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Phonological Typology in Optimality Theory

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Outline of this lecture

a. Introduction to Optimality Theory (OT; Prince & Smolensky 2004)
b. Typology in prosodic phonology: syllable structure (Prince & Smolensky 2004)
c. Typology in segmental phonology: palatalization (extending Kurisu to appear)

1. Basic architecture of OT

(1) a. Generative theory in that input is mapped onto output.
b. (Basically) parallel computation of output by hierarchical constraints.
c. Constraints are by hypothesis universal and violable.
d. The most harmonic candidate wins the competition.
e. Richness of the base prevents any restrictional impositions on input.
f. The only source of language differences lies in constraint rankings.

(2)

	/input/	*constraint 1*	*constraint 2*	*constraint 3*
a.	*candidate A*	*!		
b.	*candidate B*		*!	
c. ☞	*candidate C*			*

(3)

	/input/	*constraint 3*	*constraint 2*	*constraint 1*
a. ☞	*candidate A*			*
b.	*candidate B*		*!	
c.	*candidate C*	*!		

(4) Two types of constraints
a. Faithfulness constraints: Input-output identity is evaluated.
b. Markendess constraints: Unmarked structure or representation is favored whereas marked one is punished.

Why OT is conducive to typological research:

a. Earlier generative phonological theories (Chomsky & Halle 1968 et seq.) are essentially rule-based, and each rule does not have to be but may be *language-specific*.
b. In OT, all constraints are *universal*, and language differences arise from constraint reranking.

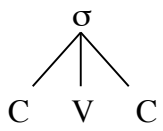
Consequences:
a. OT is inherently typological (McCarthy 2002: 108).
b. An analysis of one language gives rise to typological predictions (i.e., factorial typology).
c. Only the types of grammar yielded by permutation of constraints should exist potentially.

Worry:
There are hundreds of constraints proposed in OT literature. This entails explosion of typological patterns predicted to exist.

Partial answer:
Different rankings often converge on the same pattern. Surface patterns are not as many as possible ranking combinations (see sections 2 & 3).

2. Factorial typology I: syllable structure (Prince & Smolensky 2004)

Issue:
How OT explains possible variation of syllable inventories in human languages. We abstract away from the presence/absence of complex onsets/codas (see Kager 1999 for this aspect).

(5) a. 

b. 

c. 

d. 

Question:
Is language allowed to exploit any combinations of the four structures?

(6) Two markedness constraints
- a. Onset: Every syllable begins with a consonant.
- b. NoCoda: Every syllable ends in a vowel.

(7) Two faithfulness constraints
- a. Max: Every input material is parsed in the output (i.e., no deletion).
- b. Dep: Every material in output has a correspondent in its input (i.e., no addition).

Logical rankings of four constraints:
4!=24 different possible rankings

Question:
Does reranking of the four constraints produce 24 different patterns?

Answer:
No, because certain rankings converge on the same result (see below).

2.1 Onset

(8) Two rankings: (i) Onset outranks Faith (ii) Faith outranks Onset.

Ranking (i) (Onset » Faith):

(9)

	/CV/	Onset	Faith
a. ☞	CV		
b.	V	*!	*

(10)

	/V/	Onset	Faith
a. ☞	CV		*
b.	V	*!	

☞ Onset is required in languages with Onset » Faith.

Ranking (ii) (Faith » Onset):

(11)

	/CV/	Faith	Onset
a. ☞	CV		
b.	V	*!	*

(12)

	/V/	Faith	Onset
a.	CV	*!	
b. ☞	V		*

☞ Onset is optional in languages with Faith » Onset.

Interaction of faithfulness constraints:

(13) Two rankings: (i) Max outranks Dep (ii) Dep outranks Max

Interaction of (13) with (8i):

(14)

	/VCV/	Onset	Max	Dep
a.	V.CV	*!		
b. ☞	CV.CV			*
c.	CV		*!	

(15)

	/VCV/	Onset	Dep	Max
a.	V.CV	*!		
b.	CV.CV		*!	
c. ☞	CV			*

☞ In (8i), the two faithfulness rankings diverge into two different results.

Interaction of (13) with (8ii):

(16)

	/VCV/	Max	Dep	Onset
a. ☞	V.CV			*
b.	CV.CV		*!	
c.	CV	*!		

(17)

	/VCV/	Dep	Max	Onset
a. ☞	V.CV			*
b.	CV.CV	*!		
c.	CV		*!	

☞ In (8ii), the two faithfulness rankings converge on the same result.

Observation:
In Onset » Faith, it does matter how Onset violation incurred by the faithful candidate is avoided. The repair strategy is tangential when onsets are optional since breaching Onset is the cheapest.

Summary:
a. 2 patterns from Onset » Faith
b. 1 pattern from Faith » Onset

2.2 Coda

a. NoCoda » Faith inhibits coda consonants.
b. Faith » NoCoda sanctions coda consonants when faithful parsing of input has them.
c. The two faithfulness rankings in (13) meaningfully interact only with NoCoda » Faith.

Summary:
a. 2 patterns from NoCoda » Faith
b. 1 pattern from Faith » NoCoda

2.3 Bringing pieces together

(18)

	Onset » Faith (2 patterns)	Faith » Onset (1 pattern)
NoCoda » Faith (2 patterns)	CV (2×2=4 patterns)	(C)V (1×2=2 patterns)
Faith » NoCoda (1 pattern)	CV(C) (2×1=2 patterns)	(C)V(C) (1×1=1 pattern)

☞ Output convergence diminishes the number of surface types.

(19)

	Onset » Faith	Faith » Onset
NoCoda » Faith	CV (e.g., Senufo)	(C)V (e.g., Hawaiian)
Faith » NoCoda	CV(C) (e.g., Arabic)	(C)V(C) (e.g., Japanese)

☞ No language other than the four basic types in (19) is attested.
☞ Languages of the type VC are systematically ruled out as no possible ranking generates them.

3. Factorial typology II: palatalization (extension of Kurisu to appear)

3.1 Japanese mimetic palatalization (Mester & Itô 1989; Hamano 1998)

(20)

Base forms	*Gloss*	*Palatalized forms*	*Gloss*
zabu-zabu	splashing	ʒabu-ʒabu	splashing indiscriminately
noki-noki	stretching	ɲoki-ɲoki	stretching inelegantly
kata-kata	clattering	katʃa-katʃa	clattering a-periodically
kasa-kasa	rustling	kaʃa-kaʃa	rustling uncomfortably

☞ Coronals take precedence over labials and dorsals.

(21)

Base forms	*Gloss*	*Palatalized forms*	*Gloss*
dosa-dosa	flowing	doʃa-doʃa	flowing in large amounts
noso-noso	slowly	noʃo-noʃo	slowly but clumsy
neta-neta	sticky	netʃa-netʃa	very sticky
neto-neto	sticky	netʃo-netʃo	very sticky

☞ When the two consonants are both coronals, the right one hosts palatalization.

(22)

Base forms	*Gloss*	*Palatalized forms*	*Gloss*
poko-poko	up and down	p^{y}oko-p^{y}oko	jumping around imprudently
gobo-gobo	gurgling	g^{y}obo-g^{y}obo	gurgling messily
goho-goho	coughing	g^{y}oho-g^{y}oho	coughing with nausea

☞ The first consonant is palatalized if the root contains no coronal consonant.

(23)

Base forms	*Gloss*	*Palatalized forms*	*Gloss*
goro-goro	goggled-eyed	g^{y}oro-g^{y}oro	goggled-eyed restlessly
noro-noro	slow	ɲoro-ɲoro	wriggling around
zara-zara	coarse (texture)	ʒara-ʒara	jingling
horo-horo	weak	çoro-çoro	staggering

☞ Liquid /r/ is immune to palatalization, so the coronal priority is not applicable to /r/.

Facts of interest here:
a. Coronals are more susceptible to palatalization than non-coronals (coronal dominance effect).
b. The rhotic persistently resists palatalization (rhotic exclusion effect).

(24)

	2sg. masculine	*2sg. feminine*	*Gloss*
a.	kifæt	kifætʃ-i	open!
	zimæd	zimæʒ-i	drag!
	libæs	libæʃ-i	dress!
b.	xidæn	xiʒæɲ-i	cover!
	gidæl	giʒæy-i	kill!
c.	kitæb	kitʃæb-i	write!
	diræq	ʒiræq-i	be dry!
	sibær	ʃibær-i	break!

☞ In Harari 2nd person feminine subject construction (Leslau 1958; Rose 1997b), palatalizable segments are coronal consonants alone (24a), but /r/ is never palatalized (24c).
☞ The rightmost coronal (other than /r/) undergoes palatalization (24a, b). When the final coronal is a sonorant, a stem-medial coronal is also affected by palatalization (24b).

(25)

	2sg. masculine	*2sg. feminine*	*Gloss*
a.	libæs	libæʃ	dress!
	kift	kiftʃ	open!
	zimd	zimʒ	pull!
	dirg	dirg^{y}	hit!
	firæx	firæx^{y}	be patient!
b.	nixæβ	nix^{y}æβ	find!
	nigif	nig^{y}if	prune!
	gimim	g^{y}imim	chip the rim of the utensil!

☞ In the same morphological operation in Chaha (Polotsky 1938, 1951; Johnson 1975; Hetzron 1975, 1977; McCarthy 1983, 1986ab; Scobbie 1991; Archangeli & Pulleyblank 1994; Odden 1994; Zoll 1994; Rose 1994ab, 1997ab; Kurisu 2001), only coronal and dorsal consonants are palatalizable. Labial consonants persistently resist palatalization.
☞ Palatalization occurs stem-finally if the final segment is either a coronal or dorsal (25a).
☞ Otherwise, the rightmost dorsal is palatalized (25b).

Generalization:
Coronals are the most preferable docking sites of palatalization, and labials are the worst hosts of palatalization. Dorsals are in-between.

(26) *Lab^{y} » *Dor^{y} » *Cor^{y}

☞ Palatalized coronals are more harmonic than palatalized labials or dorsals.
☞ This hierarchy accounts for the coronal dominance effect.

(27)

	/zabu-zabu,[–ant]/	Max[–ant]	*[–Cor]^{y}	*Cor^{y}
a.	zabu-zabu	*!		
b. ☞	ʒabu-ʒabu			*
c.	zab^{y}u-zab^{y}u		*!	

☞ Candidate (27a), which does not realize the [–ant] feature, is eliminated by Max[–ant]. This is a faithfulness constraint that calls for surface exponence of [–ant], the phonological feature that is responsible for palatalization.
☞ The coronal dominance effect follows from *[–Cor]^{y} » *Cor^{y}.

Hall (2000):
a. Language exhibits an asymmetry with respect to inventories of palatalized consonants. There are many languages with palatalized non-rhotics without any palatalized apical rhotics, but not vice versa. The existence of a palatalized apical rhotic implies that of a palatalized non-rhotic.
b. Historical facts reveal high markedness of palatalized apical rhotics. Phonemic /r^{y}/ was lost in Czech and Polish (Carlton 1991). Many Romance languages still have traces of palatalized /n/ and /l/, but the remnant of /r^{y}/ is not extant at all (Hock 1991: 134). In Serbo-Croatian, /r^{y}/ was depalatalized although other palatalized sonorants remained intact (Hock 1991: 134).

(28) *[r^{y}] » *Cor^{y}

(29) *[r^{y}] » Max[–ant] » *[–Cor]^{y} » *Cor^{y}

☞ *[r^{y}] outranks *[–Cor]^{y} because palatalized non-coronals appear occasionally.
☞ This constraint hierarchy elucidates the rhotic exclusion effect.

(30)

	/goro-goro,[–ant]/	*[r^{y}]	Max[–ant]	*[–Cor]^{y}	*Cor^{y}
a.	goro-goro		*!		
b. ☞	g^{y}oro-g^{y}oro			*	
c.	gor^{y}o-gor^{y}o	*!			*

☞ High ranked *[r^{y}] blocks the coronal dominance effect.
☞ No surface realization of [–ant] is again ruled out by Max[–ant].
☞ As a consequence, the initial non-coronal consonant attracts palatalization.

3.2 Typology of consonant palatalizability

(31) a. *Lab^{y} » *Dor^{y} » *Cor^{y}
b. *[r^{y}] » *Cor^{y}
c. Max[–ant]

☞ The hierarchical rankings in (31a) and (31b) are universally fixed, respectively.
☞ (31a), (31b), and (31c) are independent of each other, allowing rerankability.

Combinability of (31a) and (31b):

(32)

*Lab^{y}	»	*Dor^{y}	»	*Cor^{y}
↑		↑		↑
*[r^{y}]		*[r^{y}]		*[r^{y}]

☞ (31b) dictates that palatalized rhotics are more marked than palatalized coronals in general.
☞ But *[r^{y}] is not intrinsically ranked with respect to *Lab^{y} and *Dor^{y}.

Combinability of (31c) and (32):

(33)

*[r^{y}]	»	*Lab^{y}	»	*Dor^{y}	»	*Cor^{y}	
↑		↑		↑		↑	↑
①Max		②Max		③Max		④Max	⑤Max

(34)

*Lab^{y}	»	*[r^{y}]	»	*Dor^{y}	»	*Cor^{y}	
↑		↑		↑		↑	↑
①Max		②Max		③Max		④Max	⑤Max

(35)

*Lab^{y}	»	*Dor^{y}	»	*[r^{y}]	»	*Cor^{y}	
↑		↑		↑		↑	↑
①Max		②Max		③Max		④Max	⑤Max

☞ No intrinsic ranking relation is established between Max[–ant] and palatalization markedness constraints. As a result, the former can occupy all potential slots available.
☞ This consideration submits 15 possible rankings.

Question:
Do we find 15 different patterns of palatalization inventories?

Answer:
No. Again, the number of predicted surface patterns is diminished by surface convergence.

(36)

Types	*Constraint rankings*	Cor^{y}	Dor^{y}	Lab^{y}	[r^{y}]
I	(33①) (34①) (35①)	✔	✔	✔	✔
II	(34②) (35②)	✔	✔	✖	✔
III	(35③)	✔	✖	✖	✔
IV	(33②)	✔	✔	✔	✖
V	(33③) (34③)	✔	✔	✖	✖
VI	(33④) (34④) (35④)	✔	✖	✖	✖
VII	(33⑤) (34⑤) (35⑤)	✖	✖	✖	✖

☞ Again, convergence is found here. Only 7 types arise out of 15 rankings.

Claim:
The typological variation in (36) is confirmed by crosslinguistic facts.

(37)

Types	*Languages*	*References*
I	Old Church Slavonic	Huntley (1993)
	Bulgarian	Scatton (1993)
	Sorbian	Stone (1993b)
	Slovene	Priestly (1993)
	Russian	Timberlake (1993), Halle (1994), Padgett (2001, 2003)
	Polabian	Polański (1993)
	Polish	Rothstein (1993), Rubach (2003), Sanders (2003)
	Lithuanian	Senn (1966)
	Irish	Ní Chiosáin (1991), Mac Eoin (1993)
	Scottish Gaelic	Gillies (1993)
	Kashmiri	Bhat (1987), Koul (2003)
	Nenets	Décsy (1966), Salminen (1998)
	Mordva	Zaicz (1998)
	Terr Lapp	Korhonen (1984)
	North Veps	Viitso (1987)
	Paez	Gerdel (1973)
	Gude	Hoskinson (1974)
	Japanese	Bloch (1950), McCawley (1968), Vance (1987)
	Buthaa Dagur	Svantesson et al. (2005)
	Khalkha Mongolian	Svantesson et al. (2005)
	Chahar	Svantesson et al. (2005)
	Buriad	Svantesson et al. (2005)
	Romanian	Chitoran (2002)
	Eastern Mari	Sebeok & Ingemann (1961), Kangasmaa-Minn (1998)
	Karaim	Hansson (2007)
	Konkani	Miranda (2003)
II	Ukranian	Shevelov (1993)
	Latvian	Schmalstieg (1993)
	Manx	Jackson (1955), Broderick (1993)
	Tibiri Hausa	Wolff (1993)
	Axininca Campa	Payne (1981), Black (1991), Spring (1994)
	Chaha	Leslau (1950), Rose (1994a, b, 1997a, b), Banksira (2000)
III	Muinane	Walton &Walton (1967)
	Toda	Emeneau (1984), Spajić et al. (1996)

☞ Most languages with a palatalized rhotic rules in all types of palatalized consonants.
☞ This suggests salient markedness of palatalized rhotic consonants.

(38) General predictions regarding consonant palatalizability

Prediction 1: Languages with palatalized labials have palatalized dorsals and coronals.
Prediction 2: Languages with palatalized dorsals have palatalized coronals.
Prediction 3: Languages lacking palatalized coronals have no palatalized consonant.

Note:
Most languages are classified into Type VI. There are too many languages to list here (e.g., Korean), so they are omitted below. Over 260 languages of this type are provided by Maddieson (1984).

(39) Type IV languages

Languages	*References*
Standard Hausa	Maddieson (1984: 318), Wolff (1993), Newman (2000)
Nambakaengo	Maddieson (1984: 367)
Mono	Olson (2005)
Belorussian	Mayo (1993)
Enga	Luzbetak (1956)
Mandarin Chinese	Duanmu (2000)
Tocharian	Winter (1998)

(40) Type V languages

Languages	*References*
Lakkia	Maddieson (1984: 334)
Siriono	Maddieson (1984: 407)
Kabardian	Maddieson (1984: 417), Colarusso (1988), Padgett (1991)
Spanish	Cressey (1978)
Rize Turkish	Brendemoen (1998)
Greek	Holton et al. (1997)
Cairene Arabic	Watson (2002)
San'ani Arabic	Watson (2002)
Macedonian	Friedman (1993)
Umbarian	Silvestri (1998)
Albanian	Bevington (1974), Demiraj (1998)
Serbo-Croatian	Browne (1993)
Czech	Short (1993a)
Slovak	Short (1993b)
Cassubian	Stone (1993a)
Muher	Rose (1997b)
CiBemba	Hyman (1994), Hyman & Moxley (1996)
Late Latin	Lloyd (1987), Vincent (1988b)
Kimatuumbi	Odden (1996)
Sunwari	Genetti (1992)
Italian	Vincent (1988a)
Kinyarwanda	Kimenyi (1978, 1979)
Campidanese Sardian	Jones (1988)
Romance Creoles	Green (1988)

(41) Type VII languages

Languages	*References*
Maori	Maddieson (1984: 345)
Hawaiian	Elbert & Pukui (1979)
Samoan	Mosel & Hovdhaugen (1992)

☞ UPSID (Maddieson 1984) supplies 20 languages of this type.
☞ Scrutiny reveals that many languages are to be grouped into other types.
☞ Such languages include Tsou, Wantoat, Koiari, Wichita, Hakka, and Fuzhou.

Observation:
a. Only those patterns predicted to exist do exist.
b. In my survey, no language deviates from the seven patterns in (36).
c. The typological predictions in (38) are borne out.

Theoretical implications:
a. Constraints are not dispersed evenly.

☞ The significant paucity of Types II and III languages suggests that palatalized rhotics tend to be viewed far more marked than we might imagine from Japanese.

(42) a. Lab^{y} ..... Dor^{y} ..... Cor^{y}
b. [r^{y}] ..... Cor^{y}

Marked ⟵⟶ *Unmarked*

☞ Among those languages with a palatalized rhotic (34 languages), 26 are affiliated with Type I.
☞ This amounts to approximately 76.5%.

b. Explaining robust crosslinguistic frequency effects of linguistic patterns is not enabled with the theory of partial ordering advocated by Anttila (1997a, b) and Anttila & Cho (1998).

☞ Partial ordering theory predicts that a candidate is predicted to exist by the grammar iff it wins in some tableau and that the candidate's probability of occurrence is *n*/*t* in general form, where *n* and *t* represent the number of tableaux in which the candidate wins and the total number of possible tableaux, respectively.

(43)

	Number of tableaux	*Probability of occurrence*
Pattern A	4	4/10=40%
Pattern B	3	3/10=30%
Pattern C	2	2/10=20%
Pattern D	1	1/10=10%
Pattern E	0	0/10%=0% (non-existent)
Total	10	100%

Problems:

a. Partial ordering theory predicts that only 20% (3/15) of languages are grouped in Type VI.
b. The total number of Types II and III languages (2/15+1/15=3/15) is erroneously expected to be the same as that of Type I languages (3/15). There are 8 Types II and III languages, which is far outnumbered by 26 Type I languages.

4. Conclusion

a. Richness of the base and universality of constraints attribute the source of language variability to different constraint rankings. OT is by nature conducive to typological research.
b. OT and typology are intimate and benefit from each other for bidirectional reasons: (i) OT is suitable for typological analyses, and (ii) typological facts feed OT analyses excellent tests.

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