The too-many-solutions problem in OT; solutions on the market

EGG Summer School, Brno 2007, 29th of July - 10th of August

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Fifth approach: McCarthy's (2006abc) OT-CC

Goal of this meeting
We will discuss another approach to the Too-many-solutions problem: McCarthy's (2006abc) OT-CC, Optimality Theory with candidate chains. OT-CC is a modification of classic OT that posits candidates c onsisting of sequences of forms ('chains') that link input to output.

Steps in the presentation

- McCarthy's approach
- Pali

OT-CC

OT-CC posits two main conditions on the validity of candidate chains:

- Gradualness
- Harmonic improvement

The *gradualness requirement* says that chains can only make one change at a time; a single change is the addition of a single violation of a basic faithfulness constraint, like MAX(feature), DEP(feature).

The *harmonic improvement requirement* says that the successive forms in a chain must increase in harmony relative to the constraint hierarchy of the language in question.

Imagine a language with both postconsonantal epenthesis and intervocalic voicing. The mapping /pap/ → [pabə] cannot take place in a single step, due to the gradualness requirement (it would involve a violation of MAX(voice) *AND* DEP(segment)). So, we must have a chain containing more than just two forms.

Consider first the chain <pap, pab, pabə>. This cannot be a valid chain, because the successive forms in this chain do not increase in harmony. In particular there is no improvement from <pap, pab> because there is no constraint requiring obstruents to be voiced at the end of a word/syllable. Therefore, this chain is invalid. We write **<pap, pab, pabə>.

The other chain, though, is valid. Both the gradualness requirement and the harmonic improvement requirement are met (if in the language the relevant constraints are properly ranked, of course); <pap, papə, pabə>.

OT-CC can explain the FCD-effect (remember the third session).
In VC_1C_2V the first consonant is always deleted; never the second (everything else being equal). In order to delete a consonant we have to take several steps. Deletion of the whole segment in one swoop is not possible, since that would add violations of two basic faithfulness constraints, MAX(place) and MAX(segment). Therefore, due to the gradualness requirement the following two chains are invalid:

Invalid chains
**<VC_1C_2V, VC_2V>
**<VC_1C_2V, VC_1V>

Coda's and debuccalization
Debuccalization is a well-attested process. In languages with this process an obstruent is typically reduced to [h] or [ʔ]. Nasals are typically reduced to [ʔ] or [N]. *Debuccalization applies in the coda, not in the onset*.

We can now account for consonant deletion with the following chain <VC_1C_2V, $VʔC_2V$, VC_2V>, at least as far as the gradualness requirement is concerned. But the chain must also meet the harmonic improvement requirement. This is decided by the grammar of the language. Under the ranking CODA-COND » MAX(place), HAVE(place) the first two forms of the chain are harmonically improving.

Harmonic improvement in debuccalization (McCarthy 2006a, p. 4).

/patka/	CODA-COND	MAX(place)	HAVE(place)
☞ paʔka		*	*
patka	*!		

Under the rankings NO-SPREAD(place) and HAVE(place) » MAX(segment) the second step in the chain is also harmonically improving:

Deletion as final result (McCarthy 2006a, p. 4).

/patka/	CODA-COND	NO-SPREAD (place)	MAX(place)	HAVE(place)	MAX (segment)
☞ paka			*		*
patka	*!				
paʔka			*	*!	
pakka		*!	*		

So we can conclude that <VC_1C_2V, $VʔC_2V$, VC_2V> is a valid chain, because it meets both the *gradualness requirement* and the *harmonic improvement requirement*.

The FCD can now simply be explained, because the chain that leads to the removal of the second consonant is not a valid chain: **<VC_1C_2V, $VC_1ʔV$, VC_1V>.

The first two forms of the chain constitute the crucial step. *There is no constraint requiring debuccalization* ***in the onset***. Therefore, the harmonic requirement condition cannot be met. This is a very ingenious explanation of the FCD. We can say:

With OT-CC we can solve the FCD!

The theory can also explain yet another instance of the too-many-solutions problem; *nasals assimilate to an onset-consonant; onset-consonants do not assimilate to nasals*.

OT-CC's explanation:
/pamka/ cannot be mapped onto [pampa]. There is no valid chain that can take care of this mapping.
By the gradualness requirement we cannot remove place and simultaneously spread another place to the vacant position. That would violate two basic faithfulness constraints, MAX(place) and NO-SPREAD(place).
By the harmonic improvement requirement we cannot debuccalize in the onset position. Therefore:

Invalid chain:
**<pamka, pamʔa, pampa>

With OT-CC we can solve the coda/onset asymmetry!

OT-CC makes certain interesting predictions.

Two interesting predictions of OT-CC
1) The coda/onset asymmetry does not hold when C_2 lacks a place node, i.e. if C_2 = [ʔ] or [h]. 'The reason: debuccalization is not a necessary precondition for deletion or assimilation when the affected segment already lacks oral place' (McCarthy 2006a:7).

(1) Onset /h/ deletion in Tonkawa

/nes-he-tsane-oʔs/	nesetsnoʔs	'I cause him to lie down'
/nes-ha-na-kapa/	nesankapa	'to cause to be stuck'

(2) Onset /h/ assimilation in Arbore

/mín-h-áw/	mínnaw	'my house'
/ʔabás-h-áw/	ʔabássaw	'my stew'

2) The asymmetry should not hold when C_2 is epenthetic, since epenthetic segments have no underlying place specification to be faithful to.

(3) Epenthetic onset assimilation in Lardil

/maɽ/	maɽta	'hand'
/ɽil/	ɽilta	'neck'
/kaŋ/	kaŋka	'speech'

OT-CC can solve other instances of the too-many-solutions problem

Massive truncation to get a favored word-ending segment (McCarthy 2006b)

Some languages require every phonological word to end in a consonant (FINAL-C).

Imagine a language that disallows obstruents at the end of a syllable (NO-CODA). Under the ranking FINAL-C, CODA-COND » MAX classical OT gives terrible results: everything is cut off from the word, until a sonorant consonant is reached, even if that is originally located far from the right side. Nature does not allow such a system.

Unwelcome effect of FINAL-C, CODA-COND » MAX (McCarthy 2006b, p. 6).

/palasanataka/	FINAL-C	CODA-COND	MAX
☞ palasan			*****
palasanataka	*!		
palasanatak		*!	*
palasanata	*!		**
palasanat		*!	***
palasana	*!		****

In OT-CC this is not possible.

<palasanataka, palasanatak> Valid only if FINAL-C » CODA-COND

<palasanataka, palasanatak, palasanata> Valid only if CODA-COND » FINAL-C

In other words, the chain <palasanataka, palasanatak, palasanata> is invalid, because it cannot meet the harmonic improvement requirement.

Remark: in order to be able to delete the vowel, we must go through two steps; deletion of an entire segment involves violations of two basic faithfulness constraints: MAX(place), MAX(segment).

Valid chain: <palasanataka, palasanatakə, palasanatak>

Invalid chain: **<palasanataka, palasanatak>

Under what ranking do the first two forms of the chain increase harmony? Probably it cannot be vowel reduction, neither can it be the unmarked status of schwa. Some constraint must be postulated requiring emptiness at the level of the place node, at the end of a word. This closely resembles classical **Government Phonology**; words end in an empty vowel (Kaye 1987).

Final empty syllables, as in GP?

So it might after all be the case that FINAL-C really is FINAL-*empty*V, in the spirit of GP.
However, once we do this, we no longer need OT-CC to explain *this specific instance* of the too-many-solutions problem (as far as I can see).

OT-CC can account for Opacity (if PRECEDENCE constraints are added).
PREC constraints inspect the structure of a chain.

Opacity; Counterfeeding Order

Bedouin Arabic
Valid chains:
<gabr>
<gabr, ga.bur>
<gabr, ga.bur, gi.bur>

The third chain leads to a phonologically transparent form. Yet this is not the actual form (Counterfeeding Opacity). This is accounted for by the constraint PREC(IDENT(low),DEP).

Effect of PREC(IDENT(low),DEP) in OT-CC (McCarthy 2006b, p. 10).

/gabr/	*COMPLEX-CODA	PREC (IDENT (low),DEP)	RAISE	IDENT (low)	DEP
☞ <gabr,gabur> <DEP>		*	*		*
<gabr,gabur,gibur> < DEP, IDENT(low)>		**!		*	*
<gabr> <>	*!				

Remark (question): imagine Bedouin Arabic′. Suppose that this language is like Bedouin Arabic, except that PREC(IDENT(low),DEP) » *COMPLEX-CODA. Wouldn't that lead to very strange results? It would be a language where epenthesis breaks up a consonant cluster, except after a low vowel.

Opacity; Counterbleeding Order

Bedouin Arabic
Valid chains:
<ħa:kimi:n>
<ħa:kimi:n, ħa:kʲimi:n>
<ħa:kimi:n, <ħa:kmi:n>
<ħa:kimi:n, <ħa:kʲimi:n, ħa:kʲmi:n>

The fourth chain leads to a phonologically non-transparent form. Yet, this is the actual form (Counterbleeding Opacity). This is accounted for by the constraint PREC(IDENT(back),MAX).

Effect of PREC(IDENT(back),MAX) in OT-CC (McCarthy 2006b, p. 11).

/ħa:kimi:n /	*iCV	*ki	MAX	PREC (ID(back), MAX).	ID (back)
☞ <ħa:kimi:n, <ħa:kʲimi:n, ħa:kʲmi:n>			*		*
<ħa:kimi:n>	*!	*!			
<ħa:kimi:n, ħa:kʲimi:n>	*!				*
<ħa:kimi:n, <ħa:kmi:n>			*	*!	

Perhaps this phenomenon of Bedouin Arabic might also be interpreted along the lines of *Old Slavic* 'metathesis' or *Meijel* 'palatalization'. It is a type of 'Opacity' whereby *a chunk of a segment is deleted; what is left of it drifts to another position.*

PALI

Pali has an elaborate system of cluster reduction. It has been the subject of a number of studies (Hankamer and Aissen 1974, Murray 1982, Vaux 1992, Zec 1995). The examples in this section are from Zec (1995).

(5)

stop + stop	*Sanskrit*	*Pali*	
	mudga	mugga	'bean'
	sapta	satta	'seven'
liquid + stop	karka	kakka	'a precious stone'
	valka	vakka	'the bark of a tree'
liquid + fricative	karsaka	kassaka	'farmer'
	sparsa	phassa	'touch'
liquid + nasal	dharma	dhamma	'righteousness'
	kalmasa	kammasa	'spotted'

synchronic cluster simplification in Pali

a.	kar+tuN (inf. suf.)	kattuN	cf. karoti	'to make'
	kir+na (past part.)	kinna	cf. kirasi	'to strew'
b.	lag+na (past part.)	lagga	cf. lagati	'to attach'
	dam+ya (passive)	damma	cf. dameti	'to tame'

Selection of the onset consonant (Zec 1995, p. 163)

(a) if the candidate consonants differ in sonority, the less sonorous one survives
(b) if the candidate consonants are equally sonorous, the second one survives.

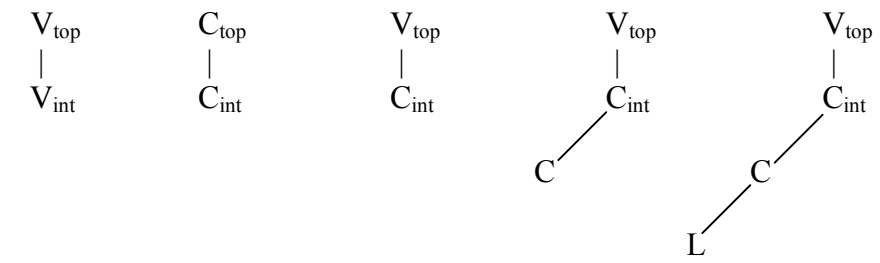
Now consider a form like */lagna/*.

It is impossible to map /lagna/ directly onto [lagga], because of the gradualness requirement. This change would involve a violation of two basic constraints: MAX(place) and NO-SPREAD (place). So we must follow the chain <lagna, lagNa, lagga>. However, this is an invalid chain: **<lagna, lagNa, lagga>, due to the harmonic improvement requirement. The chain violates this requirement, because the second form of the chain is not an improvement; there is no constraint requiring debuccalization in onset position, as we have seen before.

A somewhat orthogonal (but very important) problem (we can discuss it if there is time)
Pali cluster simplification raises very interesting problems for a theory that does not recognize IDENT, but works with DEP(feature) and MAX(feature). For instance, how can *r* 'correspond' to *t* in the mapping /kartun/ → [kattuN]; also, how can *n* 'correspond' to *g* in the mapping /lagna/ → [lagga].

I think we are forced to postulate quite abstract features. Here is an attempt (partly inspired by Morén 2003, forthcoming, Botma 2004, and Van der Hulst 1995, of course).

A theory of major classes



a. C can only project to an identical feature; so once you have C, you are done with V on the projection line.
b. L represents voicing; dependent C represents stopness.

Conclusion: OT-CC is a very ingenious approach to the too-many-solutions problem. It can explain the FCD and also various other instances of this problem. On top of that it can also account for opacity, because of the PRECEDENCE family whose function it is to inspect the structure of chains. However, *Pali* seems problematic.

Энд оф класс

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