IGRA 02: Morphology III

Harmonic Serialism: Extended Exponence

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1. Background

- *Harmonic serialism in phonology*:
  McCarthy (2008; 2010), McCarthy et al. (2012), Kimper (2012), Pater (2012), ...
  (also see Prince & Smolensky (1993; 2004) for the general option, and McCarthy (2000) for an early negative assessment)
- *Harmonic serialism in syntax*:
  Heck & Müller (2007; 2013a;b), Assmann, Georgi, Heck, Müller & Weisser (2015)
  (predecessors: Ackema & Neeleman (1998), Heck (1998; 2001), Heck & Müller (2000; 2003))
- *Harmonic serialism in morphology*:
  □

Claim:
Extended exponence provides an empirical domain in which an approach in terms of harmonic serialism suggests itself.

2. Extended Exponence

Origin (Matthews (1972, 82), Matthews (1974, 149)):
Extended (multiple) exponence in Greek verb inflection, English verb inflection, etc.

Extended exponence:
Cases of morphological realization where a single morpho-syntactic property seems to be expressed by more than one exponent (i.e., inflection marker, in the cases to be considered here).

Empirical domain:
Interaction of argument encoding and number/person marking in:

- German (case-marking on nouns, number marking)
- Archi (case-marking on nouns, number marking)
- Timucua (agreement morphology on verbs, person marking)
- Sierra Popoluca (agreement morphology on verbs, person marking)
- Swahili (negation and verb inflection)

2.1. German

Observation:
Plural can be marked twice on nouns in dative (DAT) contexts in German (Eisenberg (2000), Wiese (2000)). Note: *n* must be a DAT plural marker rather than a simple DAT marker because it does not show up in the singular.

(1) *Extended exponence in German nouns*:

a.	Kind-er-n child-PL-DAT.PL	b.	*Kind-n child.SG-DAT.PL	(German)
c.	Tisch-e-n table-PL-DAT.PL	d.	*Tisch-n table.SG-DAT.PL	

2.2. Archi

Observation:
The same phenomenon exists in the Daghestanian language Archi (Kibrik (1991; 2003), Mel'čuk (1999), Plank (1999)). Archi exhibits an ergative-absolutive (ERG-ABS) pattern of argument encoding. For a stem like *gel* ('cup'), the ERG plural is created by adding the plural marker *um* and the ERG plural marker *čaj* (in that order); for a stem like *qIin* ('bridge'), the ERG plural is derived by adding the plural marker *or* and, again, the ERG plural marker *čaj*; see (2-ac). As before, it is clear that *čaj* must be a marker of both case (ERG) and number (plural): This marker cannot be used in the singular, where the case markers *li*, *i* are used for marking ERG instead.

(2) *Extended exponence in Archi nouns*:

a.	gel-um-čaj cup-PL-ERG.PL	b.	gel-li cup.SG-ERG	(Archi)
c.	qIinn-or-čaj bridge-PL-ERG.PL	d.	qIonn-i bridge.SG-ERG	

2.3. Timucua

Observation:
A similar phenomenon can be found in the domain of verb inflection in Timucua, an extinct language isolate from Florida (Mithun (1999, 520); the discussion here is based on Granberry (1990)). Arguments are encoded by head-marking, i.e., case-sensitive agreement morphology on the verb; the pattern is a nominative-accusative one (NOM-ACC). (Assumption: case-assignment depends on Agree operations involving matching features (in the sense of Chomsky (2001)), so structural case (like NOM) is present both on the case-marked DP and the case-marking head; see, e.g., Bobaljik & Wurmbrand (2003)).)

(3) *Prefix markers*:

a. The internal argument of a transitive verb is encoded by an "object", i.e., ACC prefix.
b. Other primary arguments, including the external argument of a transitive verb, are encoded by a "subject", i.e., NOM prefix.
c. A NOM prefix precedes a ACC prefix in transitive contexts; the two markers occupy positions no. 1 and 2 in the template identified by Granberry.
d. These prefixes encode person (but not number) in addition to case:
   (i) two 1.NOM markers *ho-* and *ni-* (which "occur with approximately equal

frequency"; Granberry (1990, 86))

(ii) a 2.NOM marker *ci-*

(iii) a zero 3.NOM marker Ø-.

(4) *Suffix markers*:

a. Many more types of affixes show up on the inflected Timucua verb, but they are all suffixes.

b. Among these: number markers indicating plural (in 7th position in Granberry's template):

c. Crucially, these plural markers also involve case (NOM) and person (local vs. 3) information and thus qualify as combined PERS.NUMBER.NOM markers (not too unlike typical subject agreement markers in Indo-European languages like German or Icelandic).

d. The markers are *-bo* (for 1./2.PL.NOM arguments) and *-ma* (for 3.PL.NOM arguments).

(5) *Extended exponence in Timucua verbs*:

a. ho-ini-ta-la
1.NOM-be-ASP-LOC
'I am.'

b. ni-huba-so-si-bo-te-la (Timucua)
1.NOM-love-TR-REC-1/2.NOM.PL-ASP-LOC
'We love each other.'

c. ci-huba-so-te-le
2.NOM-love-TR-ASP-LOC
'You$_{sg}$ love (someone).'

d. ci-huba-so-bo-te-le
2.NOM-love-TR-1/2.NOM.PL-ASP-LOC
'You$_{pl}$ love (someone).'

e. ano Ø-hewa-na-no
man 3.NOM-speak-ASP-LOC
'The man is speaking.'

f. Ø-ini-ma-bi-la
3.NOM-be-3.NOM.PL-ASP-LOC
'They are just now.'

Note:

- (5-ace) involve singular subjects (1., 2., 3. person), with a prefix encoding person and case.
- (5-bdf) are corresponding examples with plural subjects (1., 2., 3. person) that exhibit extended exponence of case and person marking in Timucua.

(Other markers, irrelevant here: ASP (aspect, here: durative or bounded action), LOC (or TENSE: proximate vs. distant time), TR (transitivity), and REC (reciprocity); also note that *te/ta*, *le/la* are variants.)

2.4. Sierra Popoluca

Observation:
Sierra Popoluca (Mixe-Zoque, Mexico) employs a head-marking system of argument encoding that follows an ergative-absolutive pattern (ERG-ABS) (Elson (1960a, 29-30), Elson (1960b, 207-208)). As in Timucua, person can be marked twice on the verb.

(6) *Extended exponence in Sierra Popoluca verbs, intransitive contexts*:

a. A-nɨk-pa (Sierra Popoluca)
1.ABS-go-INC
'I am going.' (Marlett (1986, 364))

b. A-pɨːšiñ
1.ABS-man
'I am a man.'

c. Ta-hoːy-pa
1.INCL.ABS-take.a.walk-INC
'You and I take a walk.' (Elson (1960b, 208))

(7) *Extended exponence in Sierra Popoluca verbs, transitive contexts*:

a. A-Ø-koʔc-pa (Sierra Popoluca)
1.ABS-3.ERG-hit-INC
'He hits me.'

b. Ø-Aŋ-koʔc-pa
3.ABS-1.ERG-hit-INC
'I hit him.'

c. Ø-Taŋ-koʔc-pa
3.ABS-1.INCL.ERG-hit-INC
'You and I hit him.' (Elson (1960b, 208))

(8) *Order of verbal affixes in Sierra Popoluca*:
PERS.ABS – PERS.ERG – V – NUM – PASS – ASP

Note:
Number, passive, and aspect markers are ignored here.

(9) *Apparent fusional case/person markers in Sierra Popoluca*:

	ABS	ERG
1.	a	an
1.INCL	ta	tan
2.	mi	iñ
3.	Ø	i

	ABS ← ERG
1 → 2	man
2 → 1	an

Note:
This time, the evidence is not quite as direct, but it is there under an analysis that provides internal structure for the markers in (9), via subanalysis based on a decomposition of person features as in (10). The simplest analysis (that accounts for all instances of syncretism) will have to postulate that *a* is [+1], and that *t* is then marked [+1,+2] (Müller (2006)). If so, there is extended exponence of [+1] in Sierra Popoluca.

(10) *Decomposition of person features* (Frampton (2002)):

a. [+1,–2] = 1. pers.

b. [–1,+2] = 2. pers.

c. [–1,–2] = 3. pers.
d. [+1,+2] = 1. pers. incl.

2.5. Swahili

Observation (Stump (2001, 162-163)):
Noyer's concept of secondary exponence [see below] is empirically problematic since there are cases where one and the same inflection marker must act as a primary exponent of a morpho-syntactic property in one context, and as a secondary exponent of the same morpho-syntactic property in another context.

(11) *Past tense and negation in Swahili 1. plural contexts*:

a. tu-li-taka (positive)
1.PL-PAST-want
'We wanted'

b. ha-tu-ku-taka (negative)
NEG-1.PL-NEG.PAST-want
'We did not want'

(12) *Future tense and negation in Swahili 1. plural contexts*:

a. tu-ta-taka (positive)
1.PL-FUT-want
'We will want'

b. ha-tu-ta-taka (negative)
NEG-1.PL-FUT-want
'We will not want'

2.6. Interim Conclusion

Conclusion so far:
Extended exponence exists in the argument encoding systems of German, Archi, Timucua, and Sierra Popoluca, and with negative verb inflection in Swahili.

Note:
That said, there are several cases where extended exponence has been argued to show up that may not be fully convincing upon closer inspection. For instance, Matthews (1974) argues for extended exponence on the basis of German plural formation per se, based on the fact that plural may be realized by a combination of segmental plural marker (like *er*) and Umlaut of the stem vowel, as in *Buch* ('book') vs. *Büch-er* ('books'). However, this evidence for extended exponence loses its force if we assume that Umlaut is encoded on plural markers as an abstract ('floating') feature; cf., e.g., Wiese (1996). Similar conclusions may be drawn in the case of deverbal noun formation in Kujamaat Jóola discussed in Aronoff & Fudeman (2005, 154), where a class marker change is accompanied by vowel tensing.

Question:
How do current theories of morphology deal with extended exponence?

State of the art:

1. *Lexical-incremental approaches* (e.g., Wunderlich (1996)):
Extended exponence is prima facie unexpected.
Possible solution (Stiebels (2015)): A second exponent of a given feature must primarily contribute *another feature*; in addition, reference to secondary *contextual features* is needed.

2. *Inferential-realizational approaches* (e.g., Matthews (1972), Anderson (1992), Aronoff (1994), Stump (2001)):
Extended exponence is expected.

3. *Lexical-realizational approaches* (e.g., Halle & Marantz (1993), Noyer (1992), but also most of the morphematic optimality-theoretic approaches discussed in the *IGRA 02: Morphology I* handout: Grimshaw (2001), Don & Blom (2006), Trommer (2001; 2003; 2006)):

   - An exponent realizes one syntactic position (standard assumption, disjunctive ordering).
   Extended exponence is prima facie unexpected. → Reference to secondary *contextual features* is needed.
   - An exponent discharges a feature that it realizes (Noyer (1992), Trommer (1999)):
   Extended exponence is prima facie unexpected → References to secondary *discharged features* is needed.
   - Müller (2007): Reference to secondary (contextual, discharged) features can be dispensed with if post-syntactic *enrichment rules* are postulated that copy features before realization, and that act as the counterpart of *impoverishment rules*.

Observation:
The enrichment approach in Müller (2007) is compatible with the existence of multiple exponents with an *identical* feature specification. Abstracting away from cases of *form replication* (i.e., multiple occurrence of the same exponents), this does not seem to occur. Caballero & Harris (2012) give a single example from Nahuatl that is supposed to exhibit "fully superfluous multiple exponence" but this may well be misanalyzed. (It is claimed that there can be two causative suffixes in some cases, *l* and *tia*, that correspond to only one instance of causativization; however, there no evidence for the independent availability of *l* as a causative marker, and synchronically the *l*-version might simply be an optional part of the causative exponent *tia*.)

Generalization:
Extended exponence is possible only when the morpho-syntactic features of two exponents

are not identical (Stiebels (2015)); they can then (a) be in a subset relation ("partially superfluous multiple exponence", in the terminology of Caballero & Harris (2012), as in all the examples discussed here), or (b) not be in a subset relation ("overlapping multiple exponence", Caballero & Harris (2012)).

Problem:
It is not a priori clear how can this generalization be derived in a (morphematic) optimality-theoretic approach (of the type discussed in *IGRA 02: Morphology I* handout), given that an exponent whose morpho-syntactic features are a subset of the morpho-syntactic features of another exponent should be blocked as redundant.
(In contrast, overlapping exponence is unproblematic from an OT perspective.)

Claim:
This only holds for classical, parallel optimality theory, not for serial optimality theory.

3. Extended Exponence in Harmonic Serialism

3.1. Assumptions

(13) *Harmonic serialism* (McCarthy (2010), Heck & Müller (2007)):

a. Given some input I_i, the candidate set $CS_i = \{O_{i1}, O_{i2}, \ldots O_{in}\}$ is generated by applying at most *one operation* to I_i.
b. The output O_{ij} with the best constraint profile is selected as optimal.
c. O_{ij} forms the input I_{ij} for the next generation step producing a new candidate set $CS_j = \{O_{ij1}, O_{ij2}, \ldots O_{ijn}\}$.
d. The output O_{ijk} with the best constraint profile is selected as optimal.
e. Candidate set generation stops (i.e., the derivation converges) when the output of an optimization procedure is identical to the input (i.e., when the constraint profile cannot be improved anymore).

(14) *Assumptions about morphology* (simplified):

a. The initial input is a stem plus a fully specified set of morpho-syntactic features that are realized by exponents which themselves can be underspecified.
b. The optimal exponent for some feature(s) is determined by a ranked set of faithfulness constraints (deriving compatibility and specificity requirements) and other (e.g., markedness) constraints (Grimshaw (2001), Don & Blom (2006), Trommer (2001; 2003; 2006), Wunderlich (2004), Stiebels (2006)).
c. An exponent realizing the morpho-syntactic feature of a stem by attaching to it *discharges* the corresponding feature of the stem (Noyer (1992), Trommer (1999)); a discharged feature remains visible and can be realized again, but cannot be discharged again: [F] → [~~F~~].

3.2. Case study: Archi

(15) *Extended exponence in Archi nouns*:

a.	gel-um-čaj cup-PL-ERG.PL	b.	gel-li cup.SG-ERG	(Archi)
c.	qIinn-or-čaj bridge-PL-ERG.PL	d.	qIonn-i bridge.SG-ERG	

(16) *Exponents*:

a. /um/ ↔ [+pl,I]
b. /or/ ↔ [+pl,II]
c. /i/ ↔ [–pl,+erg]
d. /čaj/ ↔ [+pl,+erg]

Note:
I, II are inflection class features; these features are *morphomic* (Aronoff (1994)) rather than *morpho-syntactic*; they play no role whatsoever in syntax. Consequently, the cases of extended exponence in (15) involve subset relations (i.e., "partially superfluous" exponence).

(17) *Faithfulness constraints*:

a. IdentNum:
A number feature [F] on a stem is realized by an exponent with an identical feature.
b. IdentCase:
A case feature [F] on a stem is realized by an exponent with an identical feature.

(18) *Other constraints*:

a. MinDis ('Minimize Discharge'):
An operation does not discharge more than one feature.
b. UniqReal ('Uniqueness of Realization'):
A morpho-syntactic feature associated with a stem cannot be realized by more than one exponent.
c. ¬Con ('No Contradiction'):
Stem and exponent must not bear contradictory features.

Remarks:
(i) (18-a) basically demands agglutination and blocks portmanteau morphemes.
(ii) (18-b) prohibits extended exponence.
(iii) (18-c) primarily ensures that stem and exponent do not bear contradictory inflection class features. This should not be formulated as an Ident constraint because it would otherwise be violated in all those cases where inflection class does not play any role (e.g., in the singular in Archi) – morphomic inflection class features inherent to a stem are never discharged. In addition, ¬Con ensures that O_{114} in T_2 below does not accidentally block O_{115} (Fabian Heck (p.c.)).

3.3. A Harmonic Serialism Analysis

(19) *Ranking in Archi*:
IdentNum ≫ MinDis ≫ IdentCase ≫ IdentClass ≫ UniqReal

T_1: Deriving gel-um-čaj, Step 1: Plural marking

I_1: /*gel*$_I$ [+pl,+erg]/	IdNum	MinDis	IdCase	¬Con	UReal
☞O_{11}: gel$_I$[~~+pl~~,+erg]-um[+pl,I]			*		
O_{12}: gel$_I$[~~+pl~~,+erg]-or[+pl,II]			*	*!	
O_{13}: gel$_I$[+pl,+erg]	*!		*		
O_{14}: gel$_I$[+pl,+erg]-i[–pl,+erg]	*!			*	
O_{15}: gel$_I$[~~+pl~~,~~+erg~~]-čaj[+pl,+erg]		*!			

T_2: Deriving gel-um-čaj, Step 2: Extended exponence

I_{11}: /*gel*$_I$ [~~+pl~~,+erg]-um[+pl,I]/	IdNum	MinDis	IdCase	¬Con	UReal
O_{111}: gel$_I$[~~+pl~~,+erg]-um[+pl,I]-um[+pl,I]			*!		
O_{112}: gel$_I$[~~+pl~~,+erg]-um[+pl,I]-or[+pl,II]			*!	*	
O_{113}: gel$_I$[~~+pl~~,+erg]-um[+pl,I]			*!		
O_{114}: gel$_I$[~~+pl~~,+erg]-um[+pl,I]-i[–pl,+erg]				*!	
☞O_{115}: gel$_I$[~~+pl~~,~~+erg~~]-um[+pl,I]-čaj[+pl,+erg]					*

T_3: Deriving gel-um-čaj, Step 3: Convergence

I_{115}: /*gel*$_I$ [~~+pl~~,+erg]-um[+pl,I]-čaj[+pl,+erg]/	IdNum	MinDis	IdCase	¬Con	UReal
O_{1151}: gel$_I$[~~+pl~~,~~+erg~~]-um[+pl,I]-čaj[+pl,+erg]-um[+pl,I]					**!
O_{1152}: gel$_I$[~~+pl~~,~~+erg~~]-um[+pl,I]-čaj[+pl,+erg]-or[+pl,II]				*!	**
☞O_{1153}: gel$_I$[~~+pl~~,~~+erg~~]-um[+pl,I]-čaj[+pl,+erg]					*
O_{1154}: gel$_I$[~~+pl~~,~~+erg~~]-um[+pl,I]-čaj[+pl,+erg]-i[–pl,+erg]				*!	**
O_{1155}: gel$_I$[~~+pl~~,~~+erg~~]-um[+pl,I]-čaj[+pl,+erg]-čaj[+pl,+erg]					**!*

Note:

- T_2 illustrates how extended exponence can become optimal: The second realization of [+pl] by /*čaj*/ does not violate MinDis because [+pl] already has been discharged in the prior optimization step.
- T_3 accounts for the absence of fully superfluous multiple exponence in the world's languages.
- Outputs with exponents bearing the wrong inflection class information are harmonically bounded.

(20) *Further rankings*:

a. IdentNum ≫ IdentCase ≫ MinDis ≫ IdentClass ≫ UniqReal:
☞*gel-čaj* → no extended exponence

b. IdentNum ≫ MinDis ≫ UniqReal ≫ IdentCase ≫ IdentClass:
☞*gel-um* → no extended exponence

3.4. Global Optimization

Note:
Ceteris paribus, global, parallel optimization as it is standardly assumed will always be incompatible with extended exponence, under any ranking. (In MinDis, "operation" stands for "input-output mapping".)

T_4: Global optimization: wrong winner

I_1: /*gel*$_I$ [+pl,+erg]/	IdNum	MinDis	IdCase	¬Con	UReal
☛O_{11}: gel$_I$[~~+pl~~,+erg]-um[+pl,I]			*		
O_{12}: gel$_I$[~~+pl~~,+erg]-or[+pl,II]			*	*!	
O_{13}: gel$_I$[+pl,+erg]	*!		*		
O_{14}: gel$_I$[+pl,+erg]-i[–pl,+erg]	*!			*	
O_{15}: gel$_I$[~~+pl~~,~~+erg~~]-čaj[+pl,+erg]		*!			
O_{16}: gel$_I$[~~+pl~~,~~+erg~~]-um[+pl,I]-čaj[+pl,+erg]		*!			*
O_{17}: gel$_I$[~~+pl~~,~~+erg~~]-čaj[+pl,+erg]-um[+pl,I]		*!			*

Note:
The problem is a high-ranked MinDis. However, alternative rankings like the ones in (20) will not produce extended exponence either under global optimization.

T_5: Global optimization, second attempt: wrong winner

I_1: /*gel*$_I$ [+pl,+erg]/	IdNum	IdCase	MinDis	¬Con	UReal
O_{11}: gel$_I$[~~+pl~~,+erg]-um[+pl,I]		*			
O_{12}: gel$_I$[~~+pl~~,+erg]-or[+pl,II]		*		*!	
O_{13}: gel$_I$[+pl,+erg]	*!	*			
O_{14}: gel$_I$[+pl,+erg]-i[–pl,+erg]	*!			*	
☛O_{15}: gel$_I$[~~+pl~~,~~+erg~~]-čaj[+pl,+erg]		*			
O_{16}: gel$_I$[~~+pl~~,~~+erg~~]-um[+pl,I]-čaj[+pl,+erg]		*!			*
O_{17}: gel$_I$[~~+pl~~,~~+erg~~]-čaj[+pl,+erg]-um[+pl,I]		*!			*

Conclusion:
More generally, under global optimization, the candidate that has extended exponence will always be harmonically bounded by a candidate that leaves out one of the two markers. If

MinDis is simply abandoned, the optimal candidate will always be one where the exponent realizing a subset of the other exponent's features is blocked.

Qualification:
This only holds for scenarios with a subset relation ("partially superfluous multiple exponence"), not for those where there is no subset relation ("overlapping multiple exponence"): In these latter cases, extended exponence can be brought about both in a harmonic serialism approach and in a harmonic parallelism approach (by a high ranking of two faithfulness constraints demanding realization of $[F_1]$ and $[F_2]$, which are present on two exponents α and β, respectively, that also share some feature $[F_3]$).

Observation:
Extended exponence in the other languages discussed above works in exactly the same way.

Predecessor:
Caballero & Inkelas (2013) introduce a *stratal OT* approach that can also cover extended exponence, and has the same fatal consequence for standard parallel optimization. Crucially, in the case of Archi, it is assumed that there are two strata (root to stem and stem to word), and *um*, by stipulation, belongs to the first stratum, and *čaj* to the second.

Differences between the stratal and the harmonic serialism approaches:

- What needs to be stipulated in the stratal approach (viz., why *um* comes first) is derived in the harmonic serialism approach (via MinDis).
- Depending on a number of further assumptions, the stratal approach could be compatible with fully superfluous extended exponence; deriving this is impossible under the harmonic serialism analysis.
- Whereas the case may or be not be dubious in Archi, for some of the above cases (e.g., dative plurals in German and agreement marking in Sierra Popoluca) it seems unlikely that the two markers participating in extended exponence can be argued to belong to two different strata.
- The order of the two exponents in negative marking in Swahili poses a potential problem for both approaches; both approaches must assume that the general negation marker becomes optimal before the negation/past marker is introduced in cases like (11-b) (*ha-tu-ku-taka*). However, it is hard to see how a stratal analysis that *defines* strata on the basis of roots can accomplish that.
- More generally, if "root → stem" defines the first stratum in Caballero & Inkelas (2013), then a partially superfluous exponent can never be non-adjacent to the root. This is certainly not the case for absolutive markers on verbs in Sierra Popoluca.

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