

Class 1, 1/10/2023: OT Review and Perspective; Factorial Typology

1. Current UCLA Covid policy

“Universal Indoor Masking at UCLA Strongly Recommended Jan. 3-13, 2023

- Universal indoor masking at UCLA is strongly recommended to mitigate anticipated spike in new cases from Bruins returning from winter break travel and gatherings
- This recommendation is intended to reduce viral spread among the Bruin community and help UCLA avoid dramatic impacts to teaching, research and campus operations”

2. Assignment

- Read: Kaun reading (Factorial Typology of rounding harmony) on web site.
- Write a summary of this paper *not more than one half page long*.
 - Meaning: synthesize, condense, emphasize the big picture and the main points (don't go step-by-step or page-by-page)
- Due Wed. 1/12/23 in class (hard copy please).

3. Go over the syllabus

ORIENTATION FOR THE COURSE

4. Intellectual diversity in the field of phonology

- It's really wide — just go to a conference to find out.¹
- I could try to teach a little bit about everyone's views, but the result would be
 - Trivial coverage for any one particular thing.
 - Grouchiness on my part as I tried to do justice to research lines I find unpromising.
- So this is going to be, for better or worse, “topics found interesting/promising by me and probably by other UCLA phonology faculty.”
- If time I'll give a brief survey of omitted material at the end of the course.

5. My own stance

- I seek to ride a wave of “scientificization” that has swept through phonology in the last 20 years or so.

¹ I would say that the two top conferences, for now, are the Annual Meeting on Phonology in North America and the Manchester Phonology Conference in Europe.

6. “Scientificized” phonology

- Evaluate (and construct) theories primarily by their performance in accounting for phenomena, with issues like elegance and internal form still important but not paramount.
- The phenomena seem to be basically two:
 - How linguistic material is rendered phonologically by people, partly through retrieval of memorized forms, partly through synthesis using a phonological grammar. When we do experiments, the **wug test** tests the synthesis capacity.
 - How people assign well-formedness values to phonological forms and use this knowledge in speech perception, loanword adaptation, L2 learning. The **blick test**² tests such knowledge.
 - How people learn these two capacities, starting in infancy.
- Re. scientific methodology, *anything that helps is good*, including methodologies borrowed from other sciences.

7. List of research activities/methods that can help us

- **Classical elicitation and descriptive analysis** — nothing useful can happen on other fronts until this has been done, and done well — we’ll start with this.
- **Experiments** (wug and blick tests, per above)
- Use of **corpora** (try to study *all* the forms the native speaker knows, not just a hopefully-representative subset)
- **Computation** (for linguistic analysis that can’t be done by hand, learning simulations)
- And still: **Theoretical speculation and theory-based analysis** — nothing other than theory things can ground and unify all the other methods.

A BIT ON DESCRIPTIVE PHONOLOGY

8. What do you do if you have the opportunity to take on a new language?

9. Collect a lexicon and perform phonemic analysis

- To this day, *minimal pairs* (and their extension, minimal sets) are essential to establish structural contrasts.
- Use the classical method from the 1940s to work out the phonemic system
 - The **set of phonemes** (minimal sound inventory from which all surface sounds can be derived)
 - **Allophony** (contextual or free variation of the phonemic sounds)
- Intro textbooks to this day (e.g., mine, *Introductory Phonology* 2008) cover how to do this.

10. Collection of paradigms and search for phonological alternation

- The paradigms can be either

² Chomsky and Halle (1965): “Could *blick* be a word?” “Could *bnick* be a word?”

- **morphological** (different stems affixed in parallel ways)
- **syntactic** (different words placed in parallel phrasal contexts)
- Look for how a morpheme varies in its realization across context.
- Assess if the variants can be derived in a grammar or must be listed items.
- Work out the rules that derive phonologically predictable variants.

11. The data path to theory

observations → generalizations → analysis → theoretical implications

- No step can be skipped.
- It's been done many times.

12. Publication of phonological results from this kind of work

- Collect *nuggets* that engage in novel ways with theory and write theoretical articles about them.
- Write a reference grammar or phonology of X book to be comprehensive and useful to others.
- UCLA grad Laura McPherson is having a career of this kind.

WHY OPTIMALITY THEORY?

13. Why OT?

- UCLA phonology is an OT shop, as are quite a few other departments.
- OT dominates the journals, though perhaps less so than in former decades
- As dinosaur, I possess pre-OT theoretical experience, having used rule-based phonology for 15 years before 1993.
- I like OT because:
 - It is satisfying to reduce phonology to simple ingredients and let complexity be derived by letting them interact — see below for example.
 - It is even more satisfying when the simple ingredients have strong typological or experimental support.
 - There are data patterns that seem hard to handle without something like OT — see later today.

- OT has a track record of *broadening* phonological research, opening up new paths of research (acquisition,³ learnability,⁴ L2 phonology,⁵ variation, phonology-syntax interaction⁶ ...). It's a good fit for the “scientificization” trend just noted.
- Is OT actually *true*? A scary question for a linguist to ask!
 - Best case, I feel: biased-based modeling: use of OT and UG principles to explain *non-veridical* language acquisition.

AN OT-REVIEW EXAMPLE, USING JUST MARKEDNESS CONSTRAINTS

14. The Finnish “bad foot hiccup”

- This is meant to be an example of a canonical OT virtue: by using a “hierarchy of overrides”, we reduce complexity to simplicity — using typologically wholesome ingredients.
- Finnish word stress is extensively studied; sources used here:
 - Elenbaas, Nine, and René Kager (1999), “Ternary rhythm and the lapse constraint”, *Phonology* 16: 273-329.
 - Kiparsky, Paul. 2003. Finnish Noun Inflection. In Diane Nelson and Satu Manninen (eds.) *Generative Approaches to Finnic Linguistics*. CSLI, 2003. <http://www.stanford.edu/~kiparsky/Papers/finnish.article.pdf>

15. Preliminaries I: feet

- We can think of stress assignment not as putting in a feature [+stress], but parsing of the words into headed domains — feet.
- The idea is that effects that might seem contextually complex make sense as principles of foot form.

16. Preliminaries II: Syllable weight

- Finnish respects the widespread principle that CV: and CVC syllables are “heavy”; CV syllables are “light”.
- How to represent weight in phonology is an ever expanding area in phonology; for the latest see Kevin Ryan’s (2019) book *Prosodic Weight*.

³ James White & Megha Sundara (2014) Biased generalization of newly learned phonological alternations by 12-month-old infants. *Cognition* 133 (1):85-90 (2014)

⁴ Yang Wang and Bruce Hayes (in progress) Learning underlying representations: An approach guided by the Kenstowicz-Kisseberth UR Hierarchy, ms., UCLA.

⁵ Hiro Katsuda (2023) Loanword accentuation in Japanese: Corpus study, modeling, and experiments, UCLA dissertation, finished last weekend!

⁶ Shih, Stephanie S. and Kie Ross Zuraw (2017) Phonological conditions on variable adjective-noun word order in Tagalog. *Language: Phonological Analysis* 93:e317-e352

17. Data

- Finnish has initial main, and alternating secondaries—left to right trochees.

[ˈjær jes ˌte le ˌmæt tø ˌmy: des ˌtæn sæ] ‘from his lack of systematization’

- Don’t stress a final syllable...

[ˈo pis ˌke li ˌjɑ] can’t find gloss

- ...unless it is the only syllable.

[ˈpu:] gloss missing

- Exception to the alternation pattern: if a non-initial trochee would be of the form L + H, then you make a ternary interval — the “bad foot hiccup”.

[ˈka las te ˌlem me] ‘we’re fishing’

[ˈvoi mis te ˌlut te le ˌmas ta] ‘from causing to do gymnastics’

- But don’t⁷ make a ternary interval if you would produce final stress

[ˈra vin ˌto lat] ‘restaurants’

- Also perhaps relevant: “In Finnish the word must contain at minimum two vocalic moras and can thus be either of the shape (C)VV or (C)VCV” (Karoven dissertation; <http://finnish.umn.edu/WordProsodyinFinnish.pdf>)

18. Finnish stress by rule

- From left to right, form trochees. Codicils:
 - Don’t make a trochee if it would be L H, — but L H is in fact ok if it’s final or initial.
 - Don’t make a monosyllabic trochee unless the word is monosyllabic.

19. The ingredients of Finnish stress are simple

- Alignment of main stress to initial syllables
- Avoidance of final stress
- *LAPSE: two stressless syllables in a row
- Avoidance of [ˈL H] feet.

⁷ In truth: *optionally* don’t; we’ll cover this later.

- Cf. nonstandard Finnish dialects in which such feet are “repaired” by geminating the medial consonant: /kotihin/ → koti:n → [kotti:n] (Kiparsky 1968)
- Again: what is an override in one language is an absolute principle elsewhere.
- General leftward alignment of feet
 - All of these elements can be found pervasively in stress languages, though they are probably combined in this way only in Finnish.
 - The art of it is to prioritize them: “subject to the above ...”

EXERCISE: RANKING THE MARKEDNESS CONSTRAINTS FOR FINNISH STRESS

20. Please don't look ahead

(if you wish to receive full Socratic benefit from this exercise :=))

21. Miniaturizing the candidate set

- I am not fully confident that the following cases fully illustrate the system, but they hopefully will serve a pedagogical purpose.

Input	Candidates
H	☞ (H)
	H
L H	☞ (L H)
	L (H)
	(L)(H)
L H L L L	☞ (L H)(L L)L
	L (H L)(L L)
	(L H)(L L)(L)
	(L H) L (L L)
	(L H) L L L
L H L H L	☞ (L H) L (H L)
	(L H)(L H) L
L H L H	☞ (L H)(L H)
	(L H) L H
	(L H) L (H)
L H L	☞ (L H) L
	(L H)(L)
L	☞ (H)
	(L)
	L

22. Some fairly standard constraints for Finnish

ALIGN(W,Ft)	there must be an initial foot
FTBIN	feet must have more than one mora; i.e. *[L]
NON-FINALITY	*stress on last syllable
*LAPSE	*two adjacent unstressed syllables
*(L H)	(what it says) — a sensible ban of severe stress-weight contradiction
ALL FEET L	OT translation of L-R foot parsing: Count one violation for each σ in the configuration: $\sigma \dots [_{\text{foot}}]$

- Let us assume without further comment constraints that guarantee that feet must be maximally disyllabic and bear initial stress.

23. Socratic Finnish

- Do the ranking with tableaux.
- Add columns by grabbing “low-hanging fruit”.
- Cross out data in red once it is explained — first failed candidates, then whole inputs

24. Let’s make it a little harder (relevant to first homework)

L H L H: [ˈra vin ˌto lat] ‘restaurants’

can also be

[ˈra vin to ˌlat]

What is a sensible way to get this one?

FOLLOW-UP ON THE FINNISH STRESS PROBLEM

25. What were we just doing at the blackboard?

- We tacitly employed a standard algorithm, Recursive Constraint Demotion:
 - Find the set of **non-loser-preferrers**, designate them as the next in a descending series of “strata”
 - Remove explained losing candidates
 - Remove explained inputs
 - Repeat until all data explained.
- Finnish as an example of “complexity from layered simplicity”

26. About Recursive Constraint Demotion

- Discovered by Bruce Tesar and Paul Smolensky in 1993, topic of multiple publications by them culminating in their 2000 book *Learnability in Optimality Theory*
- Normal mode of operation is to rank the constraints in “batches” or (better) “strata”; internally unranked.
 - Any full ranking compatible with the strata will work.
- The strata for the Finnish grammar I did are shown below
- This work was the launch point for a now-widespread effort to do computational modeling of acquisition in OT.

27. Finnish with software

- There are various softwares available (Boersma, Pater, Tesar/Prince, Zuraw/Mayer); this from my “OTSoft”:

Stratum	Constraint Name	Abbreviation
Stratum #1	ALIGN(W,FT)	ALIGN(W,FT)
	*CLASH	*CLASH
	FOOTBIN	FOOTBIN
Stratum #2	NON-FIN	NON-FIN
	DEP	DEP
Stratum #3	LAPSE	LAPSE
Stratum #4	*(L H)	*(L H)
Stratum #5	ALL FEET L	ALL FEET L

/L H L H L/	ALIGN(W,FT)	*CLASH	FOOT BIN	NON- FIN	DEP	LAPSE	*(L H)	ALL FEET L
☞ (L H) L (H L)						*	*	***
(L H)(L H) L						*	**!	**
L(H L)(H L)	*!							****

28. A bit more on Finnish empirically

- Karvonen (2005, §3.2)⁸ notes a second “hiccup,” based on avoidance of [‘CVC CVV] feet:

[‘ho ri son ,ta: li] ‘horizontal’

[‘sak ra men ,ta: ri nen] ‘sacramental’

⁸ Karvonen, Daniel (2005) *Word prosody in Finnish*, UC Santa Cruz dissertation, <http://proquest.umi.com/pqdlink?vinst=PROD&attempt=1&fmt=13&startpage=-1&ver=1&vname=PQD&did=982805101&exp=01-09-2012&scaling=FULL&vtype=PQD&rq=309&cfc=1&TS=1168450105&clientId=1564>.

[ˈdi ag nos ˌtiik ka] ‘diagnostics’

vs.

[ˈa ka ˌte: mik ko] ‘academic’

so the constraint hierarchy is actually a bit more complicated.

QUICK REVIEW OF FAITHFULNESS CONSTRAINTS

29. Historical note

- Prince and Smolensky (1993) proposed a system of Faithfulness not well-articulated enough to handle phonology in general; you will see references to it from time to time but it is not widely employed today.

30. Ur-source

- McCarthy and Prince (1995): Faithfulness and Reduplicative Identity, in *University of Massachusetts Occasional Papers in Linguistics* 18: Papers in Optimality Theory. Ed. by Jill Beckman, Suzanne Urbanczyk and Laura Walsh Dickey. Pp. 249–384.

31. There are so many ways to do Faithfulness

- Faithfulness is based on resemblance.
- Resemblance can be formalized in many ways.
- Conventional *SPE*-representations (sequences of feature matrices) make it easy, but one might also pull in
 - hierarchical structure (phrasing, syllables, feet, autosegmental tiers)
 - actual phonetic form
- More on this later.

32. McCarthy and Prince’s strategy: *SPE* representations + atomism

- I believe their idea was to find the ways that two representations could differ — allocating constraints to the *smallest possible differences*.

33. Indices

To make the differences utterly explicit, we put an index on every segment.

- IDENT = differ in one feature value

/p₁ a₂ k₃/, candidate [b₁ a₂ k₃] violates IDENT(voice)

/p₁ a₂ k₃/, candidate [m₁ a₂ k₃] violates IDENT(voice) and other constraints

- MAX = an underlying segment of *some natural class* (specified with features) is missing in the surface form.

/p₁ a₂ k₃/, candidate [p₁ a₂] violates ?? (multiple answers)

- DEP = a surface segment of some natural class (specified with features) is missing in the underlying form.

/a₂ k₃/, candidate [ʔ₁ a₂ k₂] violates ?? (multiple answers)

- LINEARITY, violated when the linear order of any pair of segments is switched. Count the violations here:

/p₁ a₂ k₃/, candidate [k₃ a₂ p₁] (how many violations?)

Socrates: What about this candidate: [p₃ a₂ k₁]

- CONTIGUITY, violated when two segments are adjacent in the input but not the output, or vice versa (IO, OI)
- ANCHOR, violated when a segment is adjacent to an edge in the input but not the output.

34. Not a standard Faithfulness constraint

- IDENT(p) “Don’t change anything about [p] so it isn’t [p] any more.”
 - You’re welcome to deviate from the “standard” theory — but in the interest of scientific coherence, it’s crucial to *label* such deviations.
 - This raises vexed issues of “scientific community”, “community standards”—inevitable in writing up research results.

35. A fundamental principle of OT presentation

- Always declare the Faithfulness constraints violated by winners.
 - Or more precisely, at least one member of the lattice-based family violated by winners.
- i.e., they all need to be accounted for by the Markedness constraints that outrank them.

36. Extensions of Faithfulness

- Between a paradigm member and its presumed “base” form (Benua 1995)

heal ['hi:t] *healing* ['hi:tɪŋ] compare: *Darjeeling* [da:'dʒilɪŋ]

- Between a reduplicated morpheme and its base (McCarthy and Prince 1994)⁹
- Between a free variant and its careful-speech norm (Kawahara 2002)¹⁰

DEFINING FACTORIAL TYPOLOGY

37. Assume

- A class of universal inputs
- Some version of GEN
- A set of constraints

then, each ranking of the constraints defines a set of outputs
(many rankings define the same output set, however)

The set of distinct sets of outputs constitutes the **factorial typology** of the system
[called “factorial” because n constraints permit $n!$ rankings]

38. The appeal of factorial typology

- Proposals can be tested against typological data.
- We can consider them for defects of both undergeneration (instantly fatal) and overgeneration (hard to assess)

39. Sometimes the missing case walks in the door

- **Majority-rule vowel harmony**¹¹: “Harmonize a suffix in backness with which ever kind of vowel (back or front) occurs more often in the stem.” (Linda Lombardi¹²; for a remedy see Baković 1999¹³.)
- But Margit Bowler’s work suggests this happens in Warlpiri.

40. Some work in factorial typology

- Elenbaas, Nine and René Kager. 1999. Ternary Rhythm and the *LAPSE constraint. *Phonology* 16: 273-330.
- Matthew Gordon (2002) A factorial typology of quantity insensitive stress, *Natural Language and Linguistic Theory* 20, 491-552

⁹ McCarthy, J. and A. Prince 1995 Faithfulness and Reduplicative Identity, *University of Massachusetts Occasional Papers in Linguistics 18: Papers in Optimality Theory*. Amherst, MA: GLSA, University of Massachusetts.

¹⁰ Kawahara, Shigeto (2002) Faithfulness among variants. In Phonological Society of Japan (ed.) *Phonological Studies* 5: 47-54. Tokyo Kaitakusha.

¹¹ Unless Margit is right...

¹² Lombardi, Linda. 1996. Positional Faithfulness and Voicing Assimilation in Optimality Theory. Ms., University of Maryland, College Park

¹³ <http://roa.rutgers.edu/files/340-0899/roa-340-bakovic-2.pdf>

- Abigail Kaun (1995) The Typology of Rounding Harmony: An Optimality Theoretic Approach. Ph.D. Dissertation, UCLA. Basis of readings.

41. How to compute a factorial typology

- Choose an empirical domain (we can't do all of phonology at once)
- Choose constraints: these embody a proposal in phonological theory.
- Choose inputs: they must somehow suffice to illustrate the full range of possible phenomena.
- Choose candidates (see above for discussion)
- Calculate the typology, by hand or with software.
- (oral explanation of how it can be done fairly easily)

A TURKISH PROBLEM, FOR FACTORIAL STUDY

42. The vowels of Turkish

	<i>Front</i>		<i>Back</i>	
	<i>Unrounded</i>	<i>Rounded</i>	<i>Unrounded</i>	<i>Rounded</i>
<i>high</i>	i	y	ɯ	u
<i>nonhigh</i>	e	ø	ɑ	o

43. Data

- Solve this with rules.

	Nom.	Accus.	1sg poss.	Dative	Nom. Plur.	Ablative	gloss
1.	at	atur	atum	ata	atlar	attan	'proper name'
2.	kik	kiki	kikim	kike	kikler	kikten	'skiff'
3.	idil	idili	idilim	idile	idiller	idilden	'idyll'
4.	sarum	sarumu	sarumum	saruma	sarumlar	sarumdan	'bandage'
5.	yzym	yzymy	yzymym	yzyme	yzymler	yzymden	'grape'
6.	uʃun	uʃunu	uʃunum	uʃuna	uʃunlar	uʃundan	'gleam, flash'
7.	gørym	gørymy	gørymym	gøryme	gørymler	gørymden	'sight'
8.	satur	saturu	saturum	satura	saturlar	saturdan	'large knife'
9.	pakt	paktu	paktum	pakta	paktlar	pakttan	'pact'
10.	sart	sartu	sartum	sarta	sartlar	sarttan	'rope'
11.	pul	pulu	pulum	pula	pullar	puldan	'stamp'
12.	son	sonu	sonum	sona	sonlar	sondan	'end'
13.	køj	køjy	køjym	køje	køjler	køjden	'village'
14.	tʃent	tʃenti	tʃentim	tʃente	tʃentler	tʃentten	'a few'
15.	gark	garku	garkum	garka	garklar	garktan	'drowning'
16.	ilk	ilki	ilkim	ilke	ilkler	ilkten	'beginning'
17.	tʃenk	tʃenki	tʃenkim	tʃenke	tʃenkler	tʃenkten	'hand'
18.	fuusk	fuusku	fuuskum	fuska	fuusklar	fuusktan	'sin'
19.	balkon	balkonu	balkonum	balkona	balkonlar	balkondan	'balcony'
20.	el	eli	elim	ele	eller	elden	'hand'
16.	futtur	futtru	futrum	futra	futurlar	futturdan	'breaking of a fast'
17.	akul	aklu	aklum	akla	akullar	akuldan	'intelligence'
18.	vezin	vezni	veznim	vezne	vezinler	vezinden	'meter'
19.	burun	burnu	burnum	burna	burunlar	burundan	'nose'
20.	defin	defni	defnim	defne	definler	definden	'burial'
21.	ilim	ilmi	ilmim	ilme	ilimler	ilimden	'science'

44. OTifying the Turkish

- Suggested constraints:
 - Something about bad codas
 - Think of all the ways you could fix /vezn/ and put in candidates and appropriate Faithfulness constraints

45. Epenthesis in Palestinian Arabic¹⁴

'ʔibin	'son'	'ʔakil	'food'
'ʔibni	'my son'	'ʔakili	'my food'
'ʔibinha	'her son'	'ʔakilha	'her food'
'ʔibinkum	'your son'	'ʔakilkum	'your food'

- We know this isn't Syncope (which Palestinian also has) because of opaque stress. Heavy penults are, in general, stress-attracting:

/ʃirib-na/ → 'ʃribna 'we drank'

- Gouskova and Hall suggest that the epenthetic [i] is not quite the same vowel as underlying /i/.¹⁵
- Roughly speaking, Palestinian epenthesis is across-the-board rather than sonority-based as in Turkish: /taxt/ → [taxit] 'bed', but see source for complications we will ignore.

46. Cairene Arabic

Epenthetic vowel is final: [vezni]

EPENTHESIS: A SMALL FACTORICAL TYPOLOGY SIMULATION

47. Inputs

/ipl/ Exemplifies a bad-sonority coda
 /ilp/ Exemplifies a coda with good sonority profile

48. Reasonable outputs

/ipl/	ipl	/ilp/	ilp
	i.pil		i.lip
	ip.li		il.pi
	i.pli		i.li.pi
	i.pi.li		

- Do we have them all?
- If not, what would we include to expand the typology?

¹⁴ Source: Issam M. Abu-Salim (1980) "Epenthesis and geminate consonants in Palestinian Arabic," *Studies in the Linguistic Sciences* 10.2.

¹⁵ Maria Gouskov and Nancy Hall (2009). Acoustics of Unstressable Vowels in Lebanese Arabic. In Steve Parker (ed., 2010), *Phonological Argumentation. Essays on Evidence and Motivation*. London: Equinox. pp. 203-225.

49. Should we include [i.lpi] among the outputs?

- Proposal: to keep the problem under control, you can assume some constraints to be undominated (i.e. “we are considering only the class of languages that don’t allow sonority-reversed codas”).
- Often, this leaves enough languages under consideration to make the problem still worthwhile.
- Thus, let’s avoid, for /ilp/: i.lpi, il, ip, lip, pli, ilu (p becomes u).
 - Undominated: *HORRIBLE ONSET, MAX(C), LINEARITY, IDENT(syl)

50. Constraints

Name	
1. DEP(i)	Penalizes insertion of vowels; quality ignored here.
2. *BAD SONORITY CODA	Should be suitably formalized; violated by final [pl].
3. *CC CODA	
4. *CODA	
5. *BRANCHING ONSET	i.e. * _σ CC
6. CONTIGUITY	one violation for each pair of segments adjacent input but not output
7. ANCHOR	one violation for each segment adjacent to a particular word edge in the input but not in the output

51. Some outputs we need never consider

/ipl/ → [ip.il]
 [i.pi.li.i.i.i]

[Socrates: Why? Show with tableau rows.]