology in (37) is correct.

(b) Extend the analysis to handle cases where *cost* is followed by a pause. Following Kiparsky (1993), assume that *t/d* is deleted if it is not syllabified, e.g. [cos]t[a][gain] where angle brackets indicate syllabification. Assume the following constraints:

*COMPLEX	No tautosyllabic clusters.
ONSET	Onsets required.
ALIGN-LEFT-WORD	No resyllabification across word boundaries.
ALIGN-RIGHT-PHRASE	Phrase-final consonants are also syllable-final.
PARSE	Segments belong to syllables.

Assuming the Multiple Grammars Theory, what is predicted about the frequency of *t/d*-deletion in the prepausal environment compared to the prevocalic and preconsonantal environment?

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