Locality restriction on metathesis in Harmonic Serialism

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Metathesis is subject to locality restrictions: most known synchronic cases involve two adjacent segments, while some rare synchronic cases (arguably all diachronic) involve the transposition of segments over bounded distance. In this paper, I account for these restrictions by analyzing metathesis in Harmonic Serialism (HS, Prince and Smolensky 1993/2004, McCarthy 2000) as copy + deletion or fusion + fission and not as segment reordering. I further restrict copying to apply only inside a foot, correctly blocking unattested patterns in languages such as Kwara'ae. The locality restrictions on metathesis are determined by both the gradualness of GEN in HS and the constraints that are active in each language.

Metathesis as copy + deletion: Kwara'ae, an Austronesian language, exhibits multiple metathesis in one of its speech registers (Heinz 2004, 2005), as shown in (1b).

(1) a. /sa$_1$lo$_2$/ → ˈsaol 'sky' b. /ke$_1$ta$_2$la$_3$ku$_4$/ → ˈke$_1$a$_2$t$_1$la$_3$u$_4$k 'my hand'
c. /li$_1$ma$_2$ku$_3$/ → ˈli.ˌmauk 'my hands' d. /limaumu$_1$lu$_2$/ → ˈli.mauˌmu$_1$u$_2$l 'your hands'

I show that Kwara'ae's apparent metathesis patterns result from copy + deletion that is driven by a requirement for stressed heavy syllables (SWP) and avoidance of a foot consisting of heavy + light syllables (FOOTFORM(*HL)) shown in (2). Trochaic stress is assigned by higher ranked prosodic constraints (Step 1); then a vowel is copied into the stressed syllable to satisfy SWP (Step 2). Finally, the word final V_2 deletes (Step 3) to satisfy FOOTFORM(*HL). Crucially, the foot boundaries determine the copying domain. Consider (1c) /li$_1$ma$_2$ku$_3$/ → ˈli.ˌmauk. A highly ranked constraint banning vowel copying across a foot boundary makes it impossible for an unattested SWP-conforming candidate (ˈlia$_x$)(ˌma$_x$uk) to surface.

(2) UR: /sal$_1$o$_2$/ → Step 1: (sá.l$_1$o$_2$) → Step 2: (sáo$_2$.l$_1$**o$_2$**) → Surface: [(sáo$_2$l$_1$)]

Copy + deletion analysis of metathesis is not new (e.g., Postal 1969, Blevins & Garrett 1998). Strong evidence to prefer copy + deletion analysis comes from forms that reflect the intermediate stage candidate containing a copied vowel but without deletion (e.g., /salo/→[saol] but optionally [saolo̥] in Kwara'ae, Heinz 2005). My copy + deletion analysis extends smoothly to many other CV metathesis cases including Rotuman (McCarthy 2000), Leti (Hume 1997), Mohawk (Michelson 1988) and others.

Comparison to Parallel OT analysis: Heinz's (2005) parallel analysis of Kwara'ae metathesis relies on the family of CONTIGUITY constraints. Heinz points out both conceptual and empirical problems with LINEARITY, and shows that the SWP >> LINEARITY ranking necessary to account for simple cases predicts a wrong winner (e.g., *ˈlia.muˌmuul for (1d)ˈli.mauˌmu$_1$u$_2$l). In order to deal with the problematic cases, Heinz (2005) proliferated a family of CONTIGUITY constraints which bans both creation of new contiguous segments in the output (DEP-CONTIG) and deletion of existing contiguous segments (MAX-CONTIG). The correct surface form for (1d) is derived with the ranking of the V-V MAX-CONTIG constraint that prohibits destroying contiguous VV sequence in the input over SWP and general MAX/DEP CONTIGUITY constraints. My HS analysis, on the other hand, successfully blocks unattested patterns without proliferating a new set of faithfulness constraints, as shown above.

LINEARITY in Parallel OT and HS: The use of LINEARITY in Parallel OT has been shown to overgenerate in other languages as well. Carpenter (2002) points out that the constraint ranking proposed for analysis of Rotuman metathesis (McCarthy 2000) does not rule out problematic long-distance cases, which led her to claim that LINEARITY alone cannot prevent unattested metathesis patterns. To correctly block long-distance metathesis, Carpenter (2002) proposes a family of ADJACENCY(DOMAIN) constraints which prohibit reordering of adjacent segments in a specific domain (e.g., syllable). On the other hand, LINEARITY in HS is less problematic in blocking long-distance metathesis because of the gradualness of GEN (McCarthy 2007). At each operation, each candidate can only differ

minimally ('one change') from the input. This characteristics of HS makes it difficult to create successive intermediate steps that eventually converge with a long-distance metathesis output while improving harmony. In this sense, LINEARITY becomes less problematic in HS, and long-distance patterns will be successfully blocked in many cases.

Rotuman metathesis: However, assuming metathesis as an atomic operation in analyzing Rotuman allows unattested patterns to surface even in HS. Rotuman phase alternations (McCarthy 2000) exhibit apparent metathesis, deletion and coalescence (3).

(3) Metathesis: /pu_1re_2/ → [pu_1e_2r] Deletion: /ra_1ko_2/ → [ra_1k] Coalescence: /ho_1ti_2/ → [$hø_{1,2}t$]

I propose that these alternations are driven by a requirement for SWP and FinalStress: /pur_1e_2/ → $púr_1e_2$ → $púe_2r_1e_2$ → [$púe_2r_1$]. I analyze both apparent deletion and coalescence as going through the same process: vowel copying into the stressed syllable, and deletion of word-final vowel, followed by vowel fusion to resolve LIGHT-DIPH violations (4). Only VV of rising sonority can appear as diphthongs in a closed syllable in Rotuman. LIGHT-DIPH militates against a VV of non-rising sonority (McCarthy 2000). While the deletion of word final vowels in Step 1 is blocked by undominated MAX, deletion of the same vowel at Step 2 does not violate MAX since all input segments have (co-indexed) correspondents in the output. At Step 4, vowel fusion is preferred because of this undominated MAX.

(4) /ra_1ko_2/ → 1. $rá_1ko_2$ → 2. $rá_1o_2ko_2$ → 3. $rá_1o_2k$ → 4. [$rá_{1,2}k$]
/ho_1ti_2/ → 1. $hó_1ti_2$ → 2. $hó_1i_2ti_2$ → 3. $hó_1i_2t$ → 4. [$hǿ_{1,2}t$]

Deriving both apparent deletion and coalescence with a metathesis operation (transposition as an atomic operation) requires intermediate stage candidates [ra_1o_2k] and [ho_1i_2t] which are followed by vowel coalescence ([$ra_{1,2}k$] and [$hø_{1,2}t$]). This derivation is made possible by the ranking MAX >> LIGHT-DIPH, FINALSTRESS >> LINEARITY. However, because of this lower ranked LINEARITY, the unattested long-distance metathesis candidate [ro_2a_1k] will be predicted as a possible output since it does not violate any of the higher ranked constraints. On the other hand, my copy + deletion and subsequent fusion analysis will not allow such long-distance patterns, since /ra_1o_2k/ → [ro_2a_1k] will require an intermediate stage of /$ro_2a_1o_2k$/, which is not harmonically improving given any plausible Rotuman ranking.

CC metathesis as fusion + fission: The copy + deletion analysis is not generally desirable for CC metathesis cases since it would require an intermediate stage of C_1C_2 → $C_2C_1C_2$ which is unlikely to improve harmony in any language. Instead, I propose that apparent synchronic CC metathesis is the result of fusion + fission. In Balangao (Shelter 1976), upon affixation, a vowel deletes and creates a glottal + plosive sequence which surfaces as plosive + glottal (e.g., /ʔɨ + **hɨgɨ**p/ → ʔ**ɨgh**ɨp 'bring in'). I analyze this as fusion (/h_1g_2/ → [$g^h{}_{1,2}$]) and subsequent fission (→ [g_2h_1]). This analysis requires the two segments to be adjacent, reflecting the limits in locality that almost all of the synchronic CC metathesis cases involve adjacent segments. Unlike CV metathesis which often affects all segments in the given language, there is no synchronic CC metathesis that applies to any consonants in the language. I predict that apparent transposition of CC on the surface form is only possible for fusible pairs of consonants.

Conclusion: My analysis shows that by removing metathesis as an atomic operation in HS, desirable restrictions on locality are enforced by interactions between active constraints in each language as well as gradualness of GEN in HS. The analysis also simplifies the inventory of operations in HS, showing that the typology of metathesis can be predicted by deriving the patterns through sequential applications of simpler operations.

Selected References: Blevins & Garrett. (1998). The origin of consonant-vowel metathesis. *Language 74*, 508-556.**Canfield, T. A. (2016).** *Metathesis is real, and it is a regular relation* (Diss.). Georgetown Uni. **Carpenter, A. (2002).** Noncontiguous metathesis and adjacency. In Carpenter *et al.* (Eds.), *Papers in Optimality Theory II*. Amherst: GLSA. **Heinz, J. (2005).** Reconsidering linearity: Evidence from CV metathesis. *Proceedings of the 24th WCCFL*, 200-208. **McCarthy, J. J. (2000).** The prosody of phase in Rotuman. *Natural Language and Linguistic Theory* 18: 147-197.