Adjunction and branchingness effects in Match Theory

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Match Theory (MT), an approach to the mapping from syntactic to prosodic structure couched within Optimality Theory (Selkirk 2011, Elfner 2012, Myrberg 2013), predicts that prosodic structure should closely resemble syntactic structure, and that deviations from perfect syntax-prosody isomorphism should only arise due to markedness constraints. We undertake several case studies of this theory's predictions, drawing primarily on data from phrasing in the Bantu language Kinyambo (Bickmore 1990), in order to address two theoretical issues which loom large in MT: the proper interpretation of adjunction structures, and the precise content of CON.

We employ a new JavaScript application which we have developed, allowing us to automatically generate and evaluate prosodic tree structures of arbitrary length and depth. Using a computationally rigorous methodology and taking into consideration all possible prosodic parses given by our GEN function, we conclude that high segments of XP in syntactic adjunction structures must be visible to Match (pace Selkirk 2011), and that Selkirk's (2011) treatment of adjunction makes a pathological prediction. We further find that a commonly assumed suite of constraints cannot compel well-known branchingness effects identified by Bickmore (1990) for Kinyambo.

The Adjunction Cohesion Pathology. The MT constraints MATCH(XP,ϕ) and MATCH(ϕ,XP) insist that every syntactic XP be matched by a corresponding ϕ, and vice versa. While what counts as a visible "XP" for the Match constraints is usually straightforward, a question arises in cases of adjunction. Given the segment theory of adjunction (May 1985, Chomsky 1986, Truckenbrodt 1999), the Match theorist must determine which segment(s) of a polysegmental category are "visible" to MATCH: the lowest (1a), the highest (1b), or all segments (1c) (an underlined node induces a MATCH violation if it is not mapped to a ϕ).

(1) a. [$_{XP}$ **YP** **XP**] b. [$_{\underline{XP}}$ **YP** XP] c. [$_{\underline{XP}}$ **YP** **XP**]

Following Truckenbrodt (1995, 1999), Selkirk (2011:483, fn. 38) suggests that (1a) is the correct treatment of such structures: only the lowest segment of XP is visible to the Match constraints. But this yields the wrong result for branching XPs in Kinyambo (1990), where a process of High Tone Deletion that applies only within the phonological phrase shows that a subject containing a noun and postnominal adjective is mapped to a single phrase:

(2) a. *High-Tone Deletion on non-branching subject* (Bickmore 1990)
[$_{TP}$ [$_{NP}$ abakózi] [$_{VP}$ bákajúna]] → ($_{ϕ}$ abak**o**zi b**á**kaj**ú**na)
workers helped

b. *No HTD across branching subject's right boundary*
[$_{TP}$ [$_{NP}$ [$_{NP}$ abakózi] [$_{AP}$ bakúru]] [$_{VP}$ bákajúna]] → ($_{ϕ}$ abak**o**zi bak**ú**ru) ($_{ϕ}$ b**á**kaj**ú**na)
workers mature helped

We test sixteen distinct implementations of Match Theory, which vary in terms of three factors: (i) whether lower, higher, or all segments of XP are visible to Match, (ii) whether APs and AdvPs are visible to Match, and (iii) which of four distinct versions of CON we assume. We find that only those systems in which the **highest segment of XP is visible** can yield the correct result for the Kinyambo phrasings in (2). We further show that certain systems using Truckenbrodt's (1995,

1999) ALIGN and WRAP constraints do not have this property, and generate different and much larger typologies.

Aside from the narrow problem of failing to achieve descriptive adequacy for simple sentences in Kinyambo, our systems in which option (1a) is adopted give rise to a pathological prediction which we dub the **Adjunct Cohesion Pathology**. Such systems correctly predict languages in which BINARITY constraints force two of the three words in (2b) to phrase together. But since the maximal segment of the subject NP is invisible to the Match constraints, no constraint favors phrasing the adjective *bakúru* 'mature' with the noun *abakózi* 'workers', as opposed to with the verb *bákajúna* 'helped', as shown in (3).

(3) *A pernicious tie: neither adjunct phrasing is more harmonic*

Syntax in (2b), NP^{Max} invis.	BINMIN	BINMAX	MATCH(XP)	MATCH(ϕ)	EQSIS
((workers mature) (helped)) ~ ((workers) (mature helped))	$e_{0\sim0}$	$e_{0\sim0}$	$e_{2\sim2}$	$e_{1\sim1}$	$e_{0\sim0}$

The problem generalizes fully to other constructions; when full candidate sets are considered, we incorrectly predict no preference for phrasing adjuncts with their hosts. The problem does not arise when (1b) or (1c) is adopted, and the highest segment of XP counts for the Match constraints.

Branchingness Effects. Bickmore (1990) and others show that ϕ-construction can be sensitive to whether an XP is *branching*. For instance, the non-branching subject in (2a) is phrased with the verb, but the branching subject in (2b) is phrased alone. Twelve of sixteen MT systems we have tested are able to capture the effect for the simple examples in (2), thanks to BINARITY, but fail to generalize the effect to more complex syntactic structures, such as VPs with manner adverbs.

Tools for theory comparison. Rigorous work in OT approaches to the syntax-prosody interface requires generating and evaluating hundreds—sometimes thousands—of prosodic parses. Automation is therefore required. Our study of Kinyambo is designed to (i) demonstrate the importance of generating an entire candidate set and explicitly defining constraints, and (ii) provide an example of how to use our JavaScript application for interface research. Our software generates trees for every parse given a string of *n* words and an explicitly defined prosodic hierarchy. Our application implements GEN, CON, and EVAL, and provides a violation tableau which can be copied directly into OTWorkplace (Prince, Tesar, & Merchant 2013) for typological investigations.

Given the abundance of OT constraints proposed for the mapping from syntax to prosody, both in Truckenbrodt's (1995, 1999) Align/Wrap theory and in Match Theory, careful comparison of typological predictions is warranted. While our sixteen MT systems are all very similar, minor adjustments to GEN and CON are shown to yield wildly divergent typologies, underscoring the importance of such details. In sum, rather little is known regarding these theories' typological predictions, and our examination of the phrasing of Kinyambo represents a step toward developing a full understanding of the consequences of our prosodic representations and constraints.

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