Cophonologies all the way up

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Goal: explore how the Optimal Construction Morphology approach of Inkelas & Caballero (to appear) can account for overexponence, underexponence, "inside-out" anad "outside-in" conditioning in morphology.

1. A production-oriented model: Optimal Construction Morphology

- Optimal Construction Morphology (Caballero & Inkelas to appear): a target-driven cyclic approach to word formation in which, on each cycle of word formation, all of the morphological constructions in the language compete for a given stem.

2. Background motivations

- Languages with weird morphology (affixes in wrong or weird templatic order, multiple exponence, etc.)
- Language-specificity » universality
- Role of the lexicon
- Sense that morphology is inherently comparative

3. Basic assumptions of OCM

- OCM is target-driven: for a given meaning target T, all of the possible outputs that the grammar can create are compared to see which one is optimal
- Syntactic (word-internal) structure is emergent from the lexicon, not given in advance
- Words are formed from the elements available in the lexicon and constructicon
- OCM is cyclic. Each pass of grammar evaluation takes as input the form resulting by the previous pass (if any) and compares the results of combining that input with each individual grammatical construction with which it is compatible.
- Each construction is equipped with its own cophonology (constraint ranking)
- Affixation, realizational morphology, morphologically conditioned phonology are all accomplished by cophonologies — hence are necessarily locally conditioned by the properties of the morphological constituent they apply within

4. Consequences of basic assumptions

- Blocking and multiple exponence are emergent effects
- "inside-out" effects: allomorphy conditioned by phonological and syntactic-semantic properties of base of affixation
- "outside-in" effects: allomorphy conditioned by properties of the target even if not expressed in the base of affixation

5. Major points of contact with other approaches

- rule-based realizational approaches (e.g. Anderson 1992, Stump 2001) and constraint-based Optimality Theory approaches (e.g. Aronoff & Xu 2010).
- Lexical Morphology and Phonology (e.g. Kiparsky 1982)
- Stratal and Serial OT (e.g. Kiparsky 2000, Wolf 2008

6. Structure of talk

- What's in the OCM model
- How does OCM work
- Blocking in OCM
- Underexponence in OCM
- Overexponence in OCM
- Inside-out conditioning
- Outside-in conditining

7. What's in the model

- Meaning Target (cf. Anderson 1992)
- Lexicon and Constructicon (cf. Booij 2010)
- Cophonologies
- XY (exponence) Constraints
- Morphological stem type (not discussed here but see Caballero & Inkelas to appear)

(1) **Target**: what the speaker wants to say. *Meaning only.*

Examples:	[T = noun, plural, BOOK]	"books"
	[T = noun, plural, MOUSE]	"mice"
	[T = …]	"contemptuously"

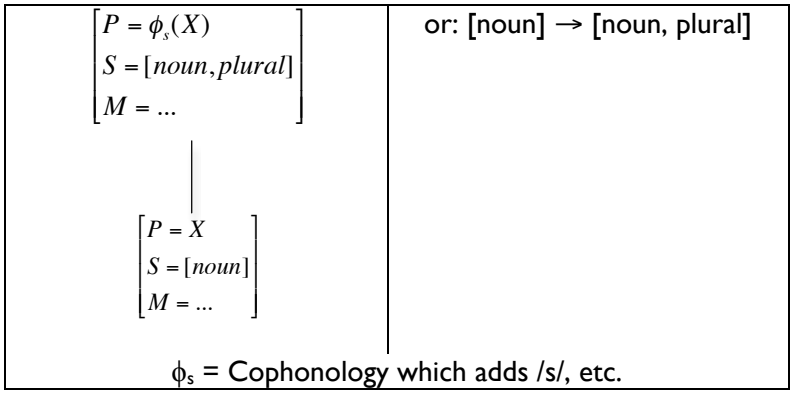
(2) **Lexicon**: list of roots or pre-formed stems or words). *Includes form (P), meaning (S), and morphological category (M).*

Examples:	[P = [bʊk], S = [noun, BOOK] …]	"book"
	[P = [mais], S = [noun, plural, MOUSE] …]	"mice"

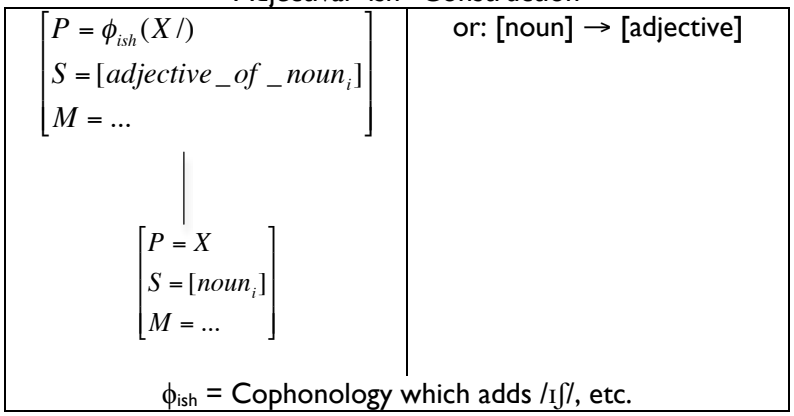
(3) **Constructicon** (list of 2-level morphological "operations"). *Includes form (P), meaning (S), and morphological category (M).*

Examples:

"Plural -s"



"Adjectival -ish" Construction



(4) **Constraints**

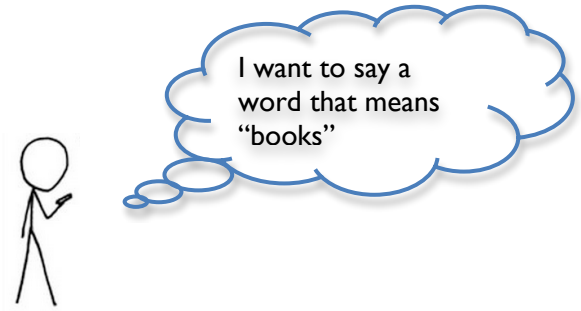
FAITH-Target: penalize output candidates which lack properties of the Target ("MAX") or possess properties not in the Target ("DEP")

XY constraints: the constraint(s) in each cophonology which mark the construction phonologically (affixation, process morphology, etc.)

BE-WORD: penalize output candidates according to their distance from wordhood on this scale of morphological type (M): Root……$Stem_i$…..$Stem_n$……Word

8. How OCM works

a. A speaker wants to say something.



b. OCM sets up a schema in which the word-in-progress (at this point null) is compared to the target meaning "books".
c. OCM scours the lexicon and constructicon to produce a set of self-standing candidates (just single picks, no combinations)
d. OCM assesses each candidate for how well it does on Constraints and chooses a winner.
e. If the winner is of M-type "Word" and matches the Target meaning perfectly, job over. If the winner is the identity candidate, job over also. But otherwise — if the winner is of a lower M-type than Word, or doesn't match the Target perfectly, and isn't input-identical — OCM makes another pass through the constructicon

Illustrative toy grammar, ignoring M-type and other details for now

(5)

Lexicon #1:	"book"	[noun, BOOK]
Lexicon #2:	"mouse"	[noun, MOUSE]
Lexicon #3:	"mice"	[noun, plural, MOUSE]
Construction # 1:	"Plural -s":	[noun] → [noun, plural]
Construction #2:	"Adjectival -ish":	[noun] → [adjective]

(6) **First pass at "books"**

Target: [noun, plural, BOOK] Input meaning: — Input form: —	selected entity	Candidates (meaning, form)	FAITH-TARGET
☞ a.	"book"	[noun, BOOK], [bʊk]	* (plural)
b.	"mice"	[noun, plural, MOUSE], [mais]	** (MOUSE, BOOK)

Winning candidate (a) doesn't match Target; continue to

Second pass at "books"

Target: [noun, plural, BOOK] Input meaning: [noun, BOOK] Input form: [bʊk]	selected entity	Candidates	FAITH-TARGET
☞ a.	"Plural -s"	[noun, plural, BOOK], [bʊks]	
b.	"Adjectival -ish"	[adjective, BOOKISH], [bʊkɪʃ]	*** (plural, noun, adjective)
c.	Identity candidate	[noun, BOOK], [bʊk]	* (plural)

Winning candidate (a) matches Target; job done

9. Blocking emerges from architecture of grammar

(7) **First pass at "mice"**

Target: [noun, plural, MOUSE] Input meaning: — Input form: —	selected entity	Candidates (meaning, form)	FAITH-TARGET
a.	"mouse"	[noun, MOUSE], [mæʊs]	* (plural)
☞ b.	"mice"	[noun, plural, MOUSE], [mais]	** (MOUSE, BOOK)

Winning candidate (b) matches Target; job done

(8) Not needed: constraint to achieve blocking, e.g.

	ECONOMY (*Struc)
mouse-s	**!
☞ mice	*
mice-s	**!

☞ Blocking effects emerge in OCM as a result of cyclic competition. No principle of blocking needs to be stipulated (cf. Anderson 1992, Noyer 1993, Xu & Aronoff 2011)

10. Exponence in OCM: XY constraints in cophonologies

- XY constraints: specify the phonological form Y that a stem with Target property X must assume.
- XY constraints accomplish affixation and other types of morphological exponence, e.g. truncation, gemination, stress and tone placement, etc.
- XY constraints resemble the realizational rules of Anderson (1992) or Stump (1991, 2001) and the exponence constraints of Xu & Aronoff 2010
- XY constraints belong to construction-specific cophonologies
- When X is null, XY = realizational morphology or morphologically conditioned phonology

(9)

Construction	XY constraint included in cophonology
PLURAL construction:	If [plural] ∈ T then candidate must end in /z/
ISH construction:	If [adjective] ∈ T then candidate must end in /ɪʃ/

Affixation: XY » Dep
Morphophonological alternations: Phono-C » XY

Target: [noun, plural, BOOK] Input meaning: [noun, BOOK] Input form: [bʊk]	selected entity	Candidates	FAITH-TARGET	AGREE-VOICE	XY	DEP
☞ a.	"Plural -s"	[noun, plural, BOOK], [bʊks]				* (s)
b.	"Plural -s"	[noun, plural, BOOK], [bʊkz]		*!		* (z)
c.	"Plural -s"	[noun, plural, BOOK], [bʊk]			*!	
d.	"Adjectival -ish"	[adjective, BOOKISH], [bʊkɪʃ]	*!** (plural, noun, adjective)			

(10) Hausa: realizational morphology and morphologically conditioned phonology

	base tone replaced	base tone preserved
zero derivation	✓	✓
overt affixation	✓	✓

a. No affixation; tone replacement (imperative formation)

ká:mà:	→ kà:má:	'catch (!)'	
bíncìké:	→ bìncìké:	'investigate (!)'	
nánné:mó:	→ nànnè:mó:	'seek repeatedly (!)' (< né:mó: 'seek')	

b. No affixation, no tone replacement (Grade 2 verbal noun formation)

fànsá:	→ fànsá:	'redeem/redeeming'
tàmbáyà:	→ tàmbáyà:	'ask/asking'

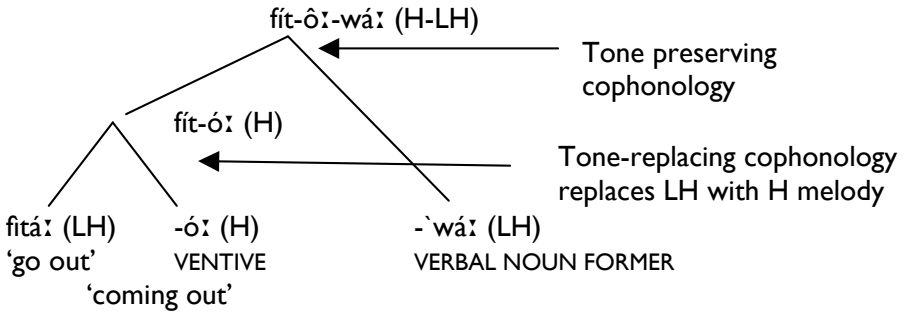
c. Overt affixation, tone replacement (various plural classes)

má:làm	→	mà:làm-ái	'teacher-pl'	-LH
rì:gá:	→	rí:g-únà:	'gown-pl'	-HL
tàmbáyà:	→	támbáy-ó:yí:	'question-pl'	-H

d. Overt suffixation, no tone replacement (various)

dáfà:	→	dáfà:-wá	'cook-ppl'	-LH
gàjé:ré:	→	gàjé:r-ìyá:	'short-fem'	-LH
hù:lá:	→	hù:lâ-ř	'hat-def'	-L

(11) Cophonologies have scope over the contents of the construction they're associated with



(12) **Canonical** XY exponence (cf. Corbett 2007, 2010): A construction uniquely introduces property X, has one XY constraint which refers to X and whose Y is shared by no other XY constraint in the language. (English plural -s, if one disregards the homophonous possessive and suppletive plural stems; Turkish ablative case, etc.)

Underexponence: XY constraints share Y, creating the potential for the same structure Y to satisfy multiple XY constraints simultaneously in the same word

Overexponence: XY constraints share X, creating the potential for property X to be exponed more than once in the same word

11. Underexponence: Multiple sources, one form

(13) *sip* *sipped*
hit **hitted*

38% of 174 English irregular verbs end in -t/-d; 55% end in coronals (www2.gsu.edu/~wwwesl/egw/jones.htm)

XY constraint? X = past; Y = "end in /d/"

11.1 Nitinaht reduplication (two reduplicative exponents merge)

- Stonham (1994): certain Nitinaht suffixes induce morphophonological changes to the base
  - NR affixes: induce reduplication of the first CV of the base, copying vowel length if any
  - CV:R: copy the first CV and lengthen the reduplicant vowel
- When more than one reduplication-triggering affix occurs in the same word, reduplication happens **only once** (p. 49).

(14) a. ƛ̓'uː-ƛ̓'uq^{w} + aːʔdɬ + aːp 'X's legs are really big' (**ƛ̓'uː-ƛ̓'u-ƛ̓'uq^{w}*)
[NR] [CV:R]

b. saː-saːtq + 'aqsiɬ + aːp 'X's eyes were really itchy' (**saː-saː-saːtq*)
[NR] [CV:R]

c. baː-baɬ + aski + yabɬ + aːp 'X is really cold on the shoulders' (**baː-ba-baɬ*)
[NR] [CV:R]

- Stonham: the demands of multiple suffixes 'unify'
- This insight is readily modeled with XY constraints in OCM

(15) X-NR: The output must exhibit CV(ː) reduplication
X-CV:R: The output must exhibit CV reduplication and vowel lengthening

(16) Word (10a) with two reduplicative suffixes: each X-REDUP satisfied by same reduplicant
1st pass at "X's legs are really big" (10a): suffix *-aːʔdɬ* selected

Input form: ƛ̓'uq^{w}		X-NR	*STRUC
☞ a.	ƛ̓'u-ƛ̓'uq^{w}-aːʔdɬ		*
b.	ƛ̓'uq^{w}-aːʔdɬ	*!	

2nd pass at "X's legs are really big" (10a): suffix *-aːp* selected

Input form: ƛ̓'u-ƛ̓'uq^{w}-aːʔdɬ		X-CV:R	*STRUC
a.	ƛ̓'uː-ƛ̓'u-ƛ̓'uq^{w}-aːʔdɬ-aːp		*!
☞ b.	ƛ̓'uː-ƛ̓'uq^{w}-aːʔdɬ-aːp		

☞ OCM generates the haplology effects of Menn & McWhinney's Repeated Morph Constraint — but emergently (and without the confusing ambiguity of what counts as a morph, e.g. as in *hit*)

11.2 Underexponence vs. anti-homophony

- Sometimes homophonous affixes *do* co-occur (contra Menn & McWhinney)
- Nitinaht: no unification of inflectional and derivational reduplication

(17) ka-ka-kawad-ataχ
DIST$_{RED}$-RED-killer_whale-ataχ$_{RED}$
'hunting killer whales'

(18) Cycle of distributive affixation: X-REDUP and ANTI-HOMOPHONY force repeat of reduplication

Target meaning: Distributive of 'hunting killer whales' Input meaning: 'hunting killer whales' Input form: ka-kawad-ataχ	Selected entity	Candidates	X-NR	**ANTI-HOM**	*STRUC
a.	"DIST$_{RED}$"	ka-kawad-ataχ	✓	*!	
☞ b.	"DIST$_{RED}$"	ka-ka-kawad-ataχ	✓		*

Summary of underexponence: multiple sources, one form
- Underexponence predicted when same phonological form Y can satisfy multiple XY constraints.
- Underexponence inhibited by input-output (or paradigmatic) anti-homophony constraints

12. Overexponence: One source, multiple forms

Overexponence ('extended exponence', or 'multiple exponence'): well-known phenomenon; see e.g. Matthews 1974; Stump 1991, 2001; Anderson 2001; Blevins 2003; Harris (in press); Xu & Aronoff 2011, Inkelas & Caballero (to appear). *There are many sources of multiple exponence.* XY constraints are one.

Breton

(19) Breton (Stump 1991a:678, 696): diminutive plurals require two exponents of plural: root.**PL**-DIM-**PL** (a) OR root-**PL**-DIM-**PL** (b):

		singular	singular diminutive	plural	plural diminutive
a.	'bone'	maen	maen-ig	mein	mein-ig-où
	'stone'	askorn	askorn-ig	eskern	eskern-ig-où
b.	'boat'	bag	bag-ig	bag-où	bag-où-ig-où
	'prayer'	pedenn	pedenn-ig	pedenn-où	pedenn-où-ig-où
	'thing'	tra	tra-ig	tra-où	tra-où-ig-où

(20) XY constraints

Diminutive-*ig* : Align-R(Dim stem, *-ig*) (in Diminutive cophonology only)
Plural-*où* : Align-R(Plural stem, *-où* (in Plural **and Diminutive** cophonologies)

Align-R(Plural stem, *-où*) » Align-R(Dim stem, *-ig*) (in Diminutive cophonology)

(21) 2nd pass at "little boats" (having picked *bag* 'BOAT' on 1st pass)

Target meaning: [noun, diminutive, plural, BOAT] Input meaning: [noun, BOAT] Input form: [bag]	Selected construction	Candidates	XY	FAITH-TARGET-PL	FAITH-TARGET-DIM
☞ a.	Plural	[noun, plural, BOAT] bag-où			*
b.	Diminutive	[noun, diminutive, BOAT] bag-ig		*	

3rd pass at "little boats" (having picked *bag-où* 'BOAT-PL' on 1st pass)

Target meaning: [noun, diminutive, plural, BOAT] Input meaning: [noun, plural, BOAT] Input form: [bag-où]	Selected construction	Candidates	XY	FAITH-TARGET-PL	FAITH-TARGET-DIM
a.	Plural	[noun, plural, BOAT] bag-où			*!
b.	Plural	[noun, plural, BOAT] bag-où-où			*!
c.	Diminutive	[noun, diminutive, BOAT] bag-où-ig	*!		
☞ d.	Diminutive	[noun, diminutive, BOAT] bag-où-ig-où			

☞ *This analysis closely resembles that of Stump 2001, who puts the Plural rule in two different rule blocks, and to that of Hyman & Mchombo 1992, who posit cyclic spell-out rules*

(22) 2nd pass at "little boat" (having picked *bag* 'BOAT' on 1st pass)

Target meaning: [noun, diminutive, BOAT] Input meaning: [noun, BOAT] Input form: [bag]	Selected construction	Candidates	XY	FAITH-TARGET	*STRUC
a.	Plural	[noun, plural, BOAT] bag-où		*!	*
☞ b.	Diminutive	[noun, diminutive, BOAT] bag-ig			
c.	Diminutive	[noun, diminutive, BOAT] bag-ig-où			*!

The (-où) exponence of plurality in the Diminutive cophonology is triggered only if the candidate contains the property [plural]. Candidate (19c) doesn't.

13. Outside-in and Inside-out effects

- Prediction of cyclic model: constraints are sensitive to (a) meaning of Target, and (b) meaning and form of partial word that exists at current stage of derivation. Effects of meaning look-ahead are possible.
- Constraints are *not* sensitive to *form* associated with constructions that express properties in the Target but haven't been added yet. No phonological "look-ahead".
- Phonological conditioning is predicted to be strictly inside-out; syn/sem conditioning is predicted to be inside-out or outside-in.
- Incrementally faithfulness-increasing morphology is predicted to occur even if globally its presence is redundant

(23) Filomeno Mata Totonac (McFarland 2008): a few roots and aspect suffixes have a suppletive allomorph for 2 person subject. Subject person is marked by an outer suffix. This could be described as a "look-ahead" effect. The presence of [subj person = 2] in the target is driving these selections.

a. /tan-paa-ti/
   come.**2SUBJ**-PROG.**2.SUBJ**-**2.SUBJ**.SG
   'you (sg) are coming'
b. /min-maa/
   come-PROG
   'he is coming'
c. */min-maa-ti/
   come-PROG-2SUBJ.SG
   'you (sg) are coming'

(24) Realis/irrealis marking in Nanti (Michael 2008:276): a dedicated inner prefix marks irrealis even though an outer passive suffix also encodes realis/irrealis. This can be described as an "inside-out" effect

a. o=oog-agani
3nmS=consume-PASS.REAL
'It is eaten'

b. tera i=**N**-p-**eNkani**
NEG.IRREAL 3mS=**IRREAL**-give-**PASS.IRREAL**
'He was not given anything'

(25) Number in Turkana (Dimmendaal 1983).

a.	[Pl root]	e-kor-òt	ŋi-kor`	[232]
		m.sg-Samburu_person.pl-**sg**	non_f.pl-Samburu_person.pl	
b.	[Sg root]	a-ŋasɛp`	**ŋa-**ŋàsɛp-**a**	[226]
		f.sg-placenta.sg	**f.pl**-placenta.sg-**pl**	
c.	[Ø root]	e-kùk-ut	ŋi-kuku-i`	[224]
		m.sg-chicken-**sg**	**non_f.pl**-chicken-**pl**	

This kind of redundancy is predicted from basic principles in OCM if the redundant layer is inside (which must be determined from evidence and accounted for)

Nanti
- 1st pass: choose root
- 2nd pass: choose prefix. Irrealis prefix p- brings stem closer to Target T
- 3rd pass: choose irrealis passive suffix. Passive needs to be marked; irrealis comes along for the ride

From a global perspective, irrealis p- is redundant and constraints like *Morpheme would disprefer forms containing it. But locally, from the inside-out, it is a value-add.

(26) *MORPHEME violated by superfluous morphology (Nanti)

Meaning target: "he was not given anything"	Candidates	FAITH-TARGET	*MORPHEME
a.	[i=**N**-p-**eNkani]** 3mS=**IRREAL**-give-**PASS.IRREAL** "he was not given anything"	✓	****!
💣 b.	[i=p-**eNkan]** 3mS-give-**PASS.IRREAL** "he was not given anything"	✓	***

14. Conclusion

- OCM is a production-oriented model of word formation with the following architectural components:
- Constructicon — each individual two-level construction is associated with a cophonology
- Grammatical locality (the grammar assesses individual layers, hence is local not global)
- Sign-based (all candidates are well-formed signs)
- Target-driven (words are not just assessed for grammaticality but also for faithfulness to an intended meaning)
- Realizational morphology and morphologically conditioned phonology are modeled with the same kind of (XY) exponence constraints

- These assumptions drive both inside-out and outside-in effects and give the model an inherently cyclic character
- Blocking and multiple exponence are emergent effects of the lexicon interacting with the grammar (Caballero & Inkelas to appear)

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