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Syntax-Prosody Mismatches in Optimality Theory

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Abstract

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In a range of languages, the mapping from syntactic to prosodic structure produces "mismatches", where a prosodic constituent has no matching syntactic constituent. This is puzzling, since prosodic structures are clearly based on syntax, and the two are often isomorphic. Here, I examine the predictions of three theories of the syntax-phonology interface using Optimality Theory: Align/Wrap Theory, Match Theory, and a c-command based theory I call Command Theory. Command Theory is shown to be well suited to deal with the phrasing of ditransitive constructions. The types of matches and mismatches predicted by these theories are examined through the lens of formal OT, with careful attention to candidate generation and constraint definitions. This is accomplished using the JavaScript application SPOT (Bellik, Bellik, & Kalivoda 2016). Data is drawn from Bantu, Germanic, Romance, Japanese, and other languages and language families.

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Chapter 1

Introduction

Phonological processes can occur in domains larger than the word, and these domains often correspond to syntactic constituents, at least roughly (Chomsky and Halle 1968; Selkirk 1974, 1986, 2011; Rotenberg 1978; Nespor and Vogel 1986; Cowper and Rice 1987; Odden 1987; Truckenbrodt 1999). But while *matching* syntactic and phonological domains may be the usual case, there are also cases of *mismatches*. That is, the domains used by phonology—call them *phonological phrases* (φ)—cannot be read off of the syntactic tree itself. This dissertation with such mismatches, in particular the following two:

(1) *Ditransitive Mismatch*
$[_{\text{vP}}\ \text{V}\ [_{\text{VP}}\ [_{\text{DP}}\ \text{N}]\ [_{\text{DP}}\ \text{N}]] \rightarrow (_{\varphi}\ \text{V N})\ (_{\varphi}\text{N})$

(2) *Kubozono's Mismatch* (Kubozono 1989; Dobashi 2003; Shinya et al. 2004; Ito and Mester 2013; Ishihara 2014)
$[_{\delta\text{P}}\ [_{\gamma\text{P}}\ [_{\beta\text{P}}\ [_{\alpha\text{P}}\ \alpha]\ \beta]\ \gamma]\ \delta] \rightarrow (_{\varphi}(_{\varphi}\ \alpha\ \beta)\ (_{\varphi}\ \gamma\ \delta))$

The Ditransitive Mismatch is a syntax–phonology mismatch on the now standard assumption that verbs with multiple internal arguments do not form a syntactic constituent with said arguments (Larson 1988). Phonological data for the mismatch is found in numerous languages. This dissertation contributes a systematic compilation of the data underpinning it. Kubozono's Mismatch is found in Japanese and Korean, and is a mismatch in that γ, δ in 2 form a prosodic constituent in the output, but are not a syntactic constituent in the input.

In this dissertation, I consider three theories of the syntax–phonology interface, and their treatment of the Ditransitive Mismatch and Kubozono's Mismatch: Match Theory (Selkirk 2011), Align/Wrap Theory (Truckenbrodt 1995, 1999), and Command Theory, a novel contribution of the dissertation. All three theories have the same underpinnings:

(3) *Theoretical underpinnings*

a. *Y-Model*
The syntactic module provides the inputs for phonological and semantic interpretation. Thus, syntactic structure-building feeds prosodification, and not vice versa.

b. *Prosodic Hierarchy and Indirect Reference*
Phonological processes are sensitive to prosodic units, not syntactic units. The prosodic hierarchy assumed here is intonational phrase (ι) $>$ phonological phrase (φ) $>$ phonological word (ω) $>$ foot (Ft) $>$ syllable (σ). These prosodic categories are those of the rather minimal hierarchy assumed by Ito and Mester (2013), but is based on and related to more elaborated hierarchies like those including the clitic group between φ and ω (Nespor and Vogel 1986), or that split the φ into major and minor phrases (Shinya et al. 2004).

c. *Weak Layering*
Prosodic structure trees are *layered* (they respect the prosodic hierarchy), but allow for recursive and non-exhaustive parsing. For example, a phonological phrase φ may contain another φ, and the intonational phrase ι may directly dominate a prosodic word ω, but a lower category can never dominate a higher category, as in $*(_{\varphi}\ \iota)$.

d. *Optimality Theory*
At least the phonological component of Universal Grammar is Optimality–Theoretic (Prince and Smolensky 2004). Full prosodifications of a syntactic input *S* are generated by a function GEN evaluated in parallel by a function EVAL. The relationship between *S* and a prosodic output *P* is mediated by a set of universal, but rankable and violable constraints, CON. There are two types of constraints: mapping constraints, which look at *P* and *S*, and markedness constraints, which look only at *P*. Since mapping constraints look at both *S* and *P*, they are essentially faithfulness constraints (Prince and Smolensky 2004). However, we maintain a distinction here between mapping and faithfulness, since mapping is a process of transduction from one alphabet onto another (XPs and X^0s onto distinct prosodic categories), while faithfulness constraints consider the relation between two fundamen-

tally phonological levels built from the same elements.

These are already four major commitments shared by Match Theory, Align/Wrap Theory, and Command Theory, and every one of them has been questioned in interesting ways. The three theories differ only in the actual contents of the universal constraint set CON. That is, they are different theories of the constraints that make up Universal Grammar.

1.1 Theories of Prosodification

Match Theory, devised by Selkirk (2011) and further developed by Elfner (2012); Myrberg (2013); Ishihara (2014); Ito and Mester (2013) and others, asserts that the syntax–prosody and prosody–syntax mapping constraints are in the family MATCH(x,y). Constraints in this family demand that a syntactic or prosodic constituent x have a perfectly matching syntactic or prosodic constituent y. To count as matching, x and y must dominate exactly the same terminals. Clearly, the theory is designed to deal with cases of matching, and not as readily with mismatches. However, Match Theory also uses markedness constraints, which can compel certain mismatches.

Truckenbrodt (1995, 1999)'s Align/Wrap Theory, based on the Edge-Based Approach of Selkirk (1986), uses two types of mapping constraints: alignment constraints (McCarthy and Prince 1993), and a constraint WRAP. Alignment constraints refer specifically to the left or right edge of an XP or φ, adding an element of directionality not found in Match Theory. While alignment constraints favor splitting an utterance into small phrases, and do not care about grouping these phrases into higher prosodic constituents, the constraint WRAP is included to favor lumping phonological phrases together in ways that respect the syntax at higher levels.

Finally, I propose a new theory based on the syntactic notion of c-command, which

I call Command Theory (CT), which is designed to explain the prosodic relationships commonly observed to hold between heads and the elements in their c-command domain. In CT, Match and Align/Wrap constraints are abandoned completely, and instead, mapping constraints favor phrasing c-commanding elements with their c-commandees, and placing phrase breaks between words that stand in a non-c-command relation. The mapping constraints C-COMMAND-φ and ANTI-C-COMMAND-φ work much the same as alignment constraints, but without direction-specificity, and neatly account for the typology of prosodic phrasing of ditransitive constructions. The appeal to c-command for prosodification is not new, but the OT implementation that I develop is novel in its ability to deal with weakly layered prosodic trees.

An overarching question of the dissertation is which of the three theories presented here best captures the mismatch and other phrasing facts. We will see that all three have their advantages and drawbacks, including CT; despite being the novel theory I present, it should be taken as one possibility among several, worthy of conituned exploration and scrutiny. What makes the incomplete and possibly empirically inadequate CT worthwhile here is the depth and rigor with which I examine its predictions and compare them to those of the theories already on the market.

1.2 OT Systems

The fundamental object of study in modern rigorous Optimality Theory is the OT *system*, explained by Alber et al. (2016) as follows:

> An OT system S is defined by specification of GEN$_S$ and CON$_S$. GEN$_S$ defines the structure of the candidates admitted by S and delimits how they are organized into the CANDIDATE SETS (csets) in which competition takes place. In the most famliar case [including all cases considered here –NK],

> a candidate is an input-output pair and each cset is derived from a single input. CON$_S$ defines each constraint of S as a function from candidates to the nonnegative integers, which are interpreted as penalties and termed VIOLATIONS, providing the basis for determining optimality. A LANGUAGE is the collection of optimal candidates from every cset admitted by GEN$_S$.

In other words, defining a system means specifying the exact candidate sets (the sets of input-output pairs competing for optimality), and the exact constraint set. The constraints must be defined explicitly enough to allow for unambiguous mapping onto appropriate violation counts. In work on syntax–prosody mapping, setting up a system using only pen and paper is an arduous task. The candidate sets are vast, as they include numerous possible bracketings of the same string. The constraints often assign a large number of violations to individual candidates, given the complexity of the structures. Thus, study of syntax–prosody mapping systems requires computational tools in order to meet the minimum requirement for rigorous OT.

As Alber et al. (2016) say, an OT system defines a set of *languages*. It is important to note that Alber et al. (2016) define *language* extensionally as a set of optimal candidates, reserving the term *grammar* for the (intensional) set of rankings that define a given language. Alber et al. (2016) define a system's typology as "the collection of all grammars admitted by the definition of S". Of primary concern to us here is to what extent a given OT system's typology resembles the empirical typology of phonological phrasing.

Since this dissertation considers multiple theories and multiple datasets, it is necessary to define multiple OT systems, e.g. a Match system for the ditransitive mismatch, an Align/Wrap system for the ditransitive mismatch, a Command system for the ditransitive mismatch, etc. Each system is a separate hypothesis about how the syntax–prosody mapping component of UG functions. Note that we cannot say that an individual constraint "predicts" anything at all; it is only in the context of a well-defined system that predictions can be made, on the basis of facts proved about the system itself.

Every OT system presented below is tested using two applications: SPOT (Bellik et al. 2016) and OTWorkplace (Prince et al. 2018). SPOT, which stands for "Syntax–Prosody in Optimality Theory", is a JavaScript application that generates entire candidate sets of prosodic trees, according to certain GEN specifications, and evaluates them against all of the constraints in CON. That is, it allows the user to define the bases of an OT system $S_X = (\text{GEN}_X, \text{CON}_X)$, and does all of the tedious calculations necessary to see what candidates the system actually generates, and what violation counts (nonnegative integers) it assigns to them. These candidate sets and violation counts are fed into OTWorkplace, which is used to calculate constraint rankings and factorial typologies. All constraint definitions as implemented in SPOT are found in Appendix A.

1.3 Organization of the Dissertation

Chapter 2 provides background on the three theories of interest: Match, Align/Wrap, and Command. Here, it is shown how these theories treat basic facts about phonological phrasing in the simplest cases, which do not involve mismatches. This sets the stage for the discussion of the Ditransitive Mismatch and Kubozono's Mismatch in the various theories.

In Chapter 3, I present the empirical data behind the Ditransitive Mismatch, and show how the entire empirical typology can be accounted for using Command Theory. This is compared with Match Theory, which is shown to have various drawbacks, such as the need for a lexical/functional distinction, and a number of seemingly unwarranted predictions.

In Chapter 4, I discuss Kubozono's Mismatch, and show how several Match and Align/Wrap systems can capture the basic facts from Japanese and Korean, without taking the distinction between accented and unaccented words into account. This essentially just constitutes a closer look at Ito and Mester (2013, 2017)'s and Ishihara's (2014) analyses of the facts, but the elucidation is helpful so that we can compare the results obtained by Command Theory with the same set of inputs.

In Chapter 5, I expand the discussion of Japanese to include all 36 input-output pairs from Ito and Mester (2013, 2017) (henceforth IM). These include both accented and unaccented words, combined freely, and the words' accentual properties affect their prosodification. However, Kubozono's Mismatch holds as an ironclad law, regardless of accentual properties. I show that while IM's Match–Theoretic analysis is ingenious and nearly correct, it does not quite account for all of the data. I propose that two markedness constraints from IM, EQUALSISTERS-2 and NOLAPSEL, be replaced by a new constraint, NOPOSTACCENTWORD.

Chapter 6 is a brief conclusion.

Chapter 2

OT Approaches to Phonological Phrasing

A basic question in prosodic theory is “How is the sentence divided into phonological phrases?” A good starting point is Dobashi’s (2003) observation that languages with SVO basic word order exhibit the following four phrasing patterns:

(4) *Dobashi’s typology of SVO (see also Samuels (2009))*

a.	(S) (V) (O)	French, Ewe
b.	(S) (V) ($\text{O}_{\text{branching}}$)	Italian
	(S) (V $\text{O}_{\text{non-branching}}$)	
c.	(S) (V O)	Kimatuumbi
d.	(S) (V O)	Kinyambo
	($\text{S}_{\text{non-branching}}$ V)	

Abstracting away from details about branchingness, (4) includes (S) (V) (O) and (S) (V O). In each case, S phrases apart from V and O. Samuels (2009) points out that a phrasing (S V) (O) is “conspicuously missing” from this typology. A theory of prosodic phrasing should reflect these observations.

In this chapter, we are going to look at factorial typologies within Align/Wrap Theory, Match Theory, and Command Theory, and evaluate how well they fit with the cross-linguistic facts. Starting from the simplest SVO cases, we see that all of the theories are approximately equal in adequacy. We will then look at the case of right-alignment in Chimwiini. Purported alignment facts are a conerstone of much prosodic theory, dating back to Selkirk's (1986) seminal paper and continuing with the OT work of Truckenbrodt (1995, 1999).

2.1 Align/Wrap Theory

Taking the typology in (4) as a starting point, we can test various combinations of OT constraints to see whether the resulting typology fits with or diverges from (4). The oldest approach is that of Align/Wrap, which derives from Selkirk's (1986) Edge-Based Theory. Selkirk (1986) proposes that there is a parameter setting which determines whether a language aligns the left boundaries or right boundaries of its XPs and φs. From a standard syntactic structure $[_{\text{DP}}$ S] $[_{\text{VP}}$ V $[_{\text{DP}}$ O]], a right-alignment setting of the parameter will derive (S) (V O), while a left-alignment setting will derive (S) (V) (O). That is, Selkirk's parameter accounts for (4a) and (4c). Additional mechanisms are needed to account for the details of (4b) and (4d), but these nevertheless do not differ radically from the two languages that the theory derives automatically.

Truckenbrodt (1995, 1999) transports Selkirk's (1986) Edge-Based Theory into OT. Selkirk's parameter is decomposed into two alignment constraints:

(5) ALIGN(XP,R,φ,R)
Assign a violation for every XP whose right edge is not aligned with the right edge of some φ.

(6) ALIGN(XP,L,φ,L)
Assign a violation for every XP whose left edge is not aligned with the left edge of some φ.

Truckenbrodt also posits a constraint WRAP(XP), defined in (7):

(7) WRAP(XP) (Truckenbrodt 1995, 1999)
Assign a violation for every XP that is not contained in some φ.

The constraints in (5–7) are implemented in SPOT and can be found on its graphical user interface (see Appendix A).

Clearly, these constraints will never favor the unattested (S V) (O) over (S) (V) (O) or (S) (V O). ALIGN-R favors placing a rightward φ-boundary at the right edge of S (an NP/DP), and ALIGN-L favors placing a leftward φ-boundary at the left edge of V, since this is the left edge of VP. Finally, there is a question of WRAP. From the definition in (7), WRAP is violated if S or O is left unparsed, and if V and O (the contents of VP) do not share a φ. Whether WRAP also requires a phrase containing S, V, and O together depends on whether the TP containing these words counts as an "XP" for the purposes of mapping. Regardless, (S V) (O) will not arise.

So what *is* predicted for SVO by the Align/Wrap Theory? This of course depends on one's assumptions about GEN and the candidate space it defines. Selkirk (1986), and many other researchers of phonological phrasing, have assumed Strict Layering to be an inviolable principle of prosodic well-formedness, meaning that no φ can contain another φ (NONRECURSIVITY) an no ω can be immediately dominated by ι (EXHAUSTIVITY). If we follow this assumption, we can investigate the following OT system:[1]

(8) $S_{\text{Align-1}}$: *Align/Wrap with Strict Layering*
  a. GEN: SPOT's GEN with Strict Layering
  b. CON: {ALIGN(XP,R,φ,R), ALIGN(XP,L,φ,L), WRAP(XP)}
  c. INPUT: $[_{\text{SP}}$ S$]$ $[_{\text{VP}}$ V $[_{\text{OP}}$ O$]]$
  (No XP contains all three words.)

With Strict Layering and three words (here S, V, O), there are only four possible candidates:

(9) 3ω *candidates with Strict Layering*
  a. (S) (V) (O)
  b. (S) (V O)
  c. (S V) (O)

[1] I will occasionally use "SP" and "OP" to stand for "subject phrase" and "object phrase", respectively, since both phrases have the same syntactic category (DP).

d. (S V O)

The factorial typology for the system allows only for (9a–b). When ALIGN-L ≫ WRAP, the output is (9a):

(10) *Tableau for (S) (V) (O) in* $S_{\text{Align-1}}$ (2/2 optima; 2/2 HBs)

[$_{\text{SP}}$ S] [$_{\text{VP}}$ V [$_{\text{OP}}$ O]]	ALIGN-L	WRAP	ALIGN-R
a. → (S) (V) (O)		*	
b. (S) (V O)	*W	L	
b. $_{\text{HB}}$ (S V) (O)	*W	*e	*W
b. $_{\text{HB}}$ (S V O)	**W	L	*W

When WRAP ≫ ALIGN-L, the output is (9b):

(11) *Tableau for (S) (V O) in* $S_{\text{Align-1}}$ (2/2 optima; 2/2 HBs)

[$_{\text{SP}}$ S] [$_{\text{VP}}$ V [$_{\text{OP}}$ O]]	WRAP	ALIGN-L	ALIGN-R
a. (S) (V) (O)	*W	L	
b. → (S) (V O)		*	
c. $_{\text{HB}}$ (S V) (O)	*W	*e	*W
d. $_{\text{HB}}$ (S V O)		**W	*W

No ranking conditions are imposed here on ALIGN-R, and removing it from CON does not affect the contents of the factorial typology. With or without ALIGN-R, we have the following typology for $S_{\text{Align-1}}$:

(12) *FacTyp for* $S_{\text{Align-1}}$

a.	(S) (V) (O)	ALIGN-L ≫ WRAP
b.	(S) (V O)	WRAP ≫ ALIGN-L

This shows that with Strict Layering maintained, an OT system can easily yield the same typological predictions for SVO as Selkirk's (1986) parameter. It also fits well with Dobashi's (2003) typology in (4), questions of branchingness aside.

But nearly concomitantly with the emergence of OT, the old Strict Layering hypothesis from prosodic theory of the 1980s came under increased scrutiny. Apparent cases of prosodic recursion and level-skipping led to the idea that putative effects of Strict Layering arise from constraint interaction rather than inviolable conditions on prosodic well-formedness. GEN with Weak Layering widens the candidate space, making pen-and-paper analysis much more tedious. It also raises a question about the continued validity of Dobashi's typology in (4), which contains only strictly layered structures for SVO. On the other hand, it is possible that (4) is correct down to the last detail. But it is also entirely possible that language data have been misinterpreted through the lens of Strict Layering, and that weakly layered structures would seem more abundant if researchers had not been so predisposed toward Strict Layering. To see why this matters, we need only check the effects of Align/Wrap Theory when GEN allows weakly layered structures:

(13) $S_{\text{Align-2}}$: *Align/Wrap with Weak Layering*
   a. GEN: SPOT's GEN with Weak Layering
      (−NonRecursivity, −Exhaustivity, −Headedness)
   b. CON: {ALIGN(XP,R,φ,R), ALIGN(XP,L,φ,L), WRAP(XP)}
   c. INPUT: $[_{\text{SP}}$ S] $[_{\text{VP}}$ V $[_{\text{OP}}$ O]]
      (No XP contains all three words.)

The [−NonRecursivity] setting of (13a) allows for φ-recursion, i.e. $(_{\varphi} \ldots \varphi \ldots)$; the [−Exhaustivity] setting for φ-skipping, i.e. $(_{\iota} \ldots \omega \ldots)$; and the [−Headedness] setting for a candidate lacking a φ head for ι alltogether. Perhaps surprisingly, Weak Layering in GEN, with everything else the same, yields a typology containing only one language, in which numerous parses are co-optimal:

(14) *Co-optima in the sole language of* $S_{\text{Align-2}}$

(S) (V (O))	((S) (V (O)))
(S) ((V) (O))	((S) ((V) (O)))
((S) (V) (O))	(((S) (V)) (O))

The structures in (14) are those that perfectly satisfy every constraint in CON. They satisfy ALIGN-R by including S), O); they satisfy ALIGN-L by including (S, (V, (O; and they satisfy WRAP by placing V and O in a φ together. Since the candidates in (14) are perfect with regard to CON, they cannot be differentiated any further, yielding a great deal of structural variation among the optima.

The structures in (14) raise a number of questions. For instance, some contain the substructure …V ($_\varphi$ O…, where a left φ-boundary separates V and O, but a right φ-boundary does not. This makes a new prediction, unavailable under Strict Layering, namely that a juncture between two prosodic words might block or trigger a "left-edge process" without triggering a "right-edge process". We will see some evidence for this configuration in the chapters that follow. For now, it is not clear whether …V ($_\varphi$ O… is compatible with (V) (O) or with (V O), in the various languages which led Dobashi (2003) to characterize the SVO-typology in (4).

An additional question concerns rhythmic grouping—specifically, what effect higher φ-structure has on the rhythmic organization of an utterance. If we assume that a φ is essentially a rhythmic unit, then a speaker of the language in (14) has two choices, freely available, regarding the rhythmic grouping of S, V, and O. Dobashi's descriptive typology, as well as the factorial typology for $S_{\text{Align-1}}$ (the Strict Layering system), never allow (S V) to form a φ (except in the special case of (4d)), but in (14) we find that SV/O, S/VO, and SVO are all licit rhythmic groupings. Indeed, while the typology excludes the undesired (S V) (O), it says nothing about whether the verb should primarily group with S or with O. This is a cause for concern if the typology in (4) reflects cross-linguistic rhythmic generalizations.

The above typology can be refined into four languages with the simple addition of one more constraint. Truckenbrodt (1995, 1999) and others have proposed various markedness constraints which can interact with the syntax–prosody mapping constraints of Align/Wrap Theory. For instance, Truckenbrodt posits a constraint $*\varphi$ of the more general STARSTRUC family (Prince and Smolensky 2004). The constraint simply assigns a violation for each phonological phrase in the output tree. Adding this to CON, we have the following system:

(15) *$S_{\text{Align-3}}$: Align/Wrap with Weak Layering 2*

a. Gen: SPOT's Gen with Weak Layering
(−NonRecursivity, −Exhaustivity, −Headedness)

b. Con: {Align(XP,R,φ,R), Align(XP,L,φ,L), Wrap(XP), $*\varphi$}

c. Input: $[_{\text{SP}}$ S$]$ $[_{\text{VP}}$ V $[_{\text{OP}}$ O$]]$
(No XP contains all three words.)

The choice here of $*\varphi$ is somewhat arbitrary; other markedness constraints can similarly reduce the amount of φ-structure in a parse. However, the simplicity of $*\varphi$ makes it useful for an introductory example. With this adjustment, the factorial typology is the following:[2]

(16) *FacTyp*$_{\text{Align-3}}$

a.	(S) (V (O))	Align-L $\gg$ $*\varphi$
b.	(S) (V O)	Align-R $\gg$ $*\varphi$ $\gg$ Align-L
c.	S V O	$*\varphi$ $\gg$ Wrap, Align-L, Align-R
d.	(S V O)	Wrap $\gg$ $*\varphi$ $\gg$ Align-L, Align-R

This typology is still quite different from that in (4), but now shares the property of banning a constituent (S V). Language (16b) is the same as (4c). Language (16c) contains no phonological phrases at all. Language (16d) is similar in that it does not rhythmically group SV or VO. Finally, (16a) is similar to (4a), though (4a) posits a right boundary after V that (16) forbids in all languages.

Missing from the typology in (16) is the French/Ewe phrasing (S) (V) (O) from (4). If this analysis of the French/Ewe phrasing is correct, then the constraint set needs to be revised. It turns out that $*\varphi$ can be replaced or supplemented by the constraint NonRecursivity, defined in (17), to make a system that includes French/Ewe.

(17) NonRecursivity *(SPOT definition 1)*
Assign a violation for every φ dominated by another φ.

[2] (16c) does not lack prosodic structure above the ω-level altogether; each terminal output string is contained in an intonational phrase whose boundaries are not shown. The structure is therefore $\{_\iota\ \omega\omega\omega\}$. The underlying assumption here is that all trees in Gen must be connected graphs.

This definition differs from that in (Truckenbrodt 1995, 1999), and various other formulations are imaginable as well (Bellik et al. 2016). With the present version of NonRecursivity replacing $*\varphi$, we get the following system:

(18) $S_{\text{Align-4}}$: *Align/Wrap with Weak Layering 3*
a. Gen: SPOT's Gen with Strict Layering
b. Con: {Align(XP,R,φ,R), Align(XP,L,φ,L), Wrap(XP), NonRecursivity}
c. Input: $[_{\text{SP}}$ S] $[_{\text{VP}}$ V $[_{\text{OP}}$ O]]
(No XP contains all three words.)

The typology for (18) is that in (19):

(19) *FacTyp*$_{\text{Align-4}}$

a.	(S) (V) (O)	Align-L, NonRec $\gg$ Wrap
b.	(S) (V (O))	Align-L, Wrap $\gg$ NonRec
c.	(S) (V O)	Wrap, NonRec $\gg$ Align-L

The typology in (19) comes quite close to that in (4): the phrasing in (19a) is that of (4a), and that in (19c) that of (4c). Only (19b), the language with (S) (V (O)), is lacking in (4). We therefore see that Align/Wrap Theory is capable of closely approximating the previously reported facts. An important aspect of this is that various Align/Wrap systems successfully avoid phrasing S and V to the exclusion of O, $S_{\text{Align-2}}$ notwithstanding.

2.2 Match Theory

Selkirk's (2011) Match Theory makes a major departure from the Edge Parameter and its OT implementation via Align/Wrap. In MT, entire constituents must be matched, rather than edges. Match constraints come in two flavors: there are syntax–phonology Match constraints (20), and phonology–syntax Match constraints (21).

(20) Match(α,π) (Selkirk 2011)
The left and right edges of a constituent of type α in the input syntactic repre-

sentation must correspond to the left and right edges of a constituent of type π in the output phonological representation.

(21) MATCH(π, α) (Selkirk 2011)
The left and right edges of a constituent of type π in the output phonological representation must correspond to the left and right edges of a constituent of type α in the input syntactic representation.

Here, α can be X^0, XP, or $CP_{\text{IllocutionaryForce}}$, and π is some prosodic category. For present purposes, $\alpha = $ XP and $\pi = \varphi$. If we ignore the fact that XP and φ are distinct kinds of objects, and refer to both as Π, then (20) amounts to MAX(Π) and (21) amounts to DEP(Π), in the Correspondence–Theoretic sense (McCarthy and Prince 1995).

Unlike the Edge-Based approach, Match Theory has never been implemented in OT theories where GEN requires Strict Layering. Coming onto the scene in 2011, MT was immediately put to use in evaluating structures with significant amounts of prosodic recursion. However, nothing prevents us from examining the effects of Match constraints with various sorts of restrictions imposed on GEN. Since (4) does not include prosodic recursion, and we have seen how Align/Wrap works with Strict Layering, it is worth seeing how MT fares with Strict Layering, too. To this end, we can consider the following system:

(22) $S_{\text{Match-1}}$: *Match with Strict Layering*
a. GEN: SPOT's GEN with Strict Layering
b. CON: {MATCH(XP,φ), MATCH(φ,XP)}
c. INPUT: [$_{\text{SP}}$ S] [$_{\text{VP}}$ V [$_{\text{OP}}$ O]]
(No XP contains all three words.)

Under this system, there is only one language. This can be deduced from the fact that MATCH(XP,φ) and MATCH(φ,XP) are not in conflict with the input (22c). The only phrasing available is (S) (V O):

(23) *Sole language of FacTyp*$_{\text{Match-1}}$
(S) (V O)

The fact that (23) is the only option in this system is demonstrated in (24).

(24) *Tableau for (S) (V O) in $S_{\text{Match-1}}$* (1/1 optima; 3/3 HBs)

[$_{\text{SP}}$ S] [$_{\text{VP}}$ V [$_{\text{OP}}$ O]]	MATCH(XP,φ)	MATCH(φ,XP)
a. → (S) (V O)	OP	
b. $_{\text{HB}}$ (S) (V) (O)	$^{\text{VP}}$e	$^{\text{(V)}}$W
b. $_{\text{HB}}$ (S V) (O)	$^{\text{VP}}$e	$^{\text{(SV)}}$W
b. $_{\text{HB}}$ (S V O)	$^{\text{VP,OP}}$W	$^{\text{(SVO)}}$W

The winning candidate (24a) ties with (b) and (c) on the SP-constraint MATCH(XP,φ). While (a) fails to match OP, (b–c) fail to match VP. The flattened candidate (d) matches neither. The fact that (a) harmonically bounds these candidates is due to its being the only candidate to satisfy the PS-constraint MATCH(φ,XP); that is, it is the only one which does not contain a φ with no matching XP.

With Strict Layering, MATCH(XP,φ) is violated whenever one XP contains another—i.e., in almost every utterance. When [$_{\text{XP}}$ X [$_{\text{YP}}$ Y]] is mapped to ($_\varphi$ X Y), YP is not matched, and when it is mapped to ($_\varphi$ X) ($_\varphi$ Y), XP is not matched. Once GEN is modified to allow for Weak Layering, the two Match constraints used in (22–24) clearly only allow the perfectly matching ($_\varphi$ S) ($_\varphi$ V ($_\varphi$ O)). Again, as said above, this parse does not violate the ban on SV-grouping, which is a point in its favor.

If Dobashi's (2003) typology (4) is correct, then the typology in (23) is insufficient. Match Theory should also provide a way of deriving (S) (V) (O) (=(4a)). One way of ensuring that each word receives its own φ involves the addition of the constraint EQUALSISTERS from Myrberg (2013), which militates against sister nodes of distinct prosodic categories. Taking the EQUALSISTERS$_{\text{Adjacent}}$ version from SPOT (see Appendix A), this constraint assigns a violation for every sequence of adjacent sister nodes $\pi\psi$, where $Cat(\pi) \neq Cat(\psi)$. The constraint is violated by the perfectly matching ($_\varphi$ S) ($_\varphi$ V ($_\varphi$ O)), since the verb's ω is an adjacent sister of the φ containing the object. To see how this works, consider the following system:

(25) $S_{\text{Match-2}}$: *Match with Weak Layering*

a. Gen: SPOT's Gen with Weak Layering
(−NonRecursivity, −Exhaustivity, −Headedness)

b. Con: {Match(XP,φ), Match(φ,XP), EqualSisters$_{\text{Adjacent}}$}

c. Input: $[_{\text{SP}}$ S] $[_{\text{VP}}$ V $[_{\text{OP}}$ O]]
(No XP contains all three words.)

The resulting typology is that in (26). The typology consists of 'Bot' grammars (Merchant and Prince 2016), grammars of the form {y,z,w≫x}, each uniquely characterized by the bottom-ranked constraint.

(26) *FacTyp*$_{\text{Match-2}}$

a.	(S) (V (O))	Match-XP, Match-φ ≫ EqSis
b.	(S) ((V) (O))	Match-XP, EqSis ≫ Match-φ
c.	(S) (V O)	Match-φ, EqSis ≫ Match-XP

Although (26b) is not the same as (4a) = (S) (V) (O), it shares the property of separating V and O, i.e.: V)(O. This means that language (26b), just like (4a), will show left- and right-edge effects between the verb and object. But (26b) has the additional property of predicting that V and O are rhythmically grouped apart from S. This is not implausible, given the ban on SV-grouping.

2.3 Comparison of Align/Wrap and Match

So far, we have seen that Align/Wrap Theory (Selkirk 1986; Truckenbrodt 1995, 1999) differs from Match Theory (Selkirk 2011) in its details, but that both theories are largely consistent with Dobashi's (2003) typology of SVO presented in (4). But these two approaches diverge when additional syntactic inputs are taken into consideration. Since Align-R and Align-L refer only to specific edges of XP or φ, while Match cares about both edges, the former theory has a *prima facie* advantage in accounting for cases where only the right or left boundary of XP is mapped to a clear φ boundary. On the other hand, Match Theory is arguably more economical to the extent that it can dispense with direction-specificity.

A classic example of a right-aligning language is Chimwiini (Kisseberth 2016). In this language, words receive an accent at the right edge of an XP, but otherwise do not, as shown in (27). Kisseberth takes the accent to indicate the right edge of a φ.

(27) *Chimwiini* (Kisseberth 2016)

a. Om**á**ri hadɨile kuwaa nv**ú**la itaak**ú**nya.
Omari said that rain will.rain
'Omari said that it will rain.'

b. M**í** nhadɨile kuwa Omar**í** mpeele Nuur**ú** pees**á**.
I said that Omari him.gave Nuuru money
'I said that Omari gave Nuuru money.'

c. Om**á**ri liweele kuwa Ham**á**di uzile g**á**ari.
Omari forgot that Hamadi bought car
'Omari forgot that Hamadi bought a car.'

In (27), we see that subjects (*Omári*, *nvúla*, *mí*, *Hamádi*), objects (*Nuurú*, *peesá*, *gáari*), and VP-final verbs (*itaakúnya*) receive an accent, while non-VP-final verbs (*hadɨile*, *liweele*) and complementizers (*kuwa*) do not. According to Kisseberth, this indicates at least the following φ-boundaries.

(28) *Chimwiini right boundaries* (Kisseberth 2016)

a. Omari)$_\varphi$ said that rain)$_\varphi$ will.rain)$_\varphi$
b. I)$_\varphi$ said that Omari)$_\varphi$ him.gave Nuuru)$_\varphi$ money)$_\varphi$
c. Omari)$_\varphi$ forgot that Hamadi)$_\varphi$ bought car)$_\varphi$

Chimwiini is like most languages reported on in the syntax–prosody literature in that only one edge of φ has been detected so far. While we have evidence for the boundaries shown in (28), it is less clear where the left edges are.

If Strict Layering holds (at least for Chimwiini), then every non-final right-boundary must have a left-boundary immediately following it, meaning that the full phrasing of (28) is that in (29):

(29) *Chimwiini phrasing under Strict Layering*

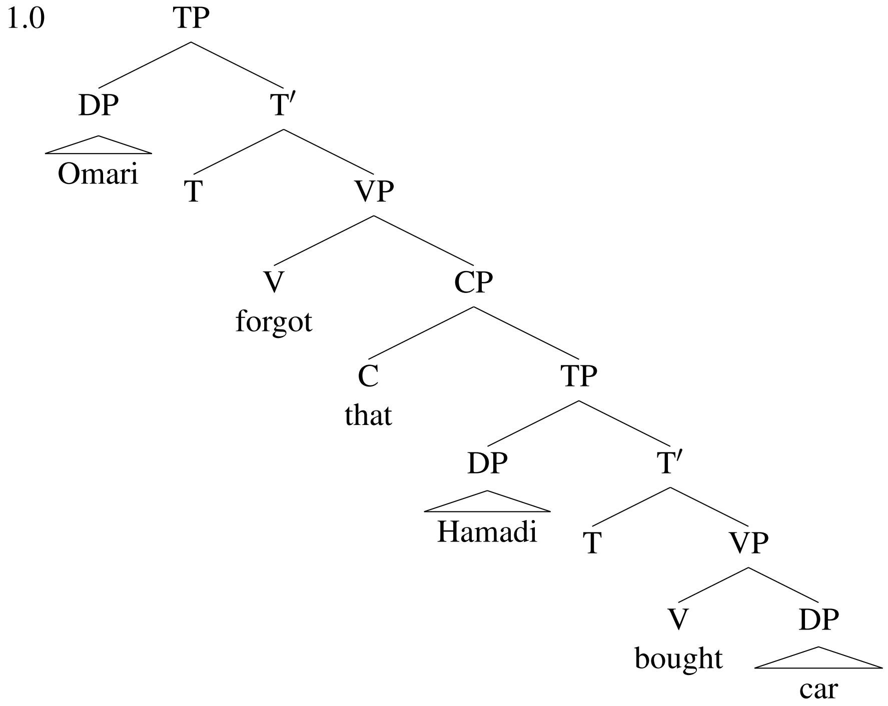
a. (Omari)$_{\varphi}$ (said that rain)$_{\varphi}$ (will.rain)$_{\varphi}$

b. (I)$_{\varphi}$ (said that Omari)$_{\varphi}$ (him.gave Nuuru)$_{\varphi}$ (money)$_{\varphi}$

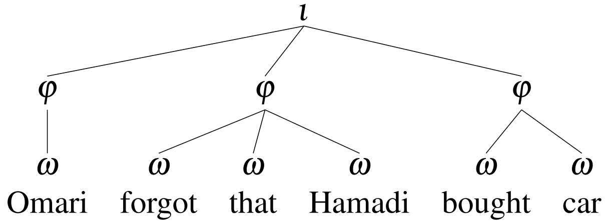
c. (Omari)$_{\varphi}$ (forgot that Hamadi)$_{\varphi}$ (bought car)$_{\varphi}$

If this is correct, then it has a fascinating and important implication for the theory of syntax–prosody mapping, in that prosodic constituents need not correspond to syntactic constituents; there is no syntactic constituent [$_{\text{XP}}$ *said that rain*], [$_{\text{XP}}$ *said that Omari*], or [$_{\text{XP}}$ *forgot that Hamadi*]—and, as discussed in the next chapter, it is also doubtful that there is any constituent [$_{\text{XP}}$ *him.gave Nuuru*]. This is illustrated by the following syntactic and prosodic trees for (29):

(30) a. *Syntactic structure for (29c)*



b. *Prosodic structure for (29c)*



The trees in (30a) and (30b) have radically different shapes, indicating that the syntax–prosody mapping procedure is capable of enormous structural distortions. But as Kisseberth (2016) points out, these sorts of mismatches follow directly from Align-R and the irrelevance of Align-L. Since all that separates *that* and *Hamadi* are left XP-boundaries (DP, TP), and these boundaries do not need to be aligned according to Align-R, it is entirely expected that these two words will occupy the same φ.

But what are the specific rankings in Align/Wrap Theory that can accomodate transformations like that in (30)? As always, this depends on the content of Gen and Con. First, suppose that Gen requires Strict Layering, and that Con contains only three constraints: Align-R, Align-L, and Wrap. Given the single input (30a), the following phrasings are predicted:[3]

(31) *FacTyp*$_{\text{Align-5}}$ *(Strict Layering)*
a. (O) (forgot) (that) (H) (bought) (car) Align-L ≫ Wrap
b. (O) (forgot) (that) (H) (bought car) Align-R ≫ Wrap ≫ Align-L
c. (O) (forgot that H bought car) Wrap ≫ Align-L, Align-R

None of the phrasings in (31) is that in (30b). In (31a–b), there are too many phrases, and in (31c) there are too few. The phrasings in (31a–b) incorrectly predict accentuation of *forgot*, *that*, and *bought*, which are not at the right edge of XP. The phrasing in (31c) correctly predicts that the verbs and complementizer will lack accentuation, but incorrectly predicts that the embedded subject *Hamadi* will as well. This shows that without some additional constraint, Align/Wrap Theory cannot accomodate a language like Chimwiini where left edges of XP are completely ignored. However, adding the simple economy constraint *φ to the system expands the typology to six languages, one of which is consistent with Chimwiini.

[3] Saying that the input is (30a) is actually too vague, since we also need to know which nodes are relevant to the mapping constraints. Here, I assume that everything but the silent T-heads and their projections are visible XPs. That is, every DP, VP, and CP is visible, while T′, TP, and T are not. This follows from the Lexical Category Condition of Truckenbrodt (1995, 1999). This condition is not in effect for every system in the dissertation, and will be mentioned when necessary.

(32) *FacTyp*$_{\text{Align-6}}$ *(Strict Layering)*

a. (O) (forgot) (that) (H) (bought) (car) AL $\gg$ WRAP, $*\varphi$

b. (O) (forgot) (that) (H) (bought car) AR $\gg$ WRAP $\gg$ AL $\gg$ $*\varphi$

c. (O) (forgot that H) (bought car) AR $\gg$ WRAP
AR $\gg$ $*\varphi$ $\gg$ AL

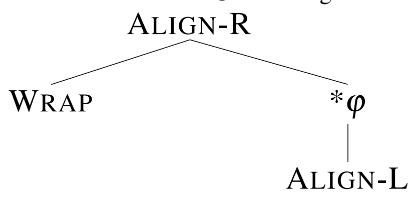
d. (O) (forgot that H bought car) WRAP $\gg$ AL, AR
[AL $\gg$ $*\varphi$] $\vee$ [AR $\gg$ $*\varphi$]

e. (O forgot that H bought car) $*\varphi$ $\gg$ AL, AR

Among the three new languages in (32) is Chimwiini (32c), at least on the assumptions of Strict Layering. None of the other phrasings in (32) would predict the correct accentuation pattern for Chimwiini, indicating that within this system, (32c) is the only Chimwiini-compliant phrasing.

To clarify, the ranking for (32c) can be represented with the following Hasse diagram:

(33) *Chimwiini ranking in* $S_{\text{Align-6}}$



The ranking conditions that together make up (33) are shown in the tableau in (34):

(34) *Tableau for Chimwiini in* $S_{\text{Align-6}}$ *(Strict Layering)* (5/5 optima; 0/27 HBs)

$[_{\text{DP1}}$ O] $[_{\text{VP1}}$ forgot $[_{\text{CP}}$ that $[_{\text{DP2}}$ H] $[_{\text{VP2}}$ bought $[_{\text{DP3}}$ car]]]]	AR	WRAP	$*\varphi$	AL
a. → (O) (forgot that H) (bought car)		^{2}	^{3}	^{3}
b. (O) (forgot) (that) (H) (bought) (car)		^{3}W	^{6}W	L
c. (O) (forgot) (that) (H) (bought car)		^{2}e	^{5}W	^{1}L
d. (O) (forgot that H bought car)	^{1}W	L	^{2}L	^{4}W
e. (O forgot that H bought car)	^{2}W	L	^{1}L	^{5}W

Candidate (d) violates AR once, by failing to align the right edge of $[_{\text{DP}}$ *Hamadi*]. Candidate (e) suffers from this same failing, and additionally fails to align the right edge of $[_{\text{DP}}$ *Omari*]. With AR top-ranked, this leaves (a–c). Candidate (c) incurs three violations of WRAP: one for not wrapping $[_{\text{VP}}$ *forgot that Hamadi bought car*]; one for not wrapping $[_{\text{CP}}$ *that Hamadi bought car*]; and one for not wrapping $[_{\text{VP}}$ *bought car*].

This is one more than (a), which, like (b), fails to wrap the matrix VP and embedded CP, but does wrap the embedded [$_{\text{VP}}$ *bought car*]. Candidate (c) has the same violation profile for WRAP as (a), leaving $*\varphi$ to rule it out for having five phrases in contrast to (a)'s two.

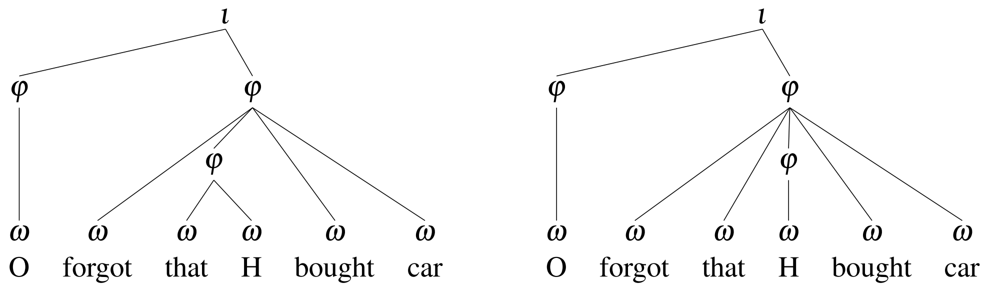
The ranking shown in (33) applies when the candidate set is limited to Strict Layering. When GEN is relaxed to allow for Weak Layering (φ-recursion, ω-under-ι, possible absence of φ altogether), the analysis works differently. With exactly the same constraints as in $S_{\text{Align-6}}$, the Weak Layering $S_{\text{Align-7}}$ has the following four-language typology:

(35) *FacTyp*$_{\text{Align-7}}$

a.	(Omari) (forgot (that) (Hamadi) (bought) (car)) (Omari) (forgot (that) (Hamadi) (bought (car))) (Omari) (forgot (that (Hamadi)) (bought) (car)) (Omari) (forgot (that (Hamadi)) (bought (car))) (Omari) (forgot (that (Hamadi) (bought)) (car)) (Omari) (forgot (that (Hamadi) (bought) (car))) (Omari) (forgot (that (Hamadi) (bought (car))))	AL $\gg *\varphi$
b.	(Omari) (forgot (that Hamadi) bought car) (Omari) (forgot that (Hamadi) bought car)	AR $\gg *\varphi \gg$ AL
c.	Omari forgot that Hamadi bought car	$*\varphi \gg$ AL, AR, WRAP
d.	(Omari forgot that Hamadi bought car)	WRAP $\gg *\varphi \gg$ AL, AR

At first glance, the typology for $S_{\text{Align-7}}$ (Align/Wrap+$*\varphi$ and Weak Layering) looks much messier and perhaps "less plausible" than that with Strict Layering. But if all we need in order to account for the phonological data from Chimwiini are the right edges, it turns out that (35b) is just as adequate as Strictly Layered (32c); on either of the optimal parses for (35b), *Omari*, *Hamadi*, and *car* are φ-final, while *forgot*, *that*, and *bought* are not. That is, the prosodic parses shown in (35b) are counter-intuitive, but place all of the words in the right positions to account for the accentuation pattern.

(36) *Counter-intuitive but acceptable optima for (35b)*



The tableau in (37) shows how the structures in (36) win out against their competitors. Since (a) and (b) are co-optimal in this language, both are shown as winning rows for the comparative tableau. The candidates presented include all eleven possible optima in this system (which together make up only four languages, given co-optimality of forms), plus one harmonic bound: (*Omari*) (*forgot that Hamadi*) (*bought car*), the winner from the Strictly Layered system.

(37) *Chimwiini optima in* $S_{\text{Align-7}}$ (11/11 optima; 1/25216 HBs)

[$_{\text{DP1}}$ O] [$_{\text{VP1}}$ forgot [$_{\text{CP}}$ that					
[$_{\text{DP2}}$ H] [$_{\text{VP2}}$ bought [$_{\text{DP3}}$ car]]]]		AR	WRAP	*φ	AL
a. →	(O) (forgot (that H) bought car)			***	***
b. →	(O) (forgot that (H) bought car)			***	***
c. HB	(O) (forgot that H) (bought car)		**W	***e	***e
d.	(O) (forgot (that) (H) (bought) (car))			^{6}W	L
e.	(O) (forgot (that) (H) (bought (car)))			^{6}W	L
f.	(O) (forgot (that (H)) (bought) (car))			^{6}W	L
g.	(O) (forgot (that (H)) (bought (car)))			^{6}W	L
h.	(O) (forgot (that (H) (bought)) (car))			^{6}W	L
i.	(O) (forgot (that (H) (bought) (car)))			^{6}W	L
j.	(O) (forgot (that (H) (bought (car))))			^{6}W	L
k.	O forgot that H bought car	^{6}W	^{6}W	L	^{6}W
l.	(O forgot that H bought car)	**W		*L	^{5}W

Candidates (d–l), the optima from languages (35a) and (35c–d), are ruled out either by ALIGN-R or by *φ; they either have far too few phrase-edges, as in (k–l), or an amount that is excessive in satisfying ALIGN-R. Since all ALIGN-R demands are the junctures *Omari*)$_\varphi$, *Hamadi*)$_\varphi$, and *car*)$_\varphi$, no more than three phonological phrases are needed; candidates (d–j) indeed satisfy ALIGN-R, but do so with more phrases than needed, running afoul of general economy codified in *φ.

More interesting for the comparison of Weak and Strict Layering analyses is the fate of candidate (c), the Chimwiini representation on Strict Layering assumptions. Here, this candidate enjoys none of its former advantages; although it satisfies the all-important ALIGN-R, it fares worse than all but (k) in terms of WRAP. With the dismemberment of $\text{VP}_1 = [_{\text{VP1}}$ *forgot* $[_{\text{CP}}$ *that* $[_{\text{DP2}}$ *Hamadi* $[_{\text{VP2}}$ *bought* $[_{\text{DP3}}$ *car*]]]]], neither VP_1 nor CP are wrapped within a φ. Candidates (a–b) manage to wrap these constituents fully, without sacrificing right-alignment, and are therefore guaranteed to win out against (c).

Returning to Match Theory, we again see that the theory gives curious results when forced into the straitjacket of Strict Layering. While MATCH(XP,φ) and MATCH(φ,XP) rarley conflict in the world of Weak Layering, here they come into irresoluble contradiction, with MATCH-XP demanding more phrases and MATCH-φ demanding as few as possible in order to avoid mismatched constituents. Specifically, the resulting typology has the following two languages:

(38) *FacTyp*$_{\text{Match-3}}$ *(Strict Layering)*
  a. (Omari) (forgot that) (Hamadi) (bought car)   MATCH-XP $\gg$ MATCH-φ
  b. (Omari) (forgot that Hamadi bought car)   MATCH-φ $\gg$ MATCH-XP

This result is made clear by the following tableau. Again, the Chimwiini-compatible candidate is included to show why it is harmonically bounded.

(39) *No Chimwiini in Match with Strict Layering* (2/2 optima; 1/30 HBs)

$[_{\text{DP1}}$ O] $[_{\text{VP1}}$ forgot $[_{\text{CP}}$ that $[_{\text{DP2}}$ H] $[_{\text{VP2}}$ bought $[_{\text{DP3}}$ car]]]]	MATCH-XP	MATCH-φ
a. → (O) (forgot that) (H) (bought car)	***	*
b. HB (O) (forgot that H) (bought car)	****W	*e
c. (O) (forgot that H bought car)	****W	L

Clearly, MATCH-XP cannot be fully satisfied given Strict Layering, since syntax has the property of XP-recursion; it is impossible under Strict Layering to simultaneously match $[_{\text{VP2}}$ *bought car*] and its subconstituent $[_{\text{DP3}}$ *car*], or to simultaneously match

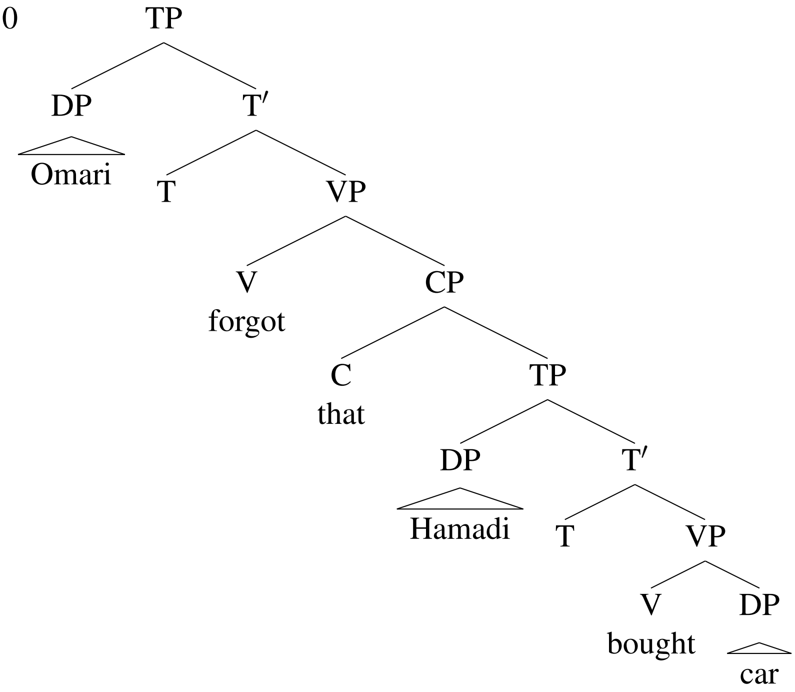
[$_{\text{VP1}}$ *forgot that Hamadi bought car*] and its various subconstituents. MATCH-XP therefore amounts to finding the candidate that matches the most XPs, since the constraint does not privilege any XP over another, being category-neutral and insensitive to the XP's height in the input tree. Here, matching VP$_1$ as in (c) means that four XPs go unmatched: [$_{\text{CP}}$ *that Hamadi bought car*], [$_{\text{DP2}}$ *Hamadi*], [$_{\text{VP2}}$ *bought car*], and [$_{\text{DP3}}$ *car*]. By sacrificing VP$_1$, (a) is able to rescue its subconstituents [$_{\text{DP2}}$ *Hamadi*] and [$_{\text{VP2}}$ *bought car*]. Although (a) accrues a violation for ignoring VP$_1$, and also fails to match [$_{\text{CP}}$ *that Hamadi bought car*] and [$_{\text{DP3}}$ *car*], it does one better than (c) on MATCH-XP. In doing so, (a) also wins out over the Chimwiini-compatible harmonic bound (b), which fails to match four XPs: [$_{\text{VP1}}$ *forgot that Hamadi bought car*], [$_{\text{CP}}$ *that Hamadi bought car*], [$_{\text{DP2}}$ *Hamadi*], and [$_{\text{DP3}}$ *car*].

In breaking up VP$_1$, candidate (a) incurs a violation of MATCH-φ. With the phonological phrases ($_{\varphi}$ *Hamadi*) and ($_{\varphi}$ *bought car*), the residue of VP$_1$ will be forced into a mismatching φ. In the case of (a), this is ($_{\varphi}$ *forgot that*). Thus, under the ranking MATCH-$\varphi \gg$ MATCH-XP, the only choice is to match the largest possible XPs, since these leave behind no mismatch-residue. The Chimwiini-compliant (b) is like (a) in that it contains a non-constituent ($_{\varphi}$ *forgot that Hamadi*), i.e. the mismatch-residue is jettisoned from ($_{\varphi}$ *bought car*). Since the two are tied on MATCH-XP, (b) can never win.

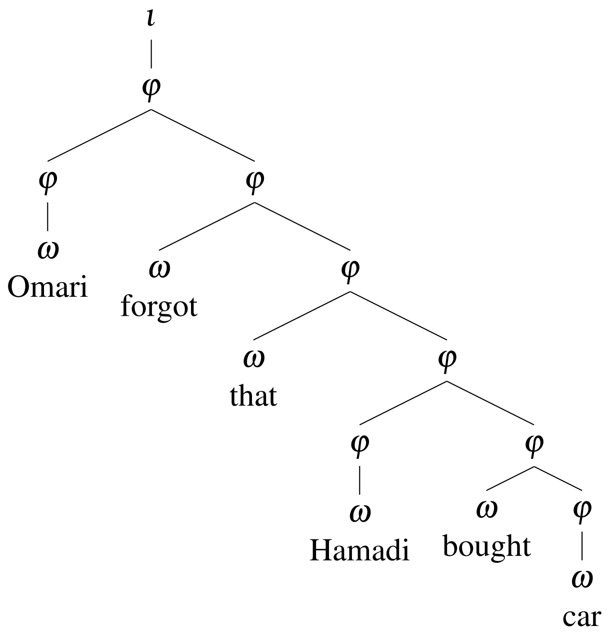
In the discussion of Chimwiini and Align/Wrap above, it was observed that structures like those originally positied for Chimwiini under Strict Layering are not the only means of explaining the phonological facts of the language; as long as *Omari*, *Hamadi*, and *car* are φ-final, and *forgot*, *that*, and *bought* are non-final, accents will be distributed appropriately. However, neither (a) nor (c) in the above tableau meets these requirements. With MATCH-XP $\gg$ MATCH-φ, we incorrectly predict accentuation of the complementizer *that*. With the reverse ranking, the embedded subject *Hamadi* is denied its rightful accent. Mixing Strict Layering and Match is thus a non-starter.

Pairing Match with Weak Layering, as is customary, brings us back to a world in which the accentual pattern is explained without recourse to a mismatching constituent ($_\varphi$ *forgot that Hamadi*). In fact, the only candidate possible given MATCH-XP and MATCH-φ is the one that satisfies them both: the perfect match.

(40) a. 1.0



b.



At this point, the question arises: Why do we need the prosodic hierarchy? Clearly, (40b) predicts exactly the right accent pattern. It would be no more complex to state the rules of Chimwiini accentuation with direct reference to the right edge of XP than to do so by relabeling each XP as φ. As Selkirk (2011) points out, this is a striking consequence of abandoning Strict Layering; where it was impossible to explain accentuation of *Hamadi* in Weak Layering without building a mismatched constituent, the problem does not arise when *Hamadi* can occupy an embedded φ. But we should question whether there is any explanatory value in positing such a system as opposed to a theory of direct reference à la Kaisse (1985), Odden (1987), Cinque (1993), Wagner (2005), Pak (2008), and Samuels (2009).

One argument for the prosodic hierarchy is the putative category-insensitivity of "phonosyntactic rules". Rules like Chimwiini accentuation care only about XP edges, treating DP, VP, CP, etc. exactly the same. Thus (the argument goes), we should bleach the syntactic representation by replacing the syntactic labels with the category-neutral φ. This is certainly possible, but it is no more explanatory than replacing the syntactic labels with the category-neutral label "XP"—i.e., it restates the initial claim of category-insensitivity.

The stronger argument for prosodic hierarchy theory, and one which this dissertation seeks to defend, comes from clear cases of syntax–prosody mismatches. The accentuation evidence from Chimwiini does not provide the requisite evidence, given its amenability to a direct reference account. We will therefore turn our attention to a range of cases where this approach fails, and simple matching is not enough. This will be the primary focus of the following chapters, drawing on data from ditransitives and rhythmic restructuring.

However, there is an additional reason to question a pure matching or direct reference approach—one which, to my knowledge, has been left unaddressed in the Match Theory literature. This involves what Richards (2016), in his Match-inspired Contiguity Theory, calls the "prosodic activity" of a left or right edge. One frequently finds diagnostics for the left or right edge of a phonological phrase, but languages where both edges are revealed are relatively rare, at least among the languages investigated so far. (Dual-edge languages include Kimatuumbi, Xitsonga, Irish, and Japanese.) In Chimwiini, the right edge of φ is the "active edge", the edge made visible to us by accentuation and other processes. The lack of a left-edge diagnostic for φ-structure in Chimwiini makes possible the sort of analytical vascillation on display above. When left-edges can be posited freely, with no empirical justification, a wide range of mutually contradictory structures will all yield the correct result.

The presence or absence of certain left-boundaries in Chimwiini is in principle open to empirical investigation. Perhaps there is a φ-initial fortition process that is undetectable without instrumental study. If such a process were discovered, and could be clearly argued to be φ-sensitive, then we could confidently adjudicate between the various structures under consideration above, with their differently placed left edges.

(41) *Problem: Unity on the right, disarray on the left*

a. (**O**mari) (**f**orgot that Hamadi) (**b**ought car) (L_3 of $S_{\text{Align-6}}$)
b. (**O**mari) (**f**orgot (**t**hat Hamadi) bought car) (L_2 co-opt. of $S_{\text{Align-7}}$)
c. (**O**mari) (**f**orgot that (**H**amadi) bought car) (L_2 co-opt. of $S_{\text{Align-7}}$)
d. (**O**mari) (**f**orgot (**t**hat (**H**amadi) (**b**ought (**c**ar)))) (L_1 co-opt. of $S_{\text{Align-7}}$)

Each parse in (39) has been shown to win on some ranking, under some set of assumptions, and each posits the correct right-boundaries for Chimwiini. However, no two of these are identical in terms of left edges, with potential disagreement on every left edge except for $_\varphi$(*Omari* and $_\varphi$(*forgot*. With such uncertainty, how are we to proceed?

The Strictly Layered (41a) posits only three left edges. This is guaranteed by the principle of proper parenthesization inherent in this theory of GEN; for every right edge, there is a unique left edge. If some initial strengthening process were discovered, then it would affect *Omari*,*forgot*, and *bought*—words that are either utterance-initial or immediately post-XP. Non-initial *that*, *Hamadi*, and *car* would not display any strengthening. Under the perfectly matching (41d), by contrast, every single word is φ-initial. This is, in a sense, much more structure than is required to explain Chimwiini accentuation. The Strict Layering theorist observes three accented words, and posits three φs. The Weak Layering Match theorist must posit six phrases to account for the same data. Thus, unless some as yet undiscovered φ-initial process confirms the predictions of (41d), general economy considerations point toward (41a) as the most parsimonious form. The trade-off is that deriving (41a) requires right-alignment, while (41d) is equivalent to saying that there is no matching procedure at all, only direct reference.

Tokizaki (1999) makes a tentative but highly suggestive observation about right- and left-edges and their relation to syntactic headedness. Left-headed languages tend to exhibit right-alignment, while right-headed languages tend to exhibit left-alignment. The examples provided by Tokizaki are the following:

(42) *Tokizaki's languages (Tokizaki 1999)*
a. *Right edges of lexically headed XPs*

i. Chimwiini (Kisseberth and Abasheikh 1974; Selkirk 1986)
ii. Kimatuumbi (Odden 1987)
iii. Xiamen (Chen 1987)

b. *Left edges of lexically headed XPs*
i. Ewe (Clements 1978)
ii. Japanese (Selkirk and Tateishi 1991)
iii. Korean (Cho 1990)
iv. Northern Kyungsang Korean (Kenstowicz and Sohn 1996)
v. Shanghai Chinese (Selkirk and Shen 1990)

These languages do not uniformly illustrate Tokizaki's point. In fact, Ewe is a left-headed language that does not fit comfortably in Tokizaki's system, and Shanghai Chinese is also an issue, as Tokizaki acknowledges. However, various languages can also be added to the lists. Additional left-headed languages with right-alignment are English (Selkirk 2000; Gussenhoven 2005) and Swedish (Myrberg and Riad 2015).[4] Citing and building on Tokizaki, Ackema and Neeleman (2003) take all (or at least most) left-headed languages to be right-aligning, and show that Old French, Middle Dutch, Arabic, Modern Dutch, and Irish might also fit within the expected parameters (though see Elfner (2012) for evidence that Irish is partially dual-edge-aligning). Ackema and Neeleman's argument relies largely on apparently non-phonological morphosyntactic phenomena (agreement weakening), but it is suggestive nonetheless. As discussed in chapter 3, Turkish may also belong to the (42b) group, and German may straddle the boundary, with right-alignment in left-headed phrases and left-alignment in right-headed phrases.

In the next section, we will look at how Command Theory handles these cases.

[4] Myrberg and Riad (2015) do not analyze Swedish as right-aligning *per se*, but it is clear from their examples that right edges are largely treated as they are in English.

2.4 Command Theory

So far, we have seen that the Align/Wrap Theory can perfectly accomodate languages like Chimwiini by classifying them as "right-aligning". The right edge of each XP is mapped to the right edge of some φ. Meanwhile, Match Theory produces the wrong results with Strict Layering, and yields Chimwiini-compatible results under Weak Layering only as long as undetected left boundaries can be included with no cost. In a sense, the right-alignment perspective from Align/Wrap Theory is more explanatory; there are no question-begging undetected left boundaries. If there are no left boundaries between, say, C^0 *that* and subject *Hamadi*, then it is not simply a coincidence that no prosodic break is detected at this juncture.

Regardless of Match Theory's other advantages over Align/Wrap, right-alignment is thus a particularly attractive way of viewing Chimwiini phrasing. Furthermore, Tokizaki's work suggests that we should take seriously the inverse correlation between head-directionality in syntax and edge-alignment in prosody; left-headed languages like English overwhelmingly exhibit right-alignment, while right-headed languages like Japanese exhibit left-alignment (see also Nespor and Vogel 1986). We will refer to this correlation as Tokizaki's Generalization.

(43) *Tokizaki's Generalization (Tokizaki 1999, my wording)*
If a language has syntactic headedness $\delta \in \{\text{R}, \text{L}\}$, then it has XP-$\varphi$ alignment δ'.

But Tokizaki's Generalization reveals a certain undesirable arbitrariness in the Align/-Wrap Theory, as there is no reason that a left-headed language could not prioritize ALIGN-L, or that a right-headed language could not prioritize ALIGN-R. If we temporarily set aside problematic cases like Ewe and Shanghai Chinese, which may ultimately invalidate Tokizaki's Generalization, we might ask: *Since there is not way to derive it in Match or Align/Wrap Theory, is there a way we can derive this generaliza-*

tion in an OT approach to prosodic hierarchy theory?

Let us briefly review what is at stake, if we are to take up this task. The following syntactic configurations should map to the following prosodic structures:

(44) *Heads on left, right-alignment*

a. $[_{\text{XP}}$ X $[_{\text{Complement}}$ Y… → $(_{\varphi}$ X Y…
b. $[_{\text{XP}}$ X $[_{\text{Complement}}$ $[_{\text{Specifier}}$ Y… → $(_{\varphi}$ X Y…
c. $[_{\text{XP}}$ X $[_{\text{Complement}}$ $[_{\text{Adjunct}}$ Y… → $(_{\varphi}$ X Y…
d. $[_{\text{XP}}$ X] $[_{\text{YP}}$ Y… → $(_{\varphi}$ X) $(_{\varphi}$ Y…

(45) *Heads on right, left-alignment*

a. …Y$]_{\text{Complement}}$ X$]_{\text{XP}}$ → …Y X$)_{\varphi}$
b. …Y$]_{\text{Specifier}}$ $]_{\text{Complement}}$ X$]_{\text{XP}}$ → …Y X$)_{\varphi}$
c. …Y$]_{\text{Adjunct}}$ $]_{\text{Complement}}$ X$]_{\text{XP}}$ → …Y X$)_{\varphi}$
d. …Y$]_{\text{YP}}$ [X$]_{\text{XP}}$ → …Y$)_{\varphi}$ (X$)_{\varphi}$

Since the edge-based theory does not distinguish between the edges of complements, specifiers, and adjuncts, but treats all XPs in a uniform manner, the above mappings cannot be reduced to a simple relation-based statement like "heads phrase with their complements"; heads also phrase with the specifiers of their complements. The situation is reminiscent of a traditional problem in syntax: clearly there is a special relation between a head and its complement, but what about the connection between a head and the specifier of its complement? In syntactic theory, facts about case-assignment and other relations between heads and specifiers of their complements led to the notion of *government*, a relation which holds between a head and a phrase in precisely this configuration, among others (Chomsky 1986). In the Minimalist Program (Chomsky 1995b), government has been abandoned, but clearly there is something correct about the idea.

Rather than attempting to re-introduce the notion of government into linguistic theory, we might ask whether there is some other uniting factor among these disparate configurations. The answer lies in the notion of c-command, a geometric relation among the nodes of a tree. The following definition from Reinhart (1976) suffices for the current discussion.

(46) *C-command* *(Reinhart 1976)*
Node *A* c-commands node *B* if neither *A* nor *B* dominates the other and the first branching node which dominates *A* dominates *B*.

The reference to “first branching node” here means that we must proceed with caution, since the Minimalist syntactic structures used here contain no unary branching, being built exclusively by the binary operation Merge (Chomsky 1995b). When Reinhart (1976) formulated (46), an XP could be unary branching if it contained neither a complement nor a specifier, as in [$_{\text{XP}}$ X^0]. In Bare Phrase Structure (Chomsky 1995a), this structure is in fact simply X, where X is simultaneously maximal (does not project further) and minimal (is not a projection itself), and can be expected to show properties of both XPs and heads. Regardless, under (46), X c-commands Y in *every* configuration of (44–45), which makes it impossible for c-command to differentiate between the (a–c) configurations that result in φ-matehood, and the (d) configurations that result in φ-separation.

But another development in syntactic theory suggests that the story is not so simple. Lexical categories are generally no longer thought to be maximal in their extended projection (Grimshaw 2005), but have at least one layer of functional structure above them. Examples include *v*, I/T, and C above V, as well as D above N (Fukui and Speas 1986; Chomsky 1986; Abney 1987; Chametzky 2000). In addition, there are the “little” category-defining heads from Distributed Morphology, such as *n*, *a*, and *v*, which sit above acategorial roots (Marantz 1997; Embick 2010). In other words, a lexical head L is usually embedded within a functional projection FP, yielding the structure [$_{\text{FP}}$ F LP]. Supposing that this is correct, L does not c-command elements outside of FP. For our purposes, this means that a non-branching NP does not c-command out of its DP in the structure [$_{\text{DP}}$ D N], where N=N^0=NP, but will c-command its complement if its maximal projection is branching. (The same holds for $\sqrt{\textsc{Root}}$ and n in a DM-style structure $[_{\mathrm{DP}}\ \mathrm{D}\ [_{n\mathrm{P}}\ n\ \sqrt{\textsc{Root}}]]$.) With these additional assumptions, (44–45) actually has the following structure, where little heads x and y are silent or otherwise phonologically negligible, undergoing cliticization or affixation by some morphological mechanism (Halle and Marantz 1993).

(47) *Heads on left, right-alignment (recast)*

a. *Head/Complement*
$[_{x\mathrm{P}}\ x\ [_{\mathrm{XP}}\ \mathrm{X}\ [_{y\mathrm{P}}\ y\ [_{\mathrm{YP}}\ \mathrm{Y}\ldots \quad \rightarrow \quad (_{\varphi}\ \mathrm{X\ Y}\ldots$

b. *Head/Spec-of-Complement*
$[_{x\mathrm{P}}\ x\ [_{\mathrm{XP}}\ \mathrm{X}\ [_{z\mathrm{P}}\ z\ [_{y\mathrm{P}}\ y\ [_{\mathrm{YP}}\ \mathrm{Y}\ldots]\ldots \quad \rightarrow \quad (_{\varphi}\ \mathrm{X\ Y}\ldots$

c. *Head/Adjunct-to-Complement*
$[_{x\mathrm{P}}\ x\ [_{\mathrm{XP}}\ \mathrm{X}\ [_{z\mathrm{P}}\ [_{y\mathrm{P}}\ y\ [_{\mathrm{YP}}\ \mathrm{Y}\ldots]\ [_{z\mathrm{P}}\ z\ldots \quad \rightarrow \quad (_{\varphi}\ \mathrm{X\ Y}\ldots$

d. *Adjacent Phrases*
$[_{x\mathrm{P}}\ x\ [_{\mathrm{XP}}\ \mathrm{X}]\ [_{y\mathrm{P}}\ y\ [_{\mathrm{YP}}\ \mathrm{Y}\ldots \quad \rightarrow \quad (_{\varphi}\ \mathrm{X})\ (_{\varphi}\ \mathrm{Y}\ldots$

(48) *Heads on right, left-alignment (recast)*

a. *Head/Complement*
$\ldots\mathrm{Y}]_{\mathrm{YP}}\ y]_{y\mathrm{P}}\ \mathrm{X}]_{\mathrm{XP}}\ x]_{x\mathrm{P}} \quad \rightarrow \quad \ldots\mathrm{Y\ X})_{\varphi}$

b. *Head/Spec-of-Complement*
$\ldots\mathrm{Y}]_{\mathrm{YP}}\ y]_{y\mathrm{P}}\ z\ ]_{z\mathrm{P}}\ \mathrm{X}]_{\mathrm{XP}}\ x]_{x\mathrm{P}} \quad \rightarrow \quad \ldots\mathrm{Y\ X})_{\varphi}$

c. *Head/Adjunct-to-Complement*
$\ldots\ z]_{z\mathrm{P}}\ [\ldots\ \mathrm{Y}]_{\mathrm{YP}}\ y]_{y\mathrm{P}}\ ]_{z\mathrm{P}}\ \mathrm{X}]_{\mathrm{XP}}\ x]_{x\mathrm{P}} \quad \rightarrow \quad \ldots\mathrm{Y\ X})_{\varphi}$

d. *Adjacent Phrases*
$\ldots\mathrm{Y}]_{\mathrm{YP}}\ y]_{y\mathrm{P}}\ [[\mathrm{X}]_{\mathrm{XP}}\ x]_{x\mathrm{P}} \quad \rightarrow \quad \ldots\mathrm{Y})_{\varphi}\ (\mathrm{X})_{\varphi}$

The upshot is that X c-commands Y in the (a–c) structures, but crucially *not* in (d); since XP is embedded within xP, it does not matter that it in itself fits the "unary branching" condition from Reinhart's definition, being too deeply embedded to c-command Y. We now define two constraints based on the phonological phrasing of c-pairs: C-COMMAND-TO-$\varphi_{\mathrm{Simple}}$ and ANTI-C-COMMAND-TO-$\varphi_{\mathrm{Simple}}$. These are labeled "simple" because they suffice for expository purposes here, but differ from the related constraints introduced in Chapter 3.

(49) C-COMMAND-TO-$\varphi_{\mathrm{Simple}}$ (CC-φ_{Simp})
If a word X c-commands an adjacent word Y in syntactic structure, then assign a violation if X and Y occupy separate φs in prosodic structure.

(50) ANTI-C-COMMAND-TO-φ_{Simple} (ANTI-CC-φ_{Simp})
If a word X and an adjacent word Y are mutually non-c-commanding, then assign a violation if X and Y occupy the same φ in prosodic structure.

We are now in a position to derive Chimwiini's phonological phrasing without making arbitrary reference to the right edge. Instead, we can view Chimwiini phrasing as the natural result of its left-headedness in syntax. The Chimwiini phrasing assumed given Strict Layering satisfies CC-φ_{Simp} and ANTI-CC-φ_{Simp} perfectly:

(51) *Command Theory derives Chimwiini right-alignment* (1/1 optima; 2/31 HBs)

[$_{\text{DP1}}$ O] [$_{\text{VP1}}$ forgot [$_{\text{CP}}$ that [$_{\text{DP2}}$ H] [$_{\text{VP2}}$ bought [$_{\text{DP3}}$ car]]]]	CC-φ_{S}	ANTI-CC-φ_{S}
a. → (O) (forgot that H) (bought car)		
b. $_{\text{HB}}$ (O) (forgot) (that) (H) (bought) (car)	***W	
c. $_{\text{HB}}$ (O forgot that H bought car)		**W

In candidate (b), there are three violations of CC-φ_{Simp}; one for the juncture separating *forgot* from the head of its complement, *that*; another for the juncture separating *that* from the head of the specifier of its complement, *Hamadi*; and a third for the juncture separating *bought* from the head of its complement, *car*. Placing all of the words in one big φ, as in (c), fully satisfies CC-φ_{Simp}, but fails on ANTI-CC-φ_{Simp} due to the boundary-free juxtaposition of *Omari* and *forgot*, and again due to the transition from *Hamadi* to *bought*. Here, the phrases containing *Omari* and *Hamadi* do c-command the material to their right, but the heads themselves, being embedded within these phrases, do not c-command any following material.

The same holds in a right-headed language, *mutatis mutandis*. The combination of CC-φ_{Simp} and ANTI-CC-φ_{Simp} give the effects of ALIGN-R in left-headed languages, and the effects of ALIGN-L in right-headed languages, thus deriving Tokizaki's Generalization without recourse to arbitrary edge-specification. With CC-φ_{Simp} and ANTI-CC-φ_{Simp}, we cannot derive an X^0-left/boundary-left or an X^0-right/boundary-right language. If it turns out that Tokizaki's Generalization can be upheld, recalcitrant data notwithstanding, then CC-φ_{Simp} and ANTI-CC-φ_{Simp} present a significant advantage over Align/Wrap.

Chapter 3

Ditransitive Mismatches

Sentences of the form [$_{\text{XP}}$ X^0 YP ZP] exhibit syntax–prosody mismatches in many languages. Even when syntactic theory shows that YP and ZP form a constituent without X^0, many languages build a prosodic constituent consisting of X^0 and YP, but excluding ZP. This is precisely the case with ditransitives and double-object constructions, which are sentence where a verb takes two internal arguments. Syntacticians have amassed significant evidence that in ditransitives, the two internal arguments form a surface constituent (Larson 1988; Harley and Miyagawa 2016), meaning that the structure is in fact [$_{\text{XP}}$ X^0 [$_{\text{WP}}$ YP ZP]], where W^0 is null. But YP and ZP seem never to phrase together in prosodic structure without X^0. The four attested phrasings of left-headed 3ω ditransitives are those in (52).

(52) *Left-headed* 3ω *ditransitive phrasings*

a.	*Ewe*	(V) (N) (N)	source
b.	*Chimwiini*	(V N) (N)	source
c.	*Kimatuumbi*	((V N) N)	source
d.	*Zulu*	(V N N)	source

Syntactic evidence indicates that in such structures, the verb does not form a constituent with either object. Rather, the two objects form a syntactic constituent to the exclusion of the verb. It therefore comes as a surprise for Match Theory that (52) does not include (V (N N)) or (V ((N) (N))). But no phrasing in (52) places the two objects in a φ of their own, without the verb.

There are two types of mismatches in (52). Ewe and Zulu are weak mismatches, since they do not phrase the objects together without the verb. But Chimwiini and Kimatuumbi are strong mismatches, since they phrase the verb with the first object to the exclusion of the second.

In this chapter, I explore these mismatches in detail, and put to use the new theory of the syntax–prosody interface called Command Theory, according to which phonological phrase construction makes reference to c-command relations between words. The idea that c-command plays a crucial role in prosody has many antecedents, including a direct reference theory by Kaisse (1985) and an OT implementation by Kim (1997). Additional evidence for the role of c-command and phonology (but outside of prosodic hierarchy theory) comes from McPherson's (2014) work on replacive tone in Dogon languages. However, the implementation of the idea here is unique, in that it is able to capture recursive phonological phrasing in a way that other theories are not designed to do (whether due to Direct Reference in Kaisse's case, or to Strict Layering in Kim's).

Below, I present a Command–Theoretic analysis of the typology of 3ω ditransitive phrasings. Ditransitives with more than three prosodic words are also reported on, but three-word cases are reported for a much wider range of languages. I compare the CT analysis with a Match–Theoretic alternative using STRONGSTART and MATCH(LexP,φ). While both systems are descriptively adequate for the basic examples in (52), the typology is much more restricted in CT than in MT. In fact, by giving up on constituent-matching, CT avoids unattested matching phrasings altogether, while MT of course admits them. I will therefore argue that CT has greater explanatory adequacy than MT.

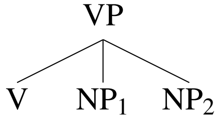
3.1 The syntax of ditransitives

Distransitive sentences are those in which a verb takes two internal arguments, as in (53a), where *Bill* is the indirect object and *a letter* the direct object.

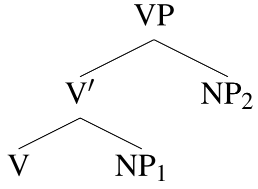
(53) a. Mary sent Bill a letter.
b. Mary sent a letter to Bill.

When asking what prosodic parse Match Theory predicts for such sentences, we need to determine the basic constituency of the string consisting of the verb and its two complements. Oehrle (1976) proposed the flat structure in (54) for such examples, meaning that neither the string *sent Bill* nor *Bill a letter* is a constituent in (53a). On this view, which countenances ternary branching in syntactic sturctures, each internal argument is a complement to the verb, and the two are therefore on equal footing in structural terms. Chomsky (1981), by contrast, proposes that only the first internal argument in a ditransitive is a true complement to the verb, forming a V' constituent which excludes the second, as shown in (55).

(54) *Ternary branching*
(Oehrle 1976)



(55) *Left-branching*
(Chomsky 1981)



But by the late 1980s, a number of asymmetries between the two internal arguments gave rise to a different theory, on which a third logically possible constituency for (53a) is assumed (Harley and Miyagawa 2016): $[_{v\mathrm{P}}\ \mathrm{V}{+}v\ [_{\mathrm{VP}}\ \mathrm{NP}_1\ \mathrm{t}_{\mathrm{V}}\ \mathrm{NP}_2]]$.

Barss and Lasnik (1986) point out that on a number of tests, the first internal argument is privileged over the second. In English, the first object may bind an anaphoric or variable second object, but not vice versa (56–57).

(56) *Anaphor licensing* (Barss and Lasnik 1986, p. 347)
a. I showed {John$_1$, him$_1$} himself$_1$ in the mirror.
b. *I showed himself$_1$ {John$_1$, him$_1$} in the mirror.

(57) *Variable binding* (Barss and Lasnik 1986, p. 348)
a. I denied each worker$_1$ his$_1$ paycheck.
b. *I denied it$_1$s ower each paycheck$_1$.

The first object can *wh*-move and bind a pronoun inside of the second object, but not vice versa, a so-called Weak Crossover Effect (58).

(58) *Weak Crossover* (Barss and Lasnik 1986, p. 348)
a. Which worker$_1$ did you deny ___ his$_1$ paycheck?
b. *Which paycheck$_1$ did you deny it$_1$s owner ___?

Also in the realm of *wh*-movement, if each internal argument in a ditransitive is a *wh*-phrase, the first moves while the second must remain in situ (59).

(59) *Superiority* (Barss and Lasnik 1986, p. 349)
a. Who did you give ___ which book?
b. *Which book did you give who ___?

Further, in what Barss & Lasnik call the *each…the other* construction, an *each* in NP$_1$ may bind *the other* in NP$_2$, but not vice versa (60).

(60) *Each … the other* (Barss and Lasnik 1986, p. 349)
a. I gave each man the other's watch.
b. *I gave the other's trainer each lion.

Finally, if the first object contains a negation, the second can be a negative polarity item, but the reverse does not hold (61).

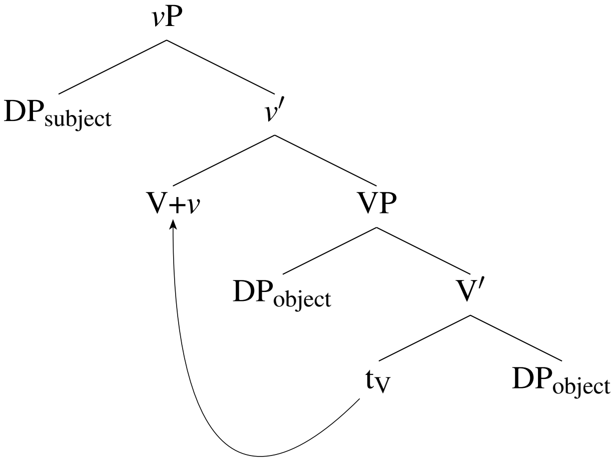
(61) *Polarity* any (Barss and Lasnik 1986, p. 350)
a. I gave no one anything.
b. *I gave anyone nothing.

While Barss and Lasnik (1986) do not propose a final theory to explain the facts in (56–61), they point out that these asymmetries might be accounted for if the first object asymetrically c-commands the second. Larson (1988) adopts this solution, developing a theory on which the two internal arguments in a ditransitive form a surface constituent to the exclusion of the verb, which undergoes head-movement to a "VP shell" position higher than and to the left of its internal arguments. The result explains not only the asymmetries from (56–61), but correctly predicts that the verbless surface VP containing the internal arguments should be able to enter into coordinations, as confirmed by data like (62), assuming Across-the-Board movement of the verb.

(62) *Coordination of surface-verbless VPs* (cf. Larson 1988, p. 345)
John sent [[Mary a letter] and [Sue a book]].

Larson's proposal is now widely adopted in Minimalist syntax (Chomsky 1995b), and its modern instantiations usually involve movement of the lexical verb V to a functional light verb *v*, as in (63). (The external argument shown in Spec,*v*P will move to T when that head is merged.)

(63)



The structure in (63) has the advantage of deriving the correct surface word order while simultaneously accounting for the asymmetries discussed above. Assuming (63) to be correct, Match Theory predicts that the VP containing the two objects will form a prosodic constituent, and that the verb and the first object will *not* form a prosodic constituent—at least in some languages. In the next section, we see that this prediction is incorrect on both counts.

The English construction in (53a) is a special kind of ditransitive, namely a double object construction, so called because both internal arguments are DPs. In other ditransitives, like (53b), repeated in (64), one of the arguments is a PP.

(64) Mary sent a letter to Bill.

Although the constructions in (53a) and (64) do not display all of the same properties (e.g. with respect to idiom tests (Larson 1988)), their surface syntactic trees are the same shape in all the ways that matter for syntax–prosody mapping. If the preposition in a ditransitive like (64) is pronounced as a separate ω in some language (perhaps due to length), then prosodic differences between the two types of ditransitives might be expected. However, since in most languages, including English, function words are clitics, I ignore the PP/DP distinction below, and assume that [$_{\text{PP}}$ P [$_{\text{DP}}$ D [$_{\text{NP}}$ N]]] is mapped to a single (possibly recursive) ω.

Coordination, anaphor licensing, variable binding, weak crossover, and NPI licensing all indicate that the constituent structures of (53a) and (64) are identical in surface syntax. This is shown in (65–69).

(65) *Coordination of surface-verbless VPs* (Larson 1988, p. 345)
John sent [[a letter to Mary] and [a book to Sue]].

(66) *Anaphor licensing*
  a. I showed John$_1$ to himself$_1$ in the mirror.
  b. *I showed him$_1$/himself$_1$ to John$_1$ in the mirror.

(67) *Variable binding*
  a. I led/showed each$_1$ dog to its$_1$ owner.
  b. *I led/showed his$_1$/her$_1$/their$_1$/its$_1$ dog to each$_1$ owner.

(68) *Weak crossover*
  a. Which dog$_1$ did you lead __ to its$_1$ owner?

b. *Which owner did you lead his$_1$/her$_1$/their$_1$/its$_1$ dog to __?

(69) *Polarity*

a. I gave nothing to anyone.

b. *I gave anything to no one.

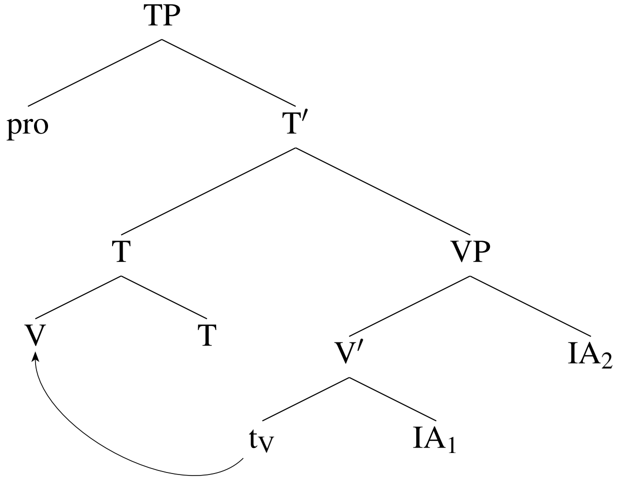
I take these tests to show that there is no syntactic difference between DP–DP and DP–PP ditransitives that would be relevant to prosody.

A skeptic might object that the tests showing an [IA IA] constituent are flawed, and that the left-branching structure from Chomsky (1981) is in fact correct. This might be possible, if the binding conditions referred to a looser notion than c-command, accounting for the binding–theoretic relations between IA$_1$ and IA$_2$ in the structure [[V IA$_1$] IA$_2$]. This could be accomplished given the Precede-and-Command theory of Bruening (2014), in which "Command" is "Phase-Command". Similarly, replacing c-command with m-command in the definitions of the binding conditions might work as an alternative. Apparent coordination of surface-verbless VPs could, in the simplest cases, be accounted for as V-ellipsis, yielding [[[V IA$_1$] IA$_2$] & [[~~V~~ IA$_3$] IA$_4$]]].

A reappraisal of the Chomsky (1981) structure should hold great appeal for Match Theorists working on English, since it makes the mapping [[V IA$_1$] IA$_2$] $\rightarrow$ ((V IA$_1$) (IA$_2$)) entirely expected. If V and IA$_1$ are a syntactic constituent excludnig IA$_2$, then building a phonological phrase ($_\varphi$ V IA$_1$), as turns out to be the case in English, is not a mismatch, but a match.

The problem for matching is that adopting the Chomsky (1981) structure (or a similar structure where the V$'$ is actually an XP) does not guarantee a surface syntactic constituent [V IA$_1$] in all languages. In fact, in any language with head-movement of the verb to a higher functional head, [t_{V} IA$_1$ IA$_2$] will be a surface constituent, even if [IA$_1$ IA$_2$] is not a constituent without the trace of the verb: [[t_{V} IA$_1$] IA$_2$]. This is shown in (70), where V moves to T, leaving VP = [t$_{\mathrm{V}}$ IA$_1$ IA$_2$].

(70) *Head Movement leaves IA-IA constituent*



Verb-movement is widespread across the languages of the world, and is indicated by the relative order of V and various elements that occur between T (or C) and VP. Compared to the usual case in Romance (Pollock 1989), Bantu (Demuth and Harford 1999; Ngonyani 2002), and non-English Germanic main clauses (den Besten 1983), English is an outlier in moving only auxiliaries to T or C, rather than all verbs. The internal structure of the VP is therefore largely irrelevant for the prosody of verb-movement languages, since [t_V IA_1 IA_2] will be a surface constituent, and [V IA_1] will not be. This is the case in English as well, if the base (and surface) constituency is in fact [V [IA_1 IA_2]], as suggested by (Larson 1988).

3.2 Evidence for ditransitive phrasing

In this section, we present the facts on ditransitive phrasing from a variety of languages. Examples of and details about each language are provided in the subsections following this broad overview.

At least one language, the Niger–Congo language Ewe, is claimed to phrase each word in a 3ω, left-headed ditransitive separately.

(71) *Analyzed as* …($_\varphi$ V) ($_\varphi$ N) ($_\varphi$ N)

a. Ewe (Tone Sandhi: Clements (1978))

Although I include the Ewe phrasing in (52), details regarding the syntax and phrasing of this language remain to be fully explored, making it difficult to conclude much from (71). See §3.2.1 below for details.

More languages phrase the verb with the first noun, but phrase the second noun separately. This group includes Romance, Bantu, Germanic, and Semitic languages.

(72) *Analyzed as* …($_\varphi$ V N) ($_\varphi$ N)

a. Catalan (phrasal stress: Prieto (2005))
b. Chaga (φ-bounded tonal phenomena: McHugh (1990a,b))
c. Chimwiini (V-Shortening, φ-final accent: Kisseberth and Abasheikh (1974, 2011))
d. English (stress, duration, etc.: Hayes (1990); Selkirk (2000); Elfner (2014))
e. Makkan Arabic (φ-internal syncope: Abu-Mansour (2011))
f. Northern Kikuyu (Downstep: Gjersøe (2015))
g. Swedish (φ-final Big Accent: Kalivoda (in prep.), Myrberg and Riad (2015))

Still other languages are purported to show no phrase-boundaries in 3ω ditransitives. Curiously, all of the members of this group that I know of so far are Bantu languages.

(73) *Analyzed as* …($_\varphi$ V N N)

a. Chichew̑a (φ-penultimate lengthening: Kanerva (1990))
b. Chizigula (φ-internal H-Anchoring, H-Spread: Kenstowicz and Kisseberth (1990))
c. Kinyambo (φ-non-final H-Deletion: Bickmore (1989, 1990)
d. Xhosa (φ-penultimate lengthening: Jokweni (1995); Zerbian (2004))
e. Zulu (φ-penultimate lengthening: Cheng and Downing (2016))

The final phrasing of a V–N–N ditransitive that I am aware of is perhaps the most interesting, if analyzed correctly. In Kimatuumbi and Xitsonga, the verb is claimed to form a minimal φ with the first noun, like in (72). But instead of phrasing apart, the bare ω of the second noun "adjoins" to the preceding minimal φ, creating a recursive structure.

(74) *Analyzed as* …($_{\varphi}$ ($_{\varphi}$ V N) N)

   a. Kimatuumbi (φ-initial H, φ-non-final shortening; Truckenbrodt (1999))
   b. Xitsonga (φ-internal H-Spread: Selkirk (2011))

The structure in (74) is distinguishable from that in (72) in that the second noun is not φ-initial—meaning that any cues to φ-initiality will be absent on it—but *is* φ-final.

Examples (72–74) all involve left-headed structures, but we must also consider the phrasing of right-headed ditransitives. These are particulary important in light of the fact that STRONGSTART has been used to account for the left-headed phrasing possibilities (Lee & Selkirk 2016, handout). Since STRONGSTART only examines the left edge of a prosodic constituent, as the name implies, what happens with right-headed ditransitives? The lack of a constraint STRONGEND predicts that there will be left–right asymmetries in any system including STRONGSTART.

At least German, Turkish, and two varieties of Korean have been claimed to have the mirror image phrasing of that in the Chimwiini-type languages in (72): the verb phrases with the closest object, which in this case is the *second* object.

(75) *Analyzed as* …($_{\varphi}$ N) ($_{\varphi}$ N V)

   a. German (φ-head stress and accent: Büring (2000))
   b. Turkish (final H in non-final φ: Güneş (2015))
   c. Korean (φ-internal Obstruent Voicing rule: Cho (1990))[1]
   d. North Kyungsang Korean (Tones: Kim (1997))

All of the right-headed ditransitive phrasings (that I am aware of) are reverse-Chimwiini: they phrase the verb and its closest object together, to the exclusion of the next-closest object. Lacking from the list are reverse-Ewe's ($_{\varphi}$ N) ($_{\varphi}$ N) ($_{\varphi}$ V),

[1] The phrasing proposed by Cho (1990) is rendered even more plausible given the findings of Jun (1998), who reports on the phonological properties of many constructions. However, since Jun (1998) does not include any examples of ditransitives, I ascribe the claim to Cho (1990) in (75c).

reverse-Kimatuumbi's ($_\varphi$ N ($_\varphi$ N V)), and reverse-Zulu's ($_\varphi$ N N V). The lack of such languages in this list seems likely to be an accident owing to the small sample size. But we can also note the lack of any phrasing grouping the two objects together, e.g. ($_\varphi$ N N) ($_\varphi$ V) or ($_\varphi$ ($_\varphi$ N N) V). The latter is predicted as the purely matching candidate, assuming an input [$_{v\mathrm{P}}$ [$_{\mathrm{VP}}$ N N] V].

3.2.1 The (V) (N) (N) Pattern

As mentioned above, 3ω ditransitives in Ewe are phrased with each word in its own φ. The evidence for this phrasing comes from a tone sandhi rule, which changes a mid tone to an extra high tone when it is between two high tones contained in the same phonological phrase (Clements 1978). In (76), the mid tone on the indirect object *Kofi* has not become extra high, as it would if high-final *àtyí* 'stick' were in its φ. (Here, V̄ is mid, V́ is high, V̀ is low, and V̋ is extra high.)[2]

(76) *Ewe* (Clements 1978; Selkirk 1986)

mēná àtyí **kō**fí
I.gave stick Kofi

'I gave a stick to Kofi.'

Since the first syllable of *Kofi* remains mid, it must be preceded by a phonological phrase's left edge. Of course, (76) shows only that the second noun phrases apart from the first, since neither the final syllable of the verb (high *ná* of *mēná*) nor the initial syllable of the first noun (low *à* of *àtyí*) would meet the structural description of the tone sandhi rule, even if the two words were contained in the same φ. Evidence for the separate phrasing of the verb and direct object comes from the following simple transitive.

[2] I use the term "rule" loosely here to refer to a regular and productive phonological phenomenon. This is simply a term of convenience. It is my view that such "rules" should in fact be analyzed as resulting from a constraint ranking in Optimality Theory.

(77) *Ewe* (Clements 1978; Selkirk 1986)

kpɔ́ ānyí
see bee

'see bee'

In (77), the mid tone on the first syllable of *ānyí* does not raise to extra high, despite being flanked on both sides by high tones. We can therefore assume with some confidence that there is a phrase break between the verb and first object in (76) as well, though this remains to be confirmed.

On the basis of (76–77), it seems as if the verb never participates in tone sandhi. However, Ewe also allows one object to appear preverbally, in which case it *does* form a φ with the verb.

(78) *Ewe* (Clements 1978; Selkirk 1986)

m'ātyíkɛ̋ dzrágé
medicine I.will.sell

'I will sell medicine.'

In (78), the final syllable of the preverbal object has gone from mid to extra high due to the high tone on the penult of the same word, and the initial high tone of the verb. These two words must be in the same φ, since otherwise the rule's structural description would not be met.

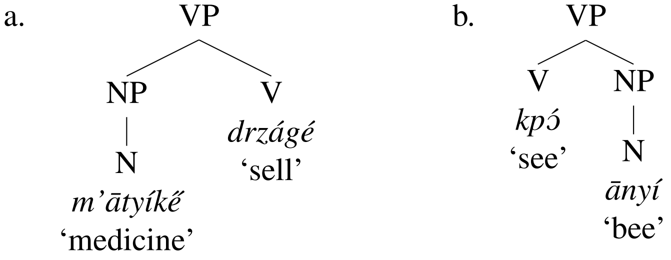
This pattern is challenging for Match Theory and Align/Wrap Theory of SP-mapping, as well as for Command Theory. Suppose that postverbal objects in Ewe are VP-internal, while preverbal objects have moved to a VP-external position. This gives us the structures [$_{\text{VP}}$ V DP] for (77) and [$_{\text{FP}}$ DP [$_{\text{VP}}$ V *t*]] for (78).

As we will see below, Match Theory has no problem accomodating the phrasing [$_{\text{VP}}$ V DP] → ($_{\varphi}$ ($_{\varphi}$ V) ($_{\varphi}$ N)), by ranking MATCH(XP,φ) over a minimal binarity constraint. However, this ranking will incorrectly predict a biphrasal structure for (78) as well: [$_{\text{FP}}$

DP [$_{\text{VP}}$ V *t*]] → *($_\varphi$ ($_\varphi$ N) ($_\varphi$ V)). We do not even need to examine a tableau to see that this is an issue; the correct phrasing [$_{\text{FP}}$ DP [$_{\text{VP}}$ V *t*]] → ($_\varphi$ N V) violates MATCH(XP,φ) twice (once for DP, once for VP), while [$_{\text{VP}}$ V DP] → ($_\varphi$ ($_\varphi$ V) ($_\varphi$ N)) satisfies it fully. There are no Match–Theoretic constraints currently on the table which can resolve this dilemma.

The situation is just as bleak for Align/Wrap Theory, since both left and right XP boundaries intervene between N and V in the structure [$_{\text{FP}}$ [$_{\text{DP}}$ N] [$_{\text{VP}}$ V *t*]]. In an influential pre-OT implementation of the Edge-Based Approach, which would go on to become the theory of ALIGN and WRAP familiar from Truckenbrodt (1995, 1999), Selkirk (1986) proposes that in Ewe, the phrase-edge parameter is set to 'left'. That is, the φ-construction algorithm places a boundary ($_\varphi$ at the left edge of every XP. In contemporary theory, this amounts to saying that ALIGN(XP,L,φ,L) is high-ranked, while ALIGN(XP,R,φ,R) is inactive. This analysis works perfectly with the syntactic structures that Selkirk proposes:

(79) *Selkirk's (1986) Syntax for Ewe*

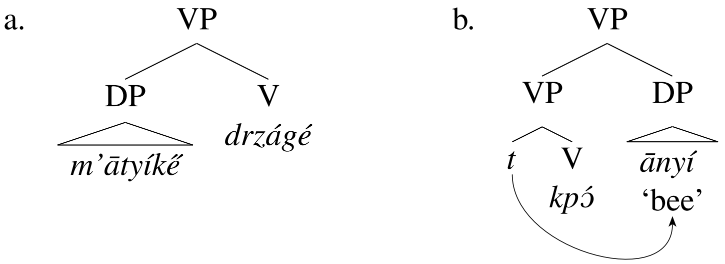


For Selkirk (1986), the Ewe VP is not inherently left- or right-headed. When the object is preverbal, this is because the VP is right-headed, and when it is postverbal, the VP is left-headed. Since it is *ex hyp.* the left edge of XP that is relevant in this language, there will be no φ-boundary between NP and V in (79a), but there will be in (79b), exactly as needed to capture the tone sandhi facts.

The problem with (79) is that variable linearization of a head does not sit well with contemporary syntactic theory. Some syntacticians follow Kayne (1994) in assuming that all XPs are actually left-headed, but even those who do not take this radical move generally assume that a category's head linearization in a given language is set in stone as either left or right. A typical approach to such variable word order would involve phrasal movement of the object, rather than variable linearization of the verb.

One approach would be to insist that Ewe is underlyingly verb-final, and that preverbal objects are *in situ* while postverbal objects have extraposed to adjoin to VP:

(80) *Alternative syntax for Ewe (to be rejected)*



This is precisely the syntactic analysis given by Hale and Selkirk (1987) for Tohono O'odham (then called Papago), a Uto-Aztecan language spoken in what is now Arizona, for essentially phonological reasons. In this language too, the verb phrases with XPs to its left, but not to its right.

If correct, the syntactic structures in (80) would work well with Match Theory, Align/Wrap Theory, and Command Theory. However, Collins (1993) argues that the VP is indeed head-initial, and that preverbal objects have moved to Spec,Agr$_{\text{O}}$P, directly above VP (a position which Chomsky (1995b), for languages in general, equates with Spec,*v*P). As it turns out, the distribution of preverbal objects is far too restricted to represent the default position. According to Collins (1993, p. 41), preverbal objects occur only in progressive constructions, and only the direct object can occupy this position.

More telling still, Collins (1993) claims that object-fronting in Stardard Ewe is accompanied by a syllabic /m/ morpheme which bears high tone. If the *m* at the beginning of *m'ātyíkẽ́* 'medicine' is this morpheme, then it is worth asking whether its high tone could be giving the appearence of tone sandhi where none has actually occurred.

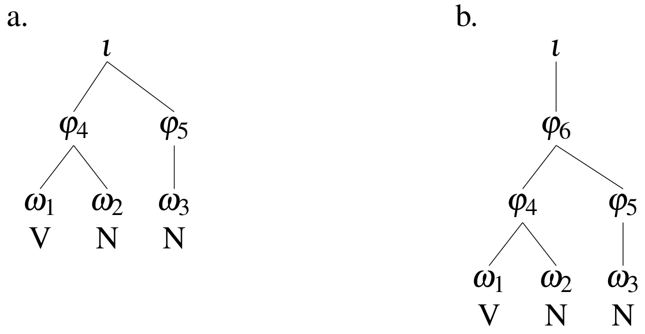
With all of these complications in mind, I take the Ewe ditransitive phrasing with a grain of salt. It does not fit well in any of the indirect reference theories discussed here. In the discussion below, I will continue referring to (V) (N) (N) as the ‘Ewe pattern’, and will point out when this phrasing is found in a factorial typology. However, more research is needed before these issues can be worked out. An interesting theory of the syntax–prosody interface should not be abandoned due to Ewe before we are more sure of its actual syntax and prosody.

The other phrasings attested in the literature are more convincing. The following section discusses the many languages in which the verb phrases with the first object, but the second object phrases apart.

3.2.2 The (V N) (N) Pattern

Catalan, Chaga, Chimwiini, English, Makkan Arabic, Northern Kikuyu, and Swedish are all language in which 3ω ditranstives contain two phonological phrases. (In English and Swedish, the non-pro-drop languages of the group, the 3ω case is one in which the subject is a pronominal proclitic.) Throughout this work, I refer to these as “Chimwiini-type” languages. Unlike the (V) (N) (N) phrasings found in Ewe (with complications), these are instances of a *strong* mismatch in ditransitive phrasing, where descending syntactic structure maps onto ascending (and thereby contradictory) prosodic structure. The full prosodic structure exhibited by these languages is either that in (81a) or in (81b).

(81) *Ditransitive phrasing in Chimwiini-type languages*



For all of these languages, more research is needed to determine which structure is correct, since the phonetic differences between the two may be quite subtle (e.g. involving declination and pitch reset rather than an immediately discernible categorical cue). Thus, in the OT sections below, I consider both (81a) and (81b) to be "Chimwiini-compliant", despite lack of conclusive evidence.

Prieto (2005) reports that Catalan displays this phrasing. The right edge of φ in this language is marked by phrasal stress and an optional continuation rise in F0.

(82) *Catalan ditransitive phrasing* (Prieto 2005)

a. ($_{\varphi}$ Comprava mapas) ($_{\varphi}$ per a l'Anna).
'I/(s)he used to by maps for Anna.'

b. ($_{\varphi}$ Va donar el llibre) ($_{\varphi}$ a la Maria).
'(S)he gave the book to Mary.'

c. ($_{\varphi}$ Va enviar petonets) ($_{\varphi}$ a l'Anna).
'(S)he sent kisses to Anna.'

d. ($_{\varphi}$ Va tirar en Joan) ($_{\varphi}$ dintre l'aigua).
'(S)he pushed Joan into the water.'

e. ($_{\varphi}$ Compra les películes) ($_{\varphi}$ a Londres).
'(S)he buys films in London.'

The same phrasing is found in Chaga (McHugh 1990a) where various tonal phenomena take the φ as their domain. The surface tonal pattern in (83b) is derived from that in (83a) by these rules.

(83) *Chaga* (McHugh 1990a; Selkirk 2000)

a. [$_{\text{VP}}$ $\underline{\text{á}}$muénenga$_{\text{V}}$ [$_{\text{NP}}$ prayáni] [$_{\text{NP}}$ mbúru]]

b. ($_{\varphi}$ amú̲enénga prayá̲ní̲) ($_{\varphi}$ mburû)
‘She has give Brian a goat.’

Goodman (1967), Kisseberth and Abasheikh (1974), Kenstowicz and Kisseberth (1977), Hayes (1989), Nespor and Vogel (1986) and Selkirk (1986) report on the distribution of vowel length in Chimwiini, a close relative of Swahili, making crucial reference to the phonological phrase. Nespor and Vogel (1986) sum up the prosodic account of Chimwiini as follows:

> ‘In Chimwiini, vowel length is generally contrastive, although there are specific environments in which it is predictable: *a*) word finally, where a vowel is predictably short if the end of the word coincides with the end of a phonological phrase, and long if it does not, *b*) before a heavy syllable within the same phonological phrase, where a vowel is short, and *c*) before a sequence of at least three syllables within the same φ, where a vowel is also predictably short.’ (Nespor & Vogel 1986:180)

Here, instead of a benefactive or applicative ditransitive, we examine another type of double-complementation structure which, by hypothesis, should be identical to other ditransitives as far as syntax–prosody mapping is concerned.

(84) *Chimwiini* (Goodman 1967; Kenstowicz and Kisseberth 1977)
($_{\varphi}$ pauzize cho:mbo) ($_{\varphi}$ mwa:mba)
he-ran vessel rock
‘He ran the vessel onto the rock.’

Here, the verb *pauzize* ‘he ran’ contains no long vowels, since it precedes the long vowel in *cho:mbo* ‘vessel’ within the same φ. The two objects, on the other hand, contain long vowels on the surface which are licensed by their words’ being φ-final. In the following ditransitive, we see that the nouns show accent while the verbs do not.

More recent evidence from Chimwiini comes from Kisseberth and Abasheikh (2011), who show that another *φ*-diagnostic comes from accent. While early work on Chimwiini paid attention only to vowel length, Kisseberth and Abasheikh (2011) find that only the final word of a *φ* can have its accent realized, and that the *φ*-boundaries identified from accent are exactly the same as those identified by vowel shortening and lack thereof.

(85) *Chimwiini* (Kisseberth and Abasheikh 2011)

N**ú**uru	mpeele	mwaal**í**mu	p**é**esa.
Nuuru	he.gave.him	teacher	money

‘Nuuru gave the teacher money.’

This is a particulary nice case for Prosodic Hierarchy theory, since it involves two distinct phonological phenomena that are sensitive to the same prosodic structure. (As is shown by *mwaalímu*, the relation between accent and length is indeed mediated by structure, and not simply the result of placing the accent on long vowels.)

Clauses with multiple *v*P-internal arguments are also mapped to the strongly mismatching prosodic structure in (81) in Northern Kikuyu. Gjersøe (2015) identifies tonal downstep (indicated by superscripted downward arrows) as an indicator of phrasing, and posits left-branching structure for the following example.

(86) *Northern Kikuyu* (Gjersøe 2015)

($_{\varphi}$ á-hɛ-ìr-ɛ́	mw-àɣáhìɲá)	($_{\varphi}$ $^{\downarrow}$ɲʒátá$^{\downarrow}$)
SM-give-PRF-FV	1-weakling	star

‘He gave the weakling a star.’

Here, the downstep on the second object is taken to indicate that this object phrases separately from the verb and first object. Meanwhile, a lack of downstep elsewhere indicates a lack of additional *φ*-boundaries.

The same structure is found in Makkan Arabic. Abu-Mansour (2011) posits the same left-branching prosodic structure for this language on the basis of *φ*-conditioned syncope. Phrasal syncope applies to the underlying /i/ in *kitaab* 'book' in (87) (as indicated by the angled brackets), but never to vowels in the first of two objects. This is accounted for if syncope applies φ-interally.

(87) *Makkan Arabic* (Abu-Mansour 2011)

($_\varphi$ ʔadeet walad-u) ($_\varphi$ k⟨i⟩taab)
gave-I son-his book

'I gave his son a book.'

Makkan Arabic therefore shares the mismatching prosodic structure exhibited by languages like Chimwiini, on Abu-Mansours's analysis.

The same phrasing pattern is found in English, as diagnosed by various factors. Hayes (1989) and Gussenhoven (2005) claim that the English Rhythm Rule (Bollinger 1965; Chomsky and Halle 1968; Liberman and Prince 1977) applies within the φ, but not across φ-boundaries. As is well known, the Rhythm Rule induces leftward stress shift to avoid a stress clash, as in the famous example *thìrteen mén* (cf. *thirtéen* in isolation). As Hayes points out, the rhythm rule applies only very awkwardly, if at all, between two objects in English. This is shown in (88a). And while they are not ditransitives, (88b–c) show that the same facts hold in similarly shaped non-ditransitives.

(88) *No Application of Rhythm Rule between Objects*
a. ??He conceded Tènnessee to Cárter.
b. ??He visited Mìssissippi twíce.
c. ??a book on Tènnessee by Kníght

That *Tennessee* can undergo the Rhythm Rule in the right prosodic environment is shown by (89), which minimally constrasts with (88c) in making *Tennessee by Night* a title or quotation rather than a sequence of two phrases.

(89) *Rhythm Rule Applies* (Hayes 1989)
a book on "Tènnessee by Níght"

The Rhythm Rule is not the only indication of the phrasing in (81) for English; phrase-final lengthening also plays a role. Elfner (2014) examines English double object constructions and reaches the same conclusion. Examining recordings of native speakers reading a set of English double object constructions, Elfner finds that there is lengthening before the second object (on the first object), but not before the first (on the verb). Furthermore, there is a rise in F0 on the verb and a fall in F0 at the right edge of each argument. And finally, Elfner reports that pauses were often inserted between the two objects, but not between the verb and the first object. She concludes that there is a stronger prosodic boundary between the two objects than between the first object and the verb. A natural interpretation of these findings is that English ditransitives have the structure in (81).

3.2.3 The ((V N) N) Pattern

The final phrasing to consider in this tour of three-word ditransitive phrasings is, like that in the previous subsection, a strong mismatch. In both Kimatuumbi (as Truckenbrodt 1995, 1999 interprets Odden's (1987) data) and Xitsonga (Selkirk 2011), the first object is phrased with the verb within a minimal φ, which in turn is sister to the second object within a maximal φ.

Odden (1987) discovered two phrase-level phenomena in Kimatuumbi, which he calls Shortening and Phrasal Tone Insertion.

(90) *Kimatuumbi Phrasal Rules* (Odden 1987)

a. *Shortening*
"Shorten long vowels in a stem, if the stem is the head of a [syntactic] phrase [XP]."

b. *Phrasal Tone Insertion (PTI)*
"[Place] an H tone on the last vowel of the last word of one phrase when the phrase is followed by another phrase, and both are dominated by an X'' phrase—in short, between phrasal daughters of a maximal projection."

Both processes are on display in (91):

(91) *Shortening and PTI in Kimatuumbi* (Odden 1987)

a. kikól**oo**mb**e**
cleaning.shell
'cleaning shell'

b. kikól**o**mb**e** chaángu
cleaning.shell my
'my cleaning shell'

c. Kikól**oo**mb**é** chaapúwaaniike.
shell broke
'The shell broke.'

d. Naampéi kikól**oo**mb**e** Mambóondo.
I.him.gave shell Mamboondo
'I gave Mamboondo the shell.'

In (91a), we see that *kikóloombe* in isolation has a long vowel in the penult and no high tone on the ultima. In (b), the vowel shortens due to the word's being non-XP-final, but still does not have a high tone on its final syllable. Odden does not consider postnominal *cháangu* 'my' to be an XP, since PTI is not seen here. In (c), where *kikóloombé* 'cleaning shell' is the subject, it retains its length and receives a final H via PTI. The crucial difference between (b) and (c) in terms of PTI is that in (c), the constituent following 'cleaning shell' is VP, i.e. an XP which induces PTI to its left. Finally, (d) shows that when 'cleaning shell' is the first object of a ditransitive, it does not undergo shortening or PTI.

Odden argues that the envirnonments for Shortening and PTI require direct reference to syntactic structure, not to prosodic structure. However, Cowper and Rice (1987) point out that Shortening seems to apply within the φ, as captured by the following rule.

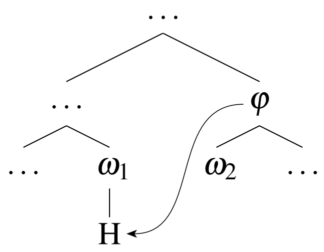
(92) *Shortening in Kimatuumbi as interpreted by Cowper and Rice (1987)*
$\mathrm{V}\!: \rightarrow \mathrm{V} \,/\, (_{\varphi} \ldots (_{\omega} \ldots \underline{\quad} \ldots)\ (_{\omega} \ldots) \ldots)$

But even with Cowper and Rice's (1987) prosodic interpretation of Kimatuumbi shortening, it is difficult to make prosodic sense of Phrasal Tone Insertion. It was not until

Truckenbrodt (1995, 1999) that PTI received a prosodic interpretation. The new interpretation was not possible until Strict Layering was abandoned.

Truckenbrodt (1995, 1999) reanalyzes PTI in Kimatuumbi as the insertion of H onto the word immediately preceding a phonological phrase. Thus, in a structure like (93), the φ imposes its H on ω_1, which precedes it, rather than on ω_2, its own first word.

(93) *Kimatuumbi Phrasal Tone Insertion* (Truckenbrodt 1995, 1999)



Truckenbrodt (1995, 1999) proposes that PTI, like in (93), is due to an alignment constraint aligning the phrase's left edge with the tone's right edge.

(94) ALIGN(φ,L,H,R) (Truckenbrodt 1995, 1999)
Align the left edge of each phonological phrase with the right edge of a high tone.

Armed with prosodic reinterpretations of Shortening and Phrasal Tone Insertion, Truckenbrodt (1995, 1999) proposes that ditransitives like (91d) have a recursive φ-structure:

(95) *Kimatuumbi* (Odden (1987); PHT-interpretation by Truckenbrodt (1995, 1999))
($_\varphi$ ($_\varphi$ naampéi kikóloombe) Mambóondo)
I.him.gave shell Mamboondo
'I gave Mamboondo the shell.'

Lack of shortening on the first object shows that it is φ-final, and the fact that it does not receive an H via PTI indicates that the second object is not a φ of its own. (This example is not ideal, in that the verb contains a long vowel and a final high tone, seemingly indicating that it is φ-final and that 'shell' is a φ as well. But the verb's final H seems to be lexically specified, and its long vowel is exempt from shortening due to morphological factors. Here we simply accept the claim that this is not revealing of φ-structure, though clearer examples would be desirable.)

Selkirk (2011), citing Kisseberth (1994) and Cassimjee and Kisseberth (1998), proposes the same recursive structure for Xitsonga ditransitives. In Xitsonga, penultimate lengthening occurs only ι-finally, so is not a diagnostic for φ-phrasing. Selkirk instead uses a process of High Tone Spread (HTS) to uncover φ-structure. According to Selkirk:

(96) *Xitsonga High Tone Spread*
'[A] lexical high tone spreads rightward from its underlying position, but it is (i) blocked from spreading onto the final, rightmost, syllable of a φ-domain and (ii) blocked from spreading across the left edge of a φ-domain.' (Selkirk 2011:443)

Evidence for the structure posited by Selkirk is provided by the data in (97). In (97a), we see that the root *xav* 'buy' and its suffixes are underlyingly tonelesss, as are *xi-phukuphuku* 'fool' and *foːle* 'tobacco'. Toneless *ndzi-* of (97a), the first person singular subject agreement prefix, has no high tone to spread rightward. In (97b), replacing *ndzi-* with high-toned *vá-*, the third plural subject agreement prefix, results in a cascade of uninterrupted HTS, stopping just short of the final [u] in the second word. We can therefore conclude that, according to Selkirk's formulation of HTS, the indirect object is φ-final.

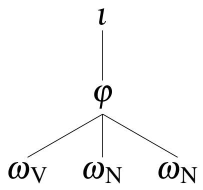
(97) *Xitsonga* (Kisseberth 1994, Cassimjee & Kisseberth 1998, Selkirk 2011)
a. ($_\varphi$ ($_\varphi$ ndzi-xav-el-a xi-phukuphuku) foːle)
1.SG.SUBJ-buy-APPL-FV CLASS7-fool tobacco
'I'm buying tobacco for a fool.'
b. ($_\varphi$ ($_\varphi$ vá-xávélá xí-phúkúphúku) folːe)
3.PL.SUBJ-buy-APPL-FV CLASS7-fool tobacco
'They're buying tobacco for a fool.'

If Truckenbrodt and Selkirk's reanalyses of the facts from Kimatuumbi and Xitsonga are on the right track, then the theory of syntax–prosody mapping should be able to map ditransitives onto the structure ($_\varphi$ ($_\varphi$ ω ω) ω). By contrast, the final pattern found in left-headed ditransitives, discussed in the following section, has considerably less structure.

3.2.4 The (V N N) Pattern

Phonological phrasing diagnostics from Chicheŵa, Chizigula, Kinyambo, Xhosa, and Zulu indicate the prosodic structure in (98), with all three words contained within a single phonological phrase, and no constituent grouping two words together to the exclusion of another.

(98) *Chicheŵa, Chizigula, Kinyambo, Xhosa, and Zulu phrasing*



As reported by Cheng and Downing (2007, 2016), Kanerva (1990), and many others, the right edge of a phonological phrase in Zulu and Chicheŵa is marked by lengthening of the penultimate vowel in the domain. In (99) and (100) below, we see that the penultimate vowel of the second object is lengthened, while the penultimate vowels in the verb and first object remain short.

(99) *Zulu* (Cheng and Downing 2007, 2016)
($_\varphi$ bá-níké ú-Síphó íí-m**aa**li)
2.SUBJ-give CL.1-Sipho CL.9-money
'They gave Sipho money.'

(100) *Chicheŵa* (Kanerva 1990)
($_\varphi$ tinapátsá mwaná $^{\mathrm{N}}$**jíí**$^{\mathrm{N}}$ga)
we-gave child bicycle
'We gave the child a bicycle.'

Jokweni (1995) reports the same phrasing for ditransitives in Xhosa, also indicated by penultimate vowel lengthening within φ (see also Zerbian 2004).

(101) *Xhosa* (Jokweni 1995)
($_{\varphi}$ ba-ník’ úmam’ úk**uu**tyá)
sc-give mother food
‘They give mother food.’

For Kinyambo, another Bantu language, Bickmore (1989, 1990) posits a rule of High Tone Deletion (HTD) which applies regressively within the phonological phrase, but does not cross phonological phrase boundaries. When a phonological phrase in Kinyambo ends with a word bearing a high tone, any high tones on the non-phrase-final words are deleted. The process does not, however, affect certain morphologically assigned high tones, making examples indicating phrasing somewhat opaque. In (102), the forms *nejákuh’* ‘he will give’ and *ómutah’* ‘friend’ have both undergone HTD, despite the presence of a morphologically required surface high tone in each. That HTD has in fact occurred is indicated by the fact that, when pronounced in isolation (i.e. trivially φ-finally), the forms are *nejákáha* and *omutáhi*, respectively. Apocope is presumably also prosody-sensitive, since it applies to each non-φ-final word here as well.

(102) *Kinyambo* (Bickmore 1989, 1990)
($_{\varphi}$ nejákuh’ ómutah’ ébitóoke)
he-will-give friend bananas
‘He will give the friend bananas.’

Finally, in Chizigula, a high tone on one word occurs on the rightmost word of its φ. When the first noun in a ditransitive has an underlying H, the H is realized on the next noun, indicating that these occupy the same φ.

(103) *Chizigula* (Kenstowicz and Kisseberth 1990; Selkirk 2000)
a. [$_{\text{VP}}$ nambikila [$_{\text{NP}}$ mvyele$^{\text{H}}$] [$_{\text{NP}}$ nyama]]

b. ($_{\varphi}$ nambilika mvyele nyáma)
'I am cooking the woman meat.'

Examples (99–103) show that all of these languages require a flat phrasing for ditransitives. I know of no phonetic or phonological evidence indicating a more articulated structure.

Finally, we examine the evidence for the reverse-Chimwiini ditransitive phrasing in right-headed languages.

3.2.5 The (N) (N V) Pattern

In Turkish, German, Korean, and North Kyungsang Korean, the verb and preceding noun occupy a φ, and the first noun is in a φ of its own. That is, these languages are like reverse-Chimwiini.

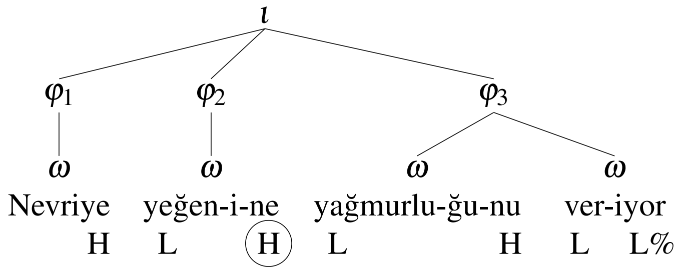
Güneş (2015) finds that in Turkish, a φ has a high tone on its final syllable. In the case of a final φ, the H can occur further to the left due to the right-alignment of L%. In the ditransitive below, 'nephew' surfaces with a final H, indicating that it is φ-final. This leads Güneş (2015) to posit the structure in (105) for the sentence in (104).

(104) *Turkish* (Güneş 2015)

Nevriye	yeğen-i-ne	yağmurlu-ğu-nu	ver-iyor.
Nevriye	nephew-POSS-DAT	raincoat-POSS-ACC	give-PROG

'Nevriye is giving her raincoat to her nephew.'

(105) *Phonological phrasing* (Güneş 2015)



For German, Büring takes phrasal stress to be a property of the φ, and makes use of a bracketed grid in which the "brackets" are boundaries of prosodic categories. In a right-headed German ditransitive (with broad focus), both objects receive a φ-level gridmark. Büring refers to the constituent "Accent Domain" (AD) between the intonational phrase and the prosodic word. Here, I identify this with the phonological phrase.

(106)

… dem	Kassierer	das	Geld	gegeben.
the.DAT	teller.DAT	the.ACC	money.ACC	given

'… given the teller the money.'

(107) *Prosodic categories as grid-bracketing (Büring 2000)*

```
(ι                    x          )
…  (φ       x  )  (φ  x          )
…  (ω       x  )  (ω  x  )  (ω x )
…  dem Kassierer  das Geld  gegeben
```

The strictly layered structure in (107) is perhaps too simplistic, since it is not an accident that a φ-level gridmark falls on *Geld* but not on *gegeben*. Cinque (1993) observes that in German, phrasal stress always falls on the object, and never on the verb, regardless of their order. He proposes an elegant analysis of this order-insensitivity by making the degree of phrasal stress on a word correspond to its depth of embedding (see also Liberman and Prince (1977)). Cinque's analysis involves direct reference to syntactic structure, but Féry (2011) proposes a similar analysis which correlates phrasal stress with depth of *prosodic* embedding.

(108) *German according to Féry (2011)*

a.

[Maria$_{\text{Top}}$	hat	einem	Kind	ein	Buch	gegeben.]$_{\text{F}}$
Maria	has	a.DAT	child.DAT	a.ACC	book.ACC	given

'Maria gave a book to a child.'

b. *Weakly layered bracketed grid*

```
(ι      )  (ι                       x          )
(φ   x  )       (φ      x  )  (φ    x )
   Maria    hat   einem Kind   ein Buch   gegeben
```

Féry's (2011) proposal posits weak layering, and attributes the verb's lack of stress to its not being parsed into a φ—unlike its objects, which are φs of their own. Like Cinque's analysis, Féry's has the benefit of explaining why there is φ-stress on *Buch* but not on *gegeben*. However, I will not attempt to generate Féry's structure in the OT analysis below, and refer the reader to Féry (2011) for extensive discussion.

Cho (1990) posits the same structure for Korean that Büring does for German, on the basis of obstruent voicing. Voiceless obstruents in Korean become voiced when between two voiced segments in the same φ. If one trigger is in another φ, the structural description is not met.

(109) *φ-intetrnal Obstruent Voicing (Cho 1990)*
[−cont, −asp, −tense] → [+voice] / [+voice]__[+voice]

An example of Obstruent Voicing is given in (110). Here, /k/ becomes [g] in the dative clitic, since each vowel of that clitic is in its φ. The same is true of the /c/→[j] and /t/→[d] in the object and verb. The initial /k/ of the second object, though, does not undergo voicing, despite being intervocalic. This shows that the final vowel of *ai-ege* 'child-DAT' is not in the φ occuped by *kwajarɨl* 'candy-ACC', as indicated in (110b).

(110) *Korean (Cho 1990)*
a. UR: [$_{VP}$ [$_{NP}$ ai-e**k**e] [$_{NP}$ **k**wa**c**a-lɨl] cun**t**a]
b. SR: ($_{\varphi}$ ai-e**g**e) ($_{\varphi}$ **k**wa**j**arɨl **j**un**d**a)
child-DAT candy-ACC give

Kim (1997) reports that the same phrasing is found in North Kyungsung Korean, as indicated by the following phrasal tones:

(111) *Northern Kyungsung Korean* (Kim 1997)
a. H on leftmost ω of φ
b. no H on rightmost σ of φ

In (112), we see that each object has an H on a non-final syllable, indicating that each is at the left edge of a φ. The verb has no H, indicating that it is non-φ-initial.

(112) *North Kyungsung Korean (Kim 1997)*
a. acumə**ń**i-eke ki**ḿ**chi-ləl phal-at-ta
housewife-DAT kimchee-ACC sell-PAST-INDIC
'sold Kimchee to a housewife in the market.'

b. chəlsuˊeke kapa´**ŋ**-əl co-t-ta
Chulsoo-DAT bag-ACC give-PAST-INDIC
‘gave a bag to Chulsoo.’

The phrasal tones shown in (112) put Northern Kyungsung Korean in the growing camp occupied by its fellow right-headed languages German (in embedded CPs), Turkish, and Korean.

This concludes the empirical overview of ditransitive phrasing. The next section introduces Command Theory, and shows how it accounts for these phrasings.

3.3 Command Theory and Ditransitives

3.3.1 The Need for C-Command

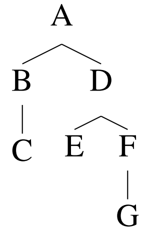
As we saw in Chapter 2, the basic idea of Command Theory is that when word *A* c-commands word *B*, the two should occupy the same phonological phrase, and that when neither word c-commands the other, the two should occupy separate phonological phrases.

Some notion of “command” plays a central role in virtually all syntactic theories (Langacker 1969; Jackendoff 1972; Lasnik 1976; Reinhart 1976; Chomsky 1986; Kayne 1994; Ernst 1994; Rizzi 1990; Chomsky 1995b; Pesetsky 1995; Epstein 1999; Bruening 2014). The command standardly assumed in current Minimalist syntax is that from Reinhart (1976), given in (113).

(113) *C-command* *(Reinhart 1976)*
Node *A* c-commands node *B* if neither *A* nor *B* dominates the other and the first branching node which dominates *A* dominates *B*.

Following this definition, in (114), A c-commands nothing; B and C both c-command D, E, F, G; D c-commands B, C; E c-commands F, G; and F and G c-command E. Other versions of command differ slightly, but usually have similar effects.

(114)



As discussed in Chapter 2, we do not assume unary branching to be an option available to the syntactic component. Rather, since syntactic objects are constructed by the binary operation Merge (Chomsky 1995b, et seq.), meaning that $[_{\mathrm{B}}$ C] in the tree above is an illicit structure. This raises the question of how to interpret “unary” phrases characterized as $[_{\mathrm{XP}}\ [_{\mathrm{X'}}\ \mathrm{X}^0]]$ within $\bar{\mathrm{X}}$-theory, now recast as simply $\mathrm{X}^{\mathrm{Max/Min}}$. We take most, if not all, lexical phrases to be embedded within functional projections, meaning that $\mathrm{X}^{\mathrm{Max/Min}}$ will (generally) not be a maximal extended projection, but part of a larger extended projection along the lines of $[_{x\mathrm{P}}\ x\ \mathrm{X}]]$, where *x* is silent or affixal (i.e. not a prosodic word, but a syllable or even a single segment). In such cases, *x*P c-commands elements previously thought to be c-commanded by X itself, and X c-commands nothing at all. This will be particularly relevant for the discussion of ditransitive phrasing below, assuming a universal DP layer above NP: $[_{\mathrm{DP}}$ D N].[3]

C-command, or a similar version of command, is relevant for virtually every aspect of syntactic theory: binding, control, movement, negative polarity, agreement, and most everything else. It is therefore unsurprising that phonologists have appealed to it as well. Appeals to c-command at the syntax–prosody interface are found in Kaisse (1985), Kim (1997), Sohn (2001), and McPherson (2014). Kaisse (1985) postulates that sandhi only occurs between two words if one word c-commands the other. Kim (1997) develops an OT theory of syntax–prosody mapping (but assuming Strict Layering), which is taken up by Sohn (2001). McPherson (2014) argues that replacive tone

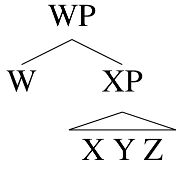
[3] I will continue to assume Bare Phrase Structure (Chomsky 1995a), but for readability will continue to occasionally use $\bar{\mathrm{X}}$-representations, as is standard practice. This means that representations like $[_{\mathrm{NP}}$ N] below should be interpreted as $\mathrm{N}^{\mathrm{Min/Max}}$, not as unary branching phrases.

in the Dogon languages affects pairs of words when one c-commands the other.

The theory that I develop here is inspired by previous theories using c-command, but differs in important ways which make it compatible with large amounts of φ-recursion. (This is shown in detail in the discussion of Kubozono's Mismatch in Chapter 2, as well as in the Command–Theoretic analysis of Kimatuumbi and Xitsonga in this chapter.)

In some ways, Command Theory makes predictions similar to those of Match Theory. But it differs in a crucial respect, by insisting that a head occupy the same φ as the words in its complement. For a structure like (115), a CT constraint responsible for grouping c-commanders and c-commandees (presented below) will only be satisfied if W is in a minimal φ with X, Y, and Z. In Match Theory, although WP should map to a φ including W, X, Y, Z, XP should also map to a φ, meaning that there will be a φ-boundary between W and X.

(115)



It has been noticed that W "wants" to occupy the same φ as the elements in XP. This is encoded in what I have referred to as Tokizaki's Generalization (Tokizaki 1999; Ackema and Neeleman 2003):

(116) *Tokizaki's Generalization (Tokizaki 1999, my wording)*
If a language has syntactic headedness $\delta \in \{\mathrm{R}, \mathrm{L}\}$, then it has XP-$\varphi$ alignment δ'.

In Match and Align approaches, *ad hoc* constraints have been grafted onto the theory in order to explain this overwhelming tendency. These include Büring's (2000) Accent-DomainFormation, Henderson's (2012) Complement-φ, and Clemens's (2014) Argument-φ:

(117) ACCENTDOMAINFORMATION (Büring 2000)

a. PRED
A predicate shares its AD [≈ φ –NK] with at least one of its arguments.

b. XP AD contains an XP. If XP and YP are within the same AD, one contains the other (where X and Y are lexical categories).

(118) COMPLEMENT-φ *(Henderson 2012)*
A functional head is parsed into the same phonological phrase as its syntactic complement.

(119) ARGUMENT-φ *(Clemens 2014, p. 130)*
A head and its internal argument(s) must be adjacent sub-constituents of a φ-phrase.

Each of these constraints mentions a derived grammatical relation (“argument of”, “complement of”, “internal argument of”). Pure Match Theory, Align/Wrap Theory, and Command Theory, by contrast, refer only to purely graph-theoretic notions, and avoid reference to such derived relations.

On Kim’s (1997) theory, the constraint relating to c-command is called C-COMMAND. It is supplemented with a constraint *{XP^2}, which refers to phrases and categories, but not to c-command.

(120) C-COMMAND (Kim 1997)
If α and β form a single P-phrase [φ], β must c-command α.

(121) *{XP^2}
Identical maximal projections cannot be organized into the same P-phrase [φ].

Kim’s C-COMMAND partially explains ditransitive mismatches, but is not sufficient to account for phonological recursion in languages like Kimatuumbi and Xitsonga—nor, as discussed in Chapter 2, in Japanese. In the following subsection, I present my version of Command Theory.

3.3.2 The Theory

The core notion in CT is not constituency, but the *c-pair* (or ‘command pair’):

(122) *C-pair (definition)*
An ordered pair of nodes (x,y) is a c-pair iff x c-commands y or y c-commands x.

It will also be useful to refer to *non-c-pairs* when neither of two words commands the other.

(123) *Non-c-pair (definition)*
An ordered pair of nodes (x,y) is a non-c-pair iff neither x nor y c-commands the other.

The phrasing of c-pairs and non-c-pairs is governed by three constraints: GROUPMAX, CC-φ, and ANTI-CC-φ. These are intended as replacements for MATCH, ALIGN, and WRAP. ANTI-CC-φ is almost equivalent to Kim's C-COMMAND (although ANTI-CC-φ violations are counted according to a more explicit definition than that given for the C-COMMAND constraint).

(124) *Command–Theoretic Constraints (complex versions)*[4]

a. GROUPMAX
Assign a violation for every c-pair that is not contained in at least one φ.

b. C-COMMAND-TO-φ (CC-φ)
For every c-pair (x,y), assign a violation for every φ that dominates x but not y, and for every φ that dominates y but not x.

c. ANTI-C-COMMAND-TO-φ (ANTI-CC-φ)
If ω_i and ω_{i+1} are mutually non-commanding, then assign a violation if there is no φ containing ω_i and excluding ω_{i+1}, and a violation if there is no φ containing ω_{i+1} and excluding ω_i.

GROUPMAX demands that if one word c-commands another (regardless of adjacency), there must be a φ that contains both words. CC-φ, by contrast, counts φs that separate

[4] These constraints differ from the simple versions given in Chapter 2, which (a) deal only with adjacent words, and (b) do not count the distance between nodes in the prosodic tree. Hence, they are no longer subscripted as “simple”.

members of a c-pair. Since the definition of CC-φ is more complicated, consider the tableau in (125).

(125) *Evaluation of CC-φ with asymmetric c-pair*

C-pairs: (X,Y)	CC-φ
a. (X Y)	0
b. (X (Y))	1
c. ((X) Y)	1
d. ((X) (Y))	2

If X asymetrically c-commands Y, then CC-φ is fully satisfied when X and Y are in the same minimal φ, as in (a). If either X or Y is in a φ that excludes the other word, like in (b) and (c), there is one violation, with the unary φ as its locus. And if both words in the c-pair are phrased separately, two violations of CC-φ are incurred.

To understand the definition of ANTI-CC-φ, consider the evaluation of these phrases when neither X nor Y c-commands the other:

(126) *Evaluation of* ANTI-*CC-φ with non-c-pair*

C-pairs: none	ANTI-CC-φ
a. (X Y)	2
b. (X (Y))	1
c. ((X) Y)	1
d. ((X) (Y))	0

In (d), ANTI-CC-φ is perfectly satisfied, since X is contained in a φ that excludes Y, and Y is contained in a φ that excludes X. If only one word is in a phrase without the other, a single violation is incurred, as in (b) and (c). And if the two words are in the same minimal φ, there is a violation for each of them.

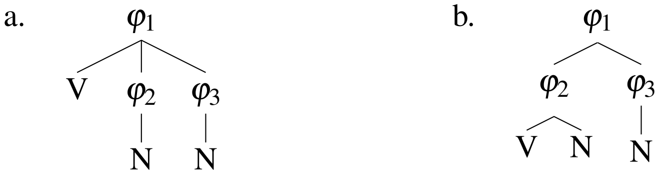
3.3.3 Basic Predictions

Without any markedness constraints to interact with, the three constraints in (124) predict two possible languages. The typology is the following:

(127) *FacTyp*$_{\text{Com-2}}$
L_1 (V (N) (N)) ANTI-CC-$\varphi \gg$ CC-φ
((V N) (N))
L_2 (V N N) CC-$\varphi \gg$ ANTI-CC-φ

In L_1, ANTI-CC-φ outranks CC-φ, and the following trees are co-optimal:

(128) *Co-optima when* ANTI-CC-$\varphi \gg$ CC-φ



These trees are co-optimal in $S_{\text{Com-2}}$ for two reasons. First, they satisfy ANTI-CC-φ, since the mutually non-c-commanding nouns are parsed into separate phrases: φ_2 and φ_3. While (128b) is attested in Chimwiini, (128a) is not attested. Low-ranked CC-φ on its own cannot decide between the two, since each incurs two violations. In the ternary-branching candidate, φ_2 separates the c-pair (V,N$_1$) and φ_3 separates the c-pair (V,N$_2$). The strictly binary candidate does no better on CC-φ, since φ_2 and φ_3 separate the c-pair (V,N$_3$). Since the Command–Theoretic constraints do not distinguish between these parses, markedness constraints will play a deciding role in the winnowing down of co-optima.

There are a number of additional candidates that satisfy ANTI-CC-φ, indicating that CC-φ cannot be inactive in the language with the co-optima in (128). The following tableau compares the co-optima in (128) with the other candidates that satisfy ANTI-CC-φ, showing how these are harmonically bounded due to GROUPMAX and CC-φ. The winning candidate from L_2 is also included on row (o).

(129) *Tableau for* L_1 *in* $S_{\text{Com-2}}$ (3/3 optima; 12/30 HBs)

[$_{VP}$ V [$_{VP}$ [$_{NP}$ N] [$_{NP}$ N]]]		Anti-CC-φ	GroupMax	CC-φ
a. →	(V (N) (N))	0	0	**
b. →	((V N) (N))	0	0	**
c. HB	((V (N)) (N))	e	e	***W
d. HB	(V ((N) (N)))	e	e	****W
e. HB	((V) (N) (N))	e	e	****W
f. HB	(((V) N) (N))	e	e	****W
g. HB	(((V) (N)) (N))	e	e	*****W
h. HB	((V) ((N) (N)))	e	e	******W
i. HB	(V N) (N)	e	*W	**e
j. HB	(V (N)) (N)	e	*W	***W
k. HB	((V) N) (N)	e	*W	****W
l. HB	((V) (N)) (N)	e	*W	*****W
m. HB	(V) (N) (N)	e	**W	****W
n. HB	(V) ((N) (N))	e	**W	******W
o.	(V N N)	**W	e	L

GroupMax bears on the phrasing of the c-pairs (V,N$_1$), (V,N$_2$). Since V and N$_2$ do not share a φ in candidates (i–n), these are ruled out by GroupMax. The remaining candidates, (a–h), satisfy GroupMax but are ruled out by CC-φ. Although the winning candidates violate CC-φ twice, candidates (a–h) violate it at least three times by introducing more φ-barriers between the verb and one or both of its arguments. So although Anti-CC-φ and CC-φ are in conflict, the ranking Anti-CC-φ $\gg$ CC-φ does not make CC-φ inactive.

The other language that arises from just the three constraints in (124) exhibits flat ditransitive phrasing, like in Zulu. This language has the ranking CC-φ $\gg$ Anti-CC-φ, as shown in the following tableau.[5]

(130) *Flattening Language L_2 with $S_{\text{Com-2}}$* (3/3 optima; 0/30 HBs)

[$_{vP}$ V [$_{VP}$ [$_{NP}$ N] [$_{NP}$ N]]]		GroupMax	CC-φ	Anti-CC-φ
a. →	(V N N)	0	0	**
b.	(V (N) (N))	e	**W	L
c.	((V N) (N))	e	**W	L

No other 3ω-ditransitive phrasings are predicted with Con restricted to GroupMax,

[5] The harmonic bounds shown in (129) are excluded from the tableau in (130) for convenience.

CC-φ, and ANTI-CC-φ. L_1 of this system is partially compatible with Chimwiini, but ruling out the undesired co-optimum would require the addition of a markedness constraint. L_2 is compatible with Zulu. There are no other languages in this system, since GROUPMAX does not conflict with CC-φ or ANTI-CC-φ.

Having seen the workings of the CT-constraints themselves, we now turn to their interactions with a single markedness constraint, BINMAX(φ,BRANCHES), abbreviated BINMAX$_{\text{B}}$. This constraint alone makes the typology start taking shape.

3.3.4 CT-Constraints and Maximal Binarity

We now formalize a system $S_{\text{Com-3}}$, based on $S_{\text{Com-2}}$. Adding BINMAX(φ,BRANCHES) to the constraint set in (124) yields the following set:

(131) CON$_{\text{Com-3}}$

a. GROUPMAX
Assign a violation for every c-pair that is not contained in at least one φ.

b. CC-φ
For every c-pair (x,y), assign a violation for every φ that dominates x but not y, and for every φ that dominates y but not x.

c. ANTI-CC-φ
If ω_i and ω_{i+1} are mutually non-commanding, then assign a violation if there is no φ containing ω_i and excluding ω_{i+1}, and a violation if there is no φ containing ω_{i+1} and excluding ω_i.

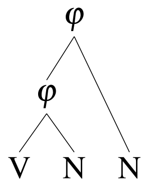
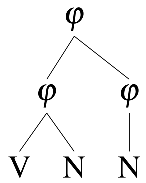
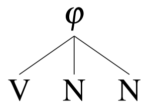
d. BINMAX(φ,BRANCHES) (categorical version)
Assign a violation for every φ that has more than two daughter nodes ('branches').

The constraint BINMAX(φ,BRANCHES) is only one of several reasonable binarity constraints defined and implemented in SPOT (Bellik et al. 2016). Details are found in Appendix A. The version adopted for $S_{\text{Com-3}}$ counts branches, rather than the number of terminal nodes, and is categorical.

The addition of BINMAX$_{\text{B}}$ gives rise to the three most widely attested phrasings, and no others. The phrasings represented are those of Kimatuumbi, Chimwiini, and

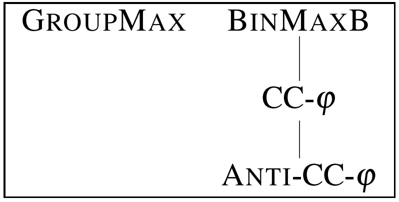
Zulu.

(132) *Command–Theoretic* $\mathit{FacTyp}_{\text{Com-3}}$

Lg.	*Ditransitive*	*Instantiation*
L1		Kimatuumbi
L2		Chimwiini
L3		Zulu

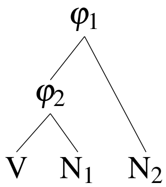
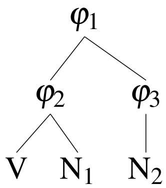
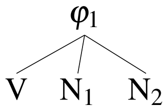
In this system, Kimatuumbi (L1) arises from ranking BinMax $\gg$ CC-φ $\gg$ Anti-CC-φ, as shown in the following Hasse diagram.

(133) *Hasse diagram for Kimatuumbi*



In Kimatuumbi, the optimal parse violates both Anti-CC-φ and CC-φ. Its Anti-CC-φ violation is due to there being no φ_3 to fully separate the two nouns. However, it still outperforms the purely flat phrasing on Anti-CC-φ, since φ_2 contains the first noun but not the second. It violates CC-φ once, since φ_2 separates the verb from the second noun, but avoids violating CC-φ a second time by adjoining the second noun to φ_2 rather than giving it a φ of its own.

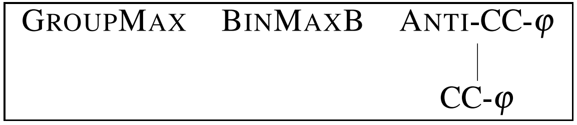
(134) *Kimatuumbi in* $S_{\text{Com-3}}$ (3/3 optima; 0/30 HBs)

[$_{vP}$ V [$_{VP}$ [$_{NP}$ N] [$_{NP}$ N]]]	GROUP$_M$	BINMAX$_B$	CC-φ	ANTI-CC-φ
a. → 	0	0	*	*
b. 	e	e	**W	L
c. 	e	*W	L	**W

Row (b) shows that CC-φ dominates ANTI-CC-φ. The optimal candidate outperforms (b) on CC-φ, since it has one less φ separating V from N_2. Since (a) and (b) are both binary-branching, they tie on BINMAX$_B$. But this constraint rules out (c), the ternary-branching Zulu parse.

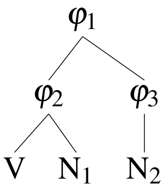
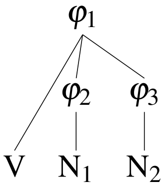
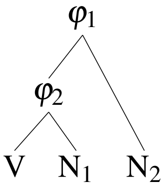
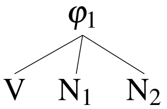
For Chimwiini, the presence of BINMAX$_B$ means that the desired ((V N) (N)) harmonically bounds the ternary-branching (V (N) (N)). BINMAX$_B$ is necessary, since the CT-constraints themselves cannot distinguish between these parses, but it is not crucially ranked. The Chimwiini ranking is shown in (135).

(135) *Hasse diagram for Chimwiini in $S_{\text{Com-3}}$*



A tableau showing this ranking for Chimwiini is given in (136).

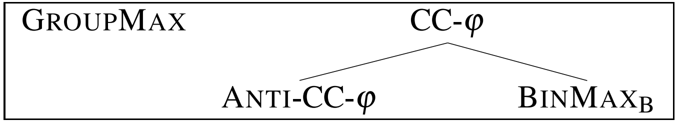
(136) *Tableau for Chimwiini in $S_{\text{Com-3}}$* (3/3 optima; 1/30 HBs)

[$_{v\mathrm{P}}$ V [$_{\mathrm{VP}}$ [$_{\mathrm{NP}}$ N] [$_{\mathrm{NP}}$ N]]]	GROUP$_{\mathrm{M}}$	ANTI-CC-φ	BINMAX$_{\mathrm{B}}$	CC-φ
a. → 	0	0	0	**
b. HB 	e	e	*W	**e
c. 	e	*W	e	*L
d. 	e	**W	*W	L

As in the markedness-free system $S_{\text{Com-2}}$, ANTI-CC-$\varphi \gg$ CC-φ rules out candidates (c) and (d), since in each, φ_1 contains both nouns. The winning candidate (a) fully satisfies ANTI-CC-φ, since φ_2 contains N_1 and not N_2, and φ_3 contains N_2 and not N_1. The Kimatuumbi phrasing (c) violates ANTI-CC-φ once; although φ_2 dominates N_1 and not N_2, there is no φ_3 shielding N_2. The Zulu phrasing (d) does even worse on ANTI-CC-φ, since neither noun is shielded from the other.

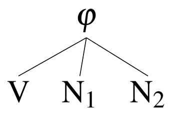
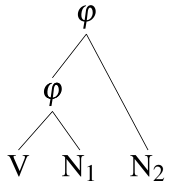
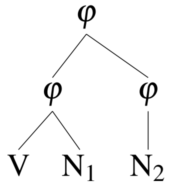
Finally, the ranking for Zulu is that in (137), where CC-φ dominates ANTI-CC-φ and BINMAX$_{\mathrm{B}}$.

(137) *Hasse diagram for Zulu in* $S_{\text{Com-3}}$



The Zulu phrasing (V N N) is the only parse that fully satisfies CC-φ; no binary-branching or noun-separating candidate makes the cut. This is shown in (138).

(138) *Tableau for Zulu in $S_{\text{Com-3}}$* (3/3 optima; 0/30 HBs)

[$_{vP}$ V [$_{\text{VP}}$ [$_{\text{NP}}$ N] [$_{\text{NP}}$ N]]]	Group$_{\text{M}}$	CC-φ	Anti-CC-φ	BinMax$_{\text{B}}$
a. → 	0	0	**	*
b. 	e	*W	*L	L
b. 	e	**W	L	L

To sum up, the four constraints GroupMax, CC-φ, Anti-CC-φ, and BinMax give rise to the ditransitive phrasings for Kimatuumbi, Chimwiini, and Zulu. The ranking for each language is given in (139).

(139) *Ranking Summary for $S_{\text{Com-3}}$ (*GroupMax *not crucially ranked)*

a.	*Kimatuumbi*	BinMax$_{\text{B}}$ $\gg$ CC-φ $\gg$ Anti-CC-φ
b.	*Chimwiini*	Anti-CC-φ $\gg$ CC-φ
c.	*Zulu*	CC-φ $\gg$ Anti-CC-φ, BinMax$_{\text{B}}$

Under none of these rankings do the two objects phrase together to the exclusion of the verb—exactly as desired, given the languages surveyed above. Any parse that does so incurs two gratuitous CC-φ violations by failing to group the verb with the words it c-commands. The same does not hold in Match Theory.

3.4 The Match–Theoretic Alternative

In Match Theory, the syntax–prosody mapping constraints are of the form Match(α, β), where α and β are constituents. The most commonly used Match constraints are those in (140) from Selkirk (2011).

(140) *Match Constraints* (Selkirk 2011; Elfner 2012)

a. MATCH(XP,φ)
Assign a violtion for every XP in the input that does not have a matching φ in the output.

b. MATCH(φ,XP) Assign a violation for every φ in the output that does not have a matching XP in the input.

Matching is defined as follows:

(141) *Definition of Matching*
A constituent α matches a constituent β if α and β have the same terminal string.

Without further elaboration, the theory is quite simple. However, there is a question as to which XPs are visible to the Match constraints. The standard theory does not consider every XP to be equal in the eyes of MATCH(XP,φ) and MATCH(φ,XP) (Selkirk 2011; Elfner 2012). One approach, taken by Elfner (2012), and adopted here, is what I refer to as the Yield Theory:

(142) *Visible XPs on Yield Theory* (cf. Elfner (2012))
An XP with terminal string T is visible to the MATCH constraints if it is the lowest XP with terminal string T.

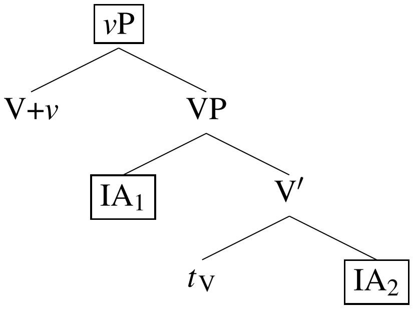
On this view, if X is silent in $[_{\text{XP}}$ X $[_{\text{YP}}$ Y]], whether due to movement or inherent silence, only YP is visible to Match; failing to build a φ ($_{\varphi}$ Y) results in just one violation of MATCH(XP,φ), not two. Under Yield Theory, no other distinctions between XPs are made.

Selkirk (2011), on the other hand, continues to assume Truckenbrodt's (1995, 1999) Lexical Category Condition (LCC), meaning that lexical but not functional XPs are visible to the Match constraints. The LCC is given in (143).

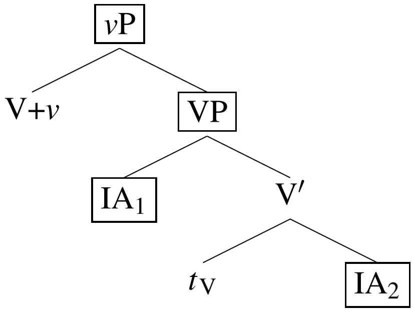
(143) *Lexical Category Condition* (Truckenbrodt 1999, p. 226)
Constraints relating syntactic and prosodic categories apply to lexical syntactic elements and their projections, but not to functional elements and their projections, or to empty syntactic elements *and their projections*. [Tacit assumption: A functional head F^0 becomes lexical if a lexical head L^0 head-adjoins to it. Cf. Baker's (1988) Goverment Transparency Corollary. –NK]

In ditransitive structures, the LCC recognizes *v*P, IA_1, and IA_2 as visible XPs. The Yield Theory recognizes VP as well, since [IA_1 IA_2] is an XP with a unique terminal string.

(144) *XP-Visibility with LCC*



(145) *XP-Visibility with Yield Theory*

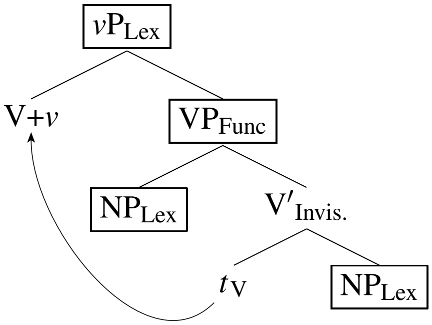


The challenge for the theory is to explain why ditransitives exhibit so many syntax–prosody mismatches, and never have a structure isomorphic with that in (145). One approach is that taken by Lee & Selkirk (2016 handout).

3.4.1 The Lexical–Functional Distinction

Lee & Selkirk (2016 handout) present an ingenious approach to the syntax–prosody mismatches observed in ditransitives. The theory has two components. The first is to address the "Big VP" Problem. Lee & Selkirk (2016) take the necessary step of distinguishing between this phrase, whose head has evacuated it, and a phrase containing an overt lexical head. The result is that *v*P is lexical and VP is functional, by virtue of V's movement to *v*:

(146)



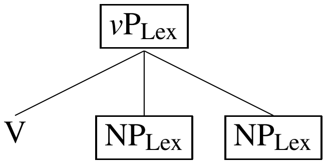
This move allows Lee & Selkirk to draw a distinction between LexPs and FuncPs. The former are those XPs which were visible under the Lexical Category Condition (Truckenbrodt 1995, 1999); the latter are all other XPs. Lee & Selkirk propose the following stringency hierarchy:

(147) *Stringency hierarchy* (Lee & Selkirk 2016)
a. Match(LexP,φ) $\subset$ Match(XP,φ)
special general

When the general constraint, Match-XP, is higher-ranked than the special Match-LexP, it demands perfect matching, even of VP. But when the special Match-LexP is high-ranked, and the general Match-XP is rendered inactive by markedness constraints, *v*P, NP$_1$, and NP$_2$ should map to φ, while VP should not.

Getting the Big VP out of the way is a necessary part of the analysis, but it is not sufficient, since as far as Match-LexP is concerned, the syntax is flat:

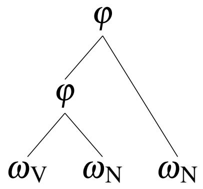
(148) *Syntax as seen by* Match-LexP



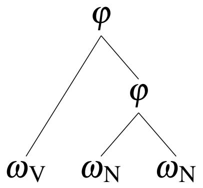
So while Match-LexP does not demand that the objects be phrased together, it does not demand that the verb phrase with the closest object, either. Phrasing the verb and closest object together still runs afoul of Match-φ, since [V NP] is not a syntactic constituent. This is where the constraint StrongStart comes in, following up on a suggestion from Selkirk (2011). The following phrasings of (148) tie on Match(LexP,φ), and worse still, the right-branching phrasing does better on Match-φ. But StrongStart favors the left-branching parse. The example is from Elfner (2012).

(149) StrongStart *vs.* Match(φ,XP) (Elfner 2012))

a. ✓ StrongStart
*Match(φ,XP)



b. ✓ Match(φ,XP)
*StrongStart



These are the basics of Lee & Selkirk's approach. Below, we examine the predictions of their system, formalized here as $S_{\text{Match-4}}$, and find that they are wholly successful in accounting for the four attested mappings repeated in (150).

(150) *Left-headed 3ω ditransitive phrasings*

a.	*Ewe*	(V) (N) (N)
b.	*Chimwiini*	(V N) (N)
c.	*Kimatuumbi*	((V N) N)
d.	*Zulu*	(V N N)

The seven constraints used in the system are given in (151).

(151) $\text{Con}_{\text{Match-4}}$

a. Match(LexP,φ)
Assign a violtion for every lexical XP in the input that does not have a matching φ in the output.

b. Match(XP,φ)
Assign a violtion for every XP in the input that does not have a matching φ in the output.

c. Match(φ,LexP)
Assign a violation for every φ in the output that does not have a matching lexical XP in the input.

d. BinMin(φ)
Assign a violation for every φ that is unary branching.

e. BinMax(φ,branches)
Assign a violation for every φ that has more than two branches.

f. StrongStart
Assign a violation for every φ whose initial daughter is ω and whose peninitial daughter is φ.

As always, the factorial typology was calculated using OTWorkplace (Prince et al. 2018), with the candidate sets and violation counts computed by SPOT (Bellik et al.

2016). This system's typology contains Ewe,[6] Kimatuumbi, Chimwiini, and Zulu, but also includes four unattested parses. Two of these, L2 and L3, phrase the two objects to the exclusion of the verb. (This is also true in L5, but since this language is broadly compatible with Ewe, it is not labelled 'unknown'.)

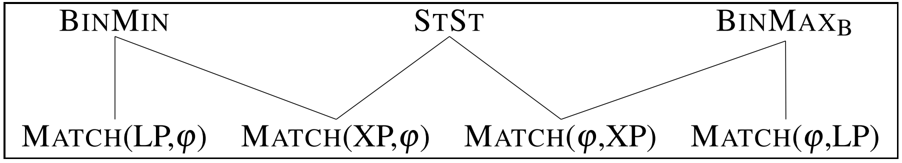
(152) *Match–Theoretic FacTyp*$_{\text{Match-4}}$

Lg.	*Ditransitive*	*Attestation*
L1	(V (N) (N))	Unknown
L2	(V ((N) (N)))	Unknown
L3	(V (N N))	Unknown
L4	((V) (N) (N))	Ewe
L5	((V) ((N) (N)))	Ewe???
L6	(V N (N))	Unknown
L7	((V N) N)	Kimatuumbi
L8	((V N) (N))	Chimwiini
L9	(V N N)	Zulu

Below, we give rankings and tableaux for the attested languages Kimatuumbi (L7), Chimwiini (L8), and Zulu (L9). (Given the syntactic complications with Ewe mentioned previously, we do not look at it in depth here.) It is also informative to see what rankings give rise to the various unattested phrasings. To this end, we will examine L3 and L6.

The ranking for Kimatuumbi in this system has two strata: a markedness stratum, and a mapping stratum. Each markedness constraint dominates two mapping constraints, and each mapping constraint is dominated by two markedness constraints.

(153) *Hasse diagram for Kimatuumbi (L7) in* $S_{\text{Match-4}}$



The ranking in (153) can be ascertained from the tableau in (154), which includes all

[6] $S_{\text{Match-4}}$ "contains Ewe" only in the sense that it predicts the ditransitive phrasing (V) (N) (N). Other aspects of Ewe phonological phrasing remain mysterious in Match Theory, Align/Wrap, and Command Theory, as discussed in §3.2.1.

nine optima, and excludes all twenty-four harmonic bounds.

(154) *Tableau for Kimatuumbi (L7) in $S_{\text{Match-4}}$* (9/9 optima; 0/24 HBs)

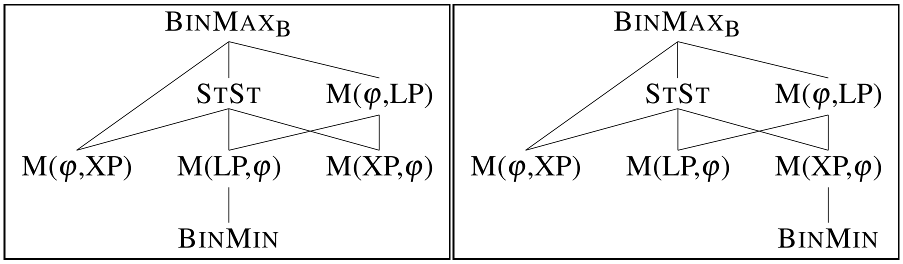
[V [[N] [N]]]		BMn	BMx$_B$	SSt	M-LP	M-XP	M(φ,LP)	M-φ
a. →	((V N) N)	0	0	0	^{2}	^{3}	*	*
b.	(V (N N))	e	e	*W	^{2}e	^{2}L	*e	L
c.	(V N N)	e	*W	e	^{2}e	^{2}*e	L	L
d.	((V N) (N))	*W	e	e	*L	^{2}L	*e	*e
e.	(V N (N))	*W	*W	e	*L	^{2}L	L	L
f.	(V ((N) (N)))	^{2}W	e	*W	L	L	*e	L
g.	(V (N) (N))	^{2}W	*W	*W	L	*L	L	L
h.	((V) ((N) (N)))	^{3}W	e	e	L	L	^{2}W	*e
i.	((V) (N) (N))	^{3}W	*W	e	L	*L	*e	*e

The entire grammar can in fact be read off of rows (a–d) alone. Rows (e–i), which contain more than one W-cell, give only a proper subset of the ranking conditions.

The sub-ranking [BinMin ≫ Match(LP,φ), Match(XP,φ)] is shown by row (d). Candidate (d), the Chimwiini parse, is favored by both Match(LP,φ) and Match-(XP,φ). Candidate (d) violates Match(LP,φ) by failing to match NP$_1$. The winning candidate fails to match not only NP$_1$, but also NP$_2$, thus faring even worse on Match-(LP,φ). The Kimatuumbi parse (a) is favored by BinMin, since it contains no unary φ. Row (c), the Zulu candidate with flat phrasing, shows [BinMax$_B$ ≫ Match-(φ,XP), Match(φ,LP)]. Row (b), the unattested (V (N N)), shows [StrongStart ≫ Match(XP,φ), Match(φ,XP)].

In Chimwiini, since the second noun is parsed into its own φ rather than adjoined, either Match(LP,φ) or Match(XP,φ) must dominate BinMin. In addition, BinMax$_B$ plays an important role in distinguishing binary-branching Chimwiini from ternary Ewe and Zulu. The two rankings that give rise to the Chimwiini phrasing are shown in (155).

(155) *Hasse diagrams for Chimwiini (L8) in $S_{\text{Match-4}}$*



The ranking conditions giving rise to (155) are shown in the following tableau:

(156) *Tableau for Chimwiini (L8) in* $S_{\text{Match-4}}$ (9/9 optima; 0/24 HBs)

[V [[N] [N]]]	BMx$_B$	SSt	M(φ,LP)	M-φ	M-LP	M-XP	BMn
a. → ((V N) (N))	0	0	*	*	*	**	*
b. ((V N) N)	e	e	*e	*e	**W	***W	L
c. ((V) ((N) (N)))	e	e	**W	*e	L	L	***W
d. (V ((N) (N)))	e	*W	*e	L	L	L	**W
e. (V (N N))	e	*W	*e	L	**W	**e	L
f. ((V) (N) (N))	*W	e	*e	*e	L	*L	***W
g. (V N (N))	*W	e	L	L	*e	**e	*e
h. (V N N)	*W	e	L	L	**W	***W	L
i. (V (N) (N))	*W	*W	L	L	L	*L	**W

In Chimwiini, the fact that the second noun occupies its own φ follows from an SP-match constraint's being ranked above BinMin; matching NP$_2$ is more important than avoiding a unary ($_\varphi$ ω). But these constraints cannot be allowed free reign, since Chimwiini fails to match lexical N$_1$ as well as the functional VP (made functional by head movement). The near-match (c) must be avoided. This is where Match(φ,LP) comes in. While every φ in (a) has an LP match in the syntax, (c) introduces φ_2=(V) and φ_3=((N) (N)). Since neither the verb word nor the pair of nouns make up lexical phrases, (c) is ruled out.

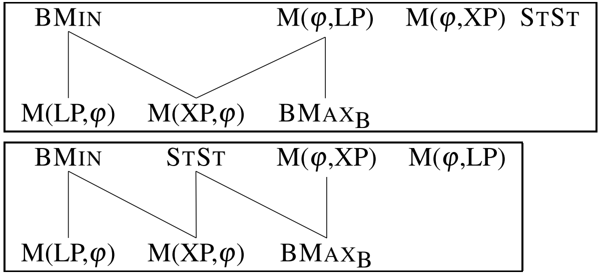
Turning to the perfectly matching candidate (d),[7] we see that StrongStart must outrank Match(φ,XP), Match(LP,φ), and Match(XP,φ). In Chimwiini, StrongStart is fully satisfied, since no φ has the structure ($_\varphi$ ω φ...). Under perfect matching, an StrongStart violation is forced, since V is sister to VP and does not form an XP on

[7] "Perfectly matching" here refers to a perfect match according to Match(XP,φ) and Match(φ,XP). The lexical versions of these constraints of course have a different idea of perfect matching.

its own. Finally, high-ranking BinMax$_{\text{B}}$ rules out the ternary-branching candidates, which outperform (a) on various Match constraints.

The typology also contains Zulu. The following two Hasse diagrams show the rankings that give rise to it.

(157) *Hasse diagrams for Zulu (L9) in* $S_{\text{Match-4}}$



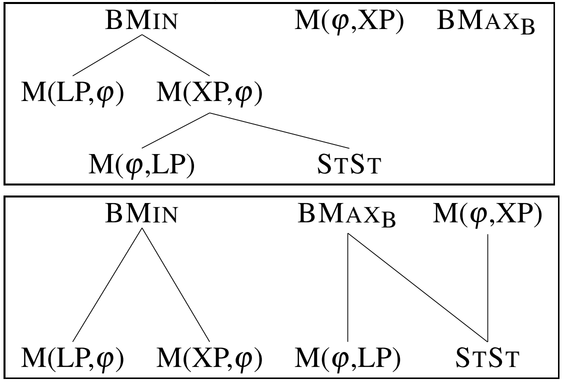
Although the two rankings are somewhat different, they have the following commonalities. In both, BinMin must dominate Match(LP,φ) and Match(XP,φ). One of the PS-match constraints must dominate BinMax$_{\text{B}}$. In addition, either StrongStart or Match(φ,LP) must dominate Match(XP,φ). To see why this is the case, consider (158).

(158) *Tableau for Zulu (L9) in* $S_{\text{Match-4}}$ (9/9 optima; 0/24 HBs)

[V [[N] [N]]]		M(φ,LP)	M-φ	BMn	SSt	M-LP	M-XP	BMax$_{\text{B}}$
a. →	(V N N)	0	0	0	0	**	***	*
b.	(V N (N))	e	e	*W	e	*L	**W	*e
c.	(V (N) (N))	e	e	**W	*W	L	*L	*e
d.	(V (N N))	*W	e	e	*W	**e	**L	L
e.	(V ((N) (N)))	*W	e	**W	*W	L	L	L
f.	((V N) N)	*W	*W	e	e	**e	***e	L
g.	((V N) (N))	*W	*W	*W	e	*L	**L	L
h.	((V) (N) (N))	*W	*W	***W	e	L	*L	*e
i.	((V) ((N) (N)))	**W	*W	***W	e	L	L	L

Having reviewed and clarified the MT analysis of Chimwiini, Kimatuumbi, and Zulu ditransitive phrasings, we turn to the unattested languages predicted by the system. In some languages of the typology, like L_3, the two nouns phrase apart from the verb as a unit, unlike in any known natural language. The grammar that gives rise to L_3 is shown in (159–160).

(159) *Hasse diagrams for Unattested L_3 in $S_{\text{Match-4}}$*

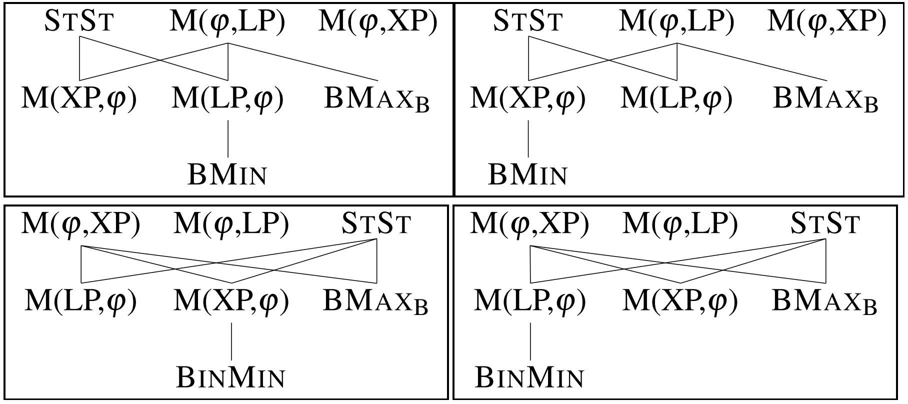


(160) *Tableau for Unattested L_3 in $S_{\text{Match-4}}$* (9/9 optima; 0/24 HBs)

[V [[N] [N]]]	M-φ	BMIN	BMAX$_B$	M-LP	M-XP	M(φ,LP)	SST
a. → (V (N N))	0	0	0	**	**	*	*
b. (V N N)	e	e	*W	**e	***W	L	L
c. (V (N) (N))	e	**W	*W	L	*L	L	*e
d. (V ((N) (N)))	e	**W	e	L	L	*e	*e
e. (V N (N))	e	*W	*W	*L	**e	L	L
f. ((V) (N) (N))	*W	***W	*W	L	*L	*e	L
g. ((V) ((N) (N)))	*W	***W	e	L	L	**W	L
h. ((V N) N)	*W	e	e	**e	***W	*e	L
i. ((V N) (N))	*W	*W	e	*L	**e	*e	L

An additional unattested language, L$_6$, is an unintended consequence of STRONGSTART, since STRONGSTART is violated by $(_\varphi\ \omega\ \varphi)$ but not by the ternary branching $(_\varphi\ \omega\ \omega\ \varphi)$. In L$_6$, only the second noun gets a φ of its own; the verb and first noun are its ω-sisters within the maximal φ.

(161) *Hasse diagrams for Unattested L_6 in $S_{\text{Match-4}}$*



(162) *Tableau for Unattested L_6 in $S_{\text{Match-4}}$* (9/9 optima; 0/24 HBs)

[V [[N] [N]]]		M(φ,LP)	M-φ	SST	M-LP	M-XP	BMX$_B$	BMN
a. →	(V N (N))	0	0	0	*	**	*	*
b.	(V N N)	e	e	e	**W	***W	*e	L
c.	(V (N) (N))	e	e	*W	L	*L	*e	**W
d.	(V ((N) (N)))	*W	e	*W	L	L	L	**W
e.	(V (N N))	*W	e	*W	**W	**e	L	L
f.	((V) (N) (N))	*W	*W	e	L	*L	*e	***W
g.	((V) ((N) (N)))	**W	*W	e	L	L	L	***W
h.	((V N) N)	*W	*W	e	**W	***W	L	L
i.	((V N) (N))	*W	*W	e	*e	**e	L	*e

That the unattested phrasing (V N_1 (N_2)) wins in this language (L_6 in $S_{\text{Match-4}}$) is shown by the tableau above. That (V N_1 (N_2)) beats the flat (V N_1 N_2) shows that either MATCH(LP,φ), MATCH(XP,φ), or both dominate BINMIN. The two SP-mapping constraints favor giving NP_2 its own φ, while the minimal binarity constraint BINMIN disfavors building the unary phrase (N_2).

An even better parse in terms of SP-mapping is candidate (c): (V (N_1) (N_2)). This has the structure $(_\varphi\ \underline{\omega\ \varphi}\ \varphi)$, the underlined portion of which induces a violation of STRONGSTART. The sequence $\omega\varphi$ is a transition from a lower level of the prosodic hierarchy to a higher one. This in itself does not violate STRONGSTART, but the sequence at the beginning of its containing φ renders that φ a "weak start". The same is not true of the winning output (V N_1 (N_2)) with its structure $(_\varphi\ \omega\ \omega\ \varphi)$. Here, the low-to-high category transition does not occur between the two leftmost nodes of the containing φ, meaning that STRONGSTART is satisfied. Rows (a–c) show that STRONGSTART dominates MATCH(LP,φ), MATCH(XP,φ), and BINMIN.

Candidates (d–i) are ruled out by the PS-mapping constraints MATCH(φ,LP) and MATCH(φ,XP). Building a φ containing just V or V N_1 induces a violation of both SP-mapping constraints. Building a φ containing N_1 and N_2 induces a violation of MATCH(LP,φ), since $[_{VP}\ [_{NP}\ N_1]\ [_{NP}\ N_2]]$ is not a lexical XP, having lost its head via V-to-*v* movement.

Command Theory does not make this prediction. (V N (N)) is not motivated by the command constraints, and STRONGSTART is unnecessary in (but not incompatible with) CT.

3.5 Conclusion

In conclusion, Command Theory predicts only attested phrasings of ditransitives, and offers a principled explanation of the ditransitive mismatch seen in language after language. Match Theory, by contrast, predicts a number of unattested languages. In addition, CT does not require any reference to the distinction between lexical and functional categories, while MT needs the constraint MATCH(LexP,φ) in addition to the general MATCH(XP,φ).

Command Theory has the additional advantage of providing an explanation for Tokizaki's Generalization that syntactically δ-headed languages generally exhibit anti-δ-alignment of XP and φ boundaries, discusesd in Chapter 2.

In the next chapter, we will see how MT and CT handle phonological phrasing in Japanese, contrasting Ito and Mester's (2013) MT analysis with one using CC-φ.

Chapter 4

Kubozono's Mismatch

4.1 Introduction

In this chapter I address the problem of prosodic rebracketing discovered by Kubozono (1989), illustrated by the following triplet of abstract syntax–phonology mappings:[1]

(163) *Kubozono's Mismatch*

a. [[a] b] → (a b)
b. [[[a] b] c] → ((a b) c)
c. [[[[a] b] c] d] → ((a b) (c d))

Below, I will refer to the set of facts in (163), particularly (163c), as *Kubozono's Mismatch*, or KM.

In (163), the terminals *a*, *b*, and *c* are unaccented syntactic/prosodic words in Tokyo Japanese (henceforth "Japanese"), with syntactic and prosodic structures as proposed by Ito and Mester (2013, 2017). The same mappings are observed in North Kyungsang Korean, as well (Kim 1997; Sohn 2001) It is crucial that these words are unaccented, as word-level accent has a major effect on phonological phrasing in Japanese. These facts have been experimentally confirmed by Shinya et al. (2004), though these authors posit the flat prosodic structure (abc) for (163b). The distinction is phonetically under-

[1] As always in this dissertation, unlabelled square brackets [...] demarcate a syntactic constituent $XP \neq CP_{IF}$—that is, an XP that is not a CP with illocutionary force—and unlabelled parentheses (...) demarcate a phonological phrase φ. Each syntactic tree has a root node CP, and each prosodic tree has a root node ι. Brackets for CP and ι are not shown.

determined, so I take $((ab)c)$ and (abc) to both be compatible with Tokyo Japanese in the pages below.

The rebracketing in (163) has been investigated Match–Theoretically by Ishihara (2014), who identifies a candidate comparison which presents a surprising (but surmountable) challenge for the theory. The comparison in question, which Ishihara dubs the *Recursivity Problem*, is shown in (164).

(164) *The Recursivity Problem (Ishihara 2014)*
$[[[[a]b]c]d] \quad \rightarrow \quad ((ab)(cd)), \quad *(ab)(cd)$

While $((ab)(cd))$ is the correct output for Japanese, careful attention is needed to ensure that it beats $(ab)(cd)$. Many OT typologies using a handful of oft-invoked constraints are surprisingly unable to handle this problem. To deal with the problem, Ishihara proposes a new constraint MATCH-MAX, which favors $((ab)(cd))$ over $(ab)(cd)$ because it demands that the highest lexical XP, in this case $[abcd]$, be mapped to a highest φ.

Ishihara's (2014) proposed constraint is attractive in that it favors the correct output in (164). It also has the conceptual advantage of not introducing any new constraint types, instead adding a constraint to the MATCH family. And Ito and Mester (2013, 2017) use it in their analysis of a larger set of facts concerning phrasing and accentuation. However, another problem arises without further modification to the theory: the *Squishing Problem*.

(165) *The Squishing Problem*
$[[[[a]b]c]d] \quad \rightarrow \quad ((ab)(cd)), \quad *((ab)cd)$

Ito and Mester (2017) solve the Squishing Problem (though they do not call it this) by distinguishing two types of maximal binarity constraints: those that refer to terminal nodes, and those that refer to branches. Bellik & Kalivoda (in prep.) refer to these as *leaf-binarity* and *branch-binarity*, respectively. In the case at hand, the relevant constraints are BinMax(φ,ω) and BinMax(φ,branches), which are implemented in SPOT (Bellik et al. 2016). Details are found in Appendix A.

Although appealing to the leaf-branch distinction is one promising solution, many combinations of common constraints do the same. In this chapter, I examine the effects of the following constraints in various grammars:

(166) *Match–Theoretic constraint menu*
  a. *Match constraints*
    i. Match(XP,φ) (sp)
    ii. Match(φ,XP) (ps)
    iii. Match(XP$_{\text{Max}}$,φ_{Max}) (xm)
  b. *Markedness constraints*
    i. BinMin(φ)[2] (p2)
    ii. BinMax(φ,b) (pb)
    iii. BinMax(φ, ω) (pw)
    iv. EqualSisters (es)
    v. NonRecursivity (nr)

A surprising finding is that the three constraints Match(XP), BinMin-φ, and EqualSisters can work together to yield exactly the pattern in (163). In fact, we demonstrate that the following is true:

(167) *Minimal Match–Theoretic System (informally)*
Drawing from the Match–Theoretic constraints in (166), the smallest solution to Kubozono's Mismatch uses Con={Match(XP,φ), BinMin(φ), EqualSisters}.

We also examine systems drawing from the following menu of constraints from the Edge-Based Approach (Truckenbrodt 1995, 1999). (Align-L is not included, since it is not violated by any candidate.)

[2] There are in fact two constraints which demand φ-binarity in SPOT: BinMin(φ,branches) and BinMin(φ,ω). Here, only ω and φ can be daughter to φ, so the two constraints behave identically. They assign differing values only when φ contains one ω and one node of some lower category. For example, $(_{\varphi}\ \sigma\ \omega)$ satisfies BinMin(φ,b), but incurs one violation of BinMin(φ, ω). Since the distinction is irrelevant here, I simply drop the second argument of the constraint.

(168) *Align/Wrap–Theoretic constraint menu*

a. *Align/Wrap constraints*

i. ALIGN(XP,R,φ,R) (AR)

ii. WRAP(XP,φ) (WR)

b. *Markedness constraints*
Same as in (166b).

While XP-φ alignment constraints at the SP-interface have received much justified criticism (Selkirk 2011; Elfner 2012; Ishihara 2014), a further finding partially exonerates Align/Wrap Theory at least when it comes to its ability to handle Kubozono's Mismatch. We demonstrate that a simple system involving ALIGN(XP,R,φ,R), WRAP(XP), BINMIN, and EQUALSISTERS is just as descriptively adequate as the smallest Match–Theoretic system—though unsurprisingly, their factorial typologies are non-identical.

The chapter is structured as follows. §4.2 provides an overview of the data from Tokyo Japanese behind Kubozono's Mismatch, and dismisses the plausibility of a direct-reference account, with or without phases. §4.3 reviews previous OT approaches, especially that of Ishihara (2014). Here, it is shown that Ishihara solves the Recursivity Problem but not the Squishing Problem. The following two sections discuss solutions to Kubozono's Mismatch which avoid the Recursivity and Squishing problems. The solution in §4.4, called $S_{\text{Match-8}}$, involves three constraints: MATCH-XP, EQUALSISTERS, and BINMIN, while the solution in §4.5, $S_{\text{Align-9}}$, shows that MATCH-XP can be replaced by a combination of ALIGN-R and WRAP with the same markedness constraints.

4.2 Phrasing in Japanese

Kubozono (1989) discovered that phrases like (169–170) have indistinguishable intonational properties in Japanese, despite differing in syntactic structure.

(169) *All accented left-branching*

Máriko-ga	nónda	wáin-no	niói
Mariko-NOM	drank	wine-GEN	smell

‘the smell of wine which Mariko drank’

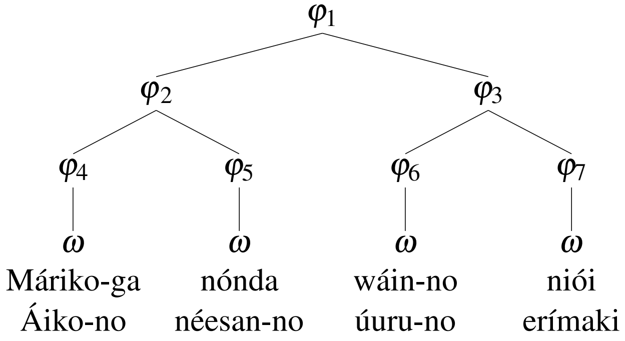
(170) *All accented balanced branching*

Áiko-no	néesan-no	úuru-no	erímaki
Aiko-GEN	sister-GEN	wool-GEN	muffler

‘Aiko’s sister’s woollen muffler’

Rather than drifting uniformly downward, the F_0 contour for (169–170) receives a “metrical boost” on the third word (*wáin-no* and *úuru-no*, respectively). For Kubozono (1989), a metrical boost of this sort indicates the left edge of a non-minimal minor phrase.

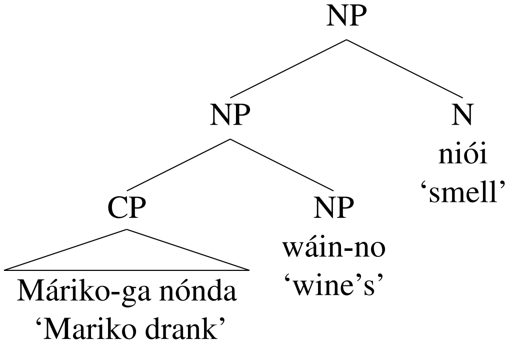
(171) *Prosodic representation of (169–170) (Kubozono 1989)*



Phrasing (170) as in (171) is exactly what is expected on a direct-reference or pure matching account of the syntax–phonology mapping. Both φ_2 and φ_3 correspond to syntactic constituents: the possessor phrase *Áiko-no néesan-no* ‘Aiko’s sister’ and possessum phrase *úuru-no erímaki* ‘woollen muffler’, respectively. Thus, at least for the possessor/φ_2 and possessum/φ_3, MATCH(XP,φ) and MATCH(φ,XP) are perfectly respected.

The fact that (169) also maps to the prosodic structure in (171) is more surprising from a matching or direct reference perspective. Here, while the relative clause which maps to φ_2 is indeed a syntactic constituent, the remaining two words are not:

(172)



The mapping fom (172) to (171) therefore constitutes a syntax–prosody mismatch. The phrase φ_3 does not correspond to any syntactic constituent in (172). This leads Kubozono (1989) to posit a rule of metrical restructuring which takes a prosodic structure matching the syntactic structure in (172), and alters it to take on the structure of (171).

In (169–172), every word is accented, as indicated by the acute accents. As is well known, a word of Tokyo Japanese is either lexically specified for accent on a particular mora, or lexically specified to lack accent. An accented word in Japanese is always the unique head of a phonological phrase, regardless of its syntactic position (Ito and Mester 2013, 2017). A consequence of this fact is that a string consisting exclusively of accented words will be parsed such that each word projects its own phonological phrase. This is the source of φ_4, φ_5, φ_6, and φ_7 in (171) above. If, e.g., *Máriko-ga nónda* were contained directly in φ_2, one of these two accented words would be a non-φ-head.

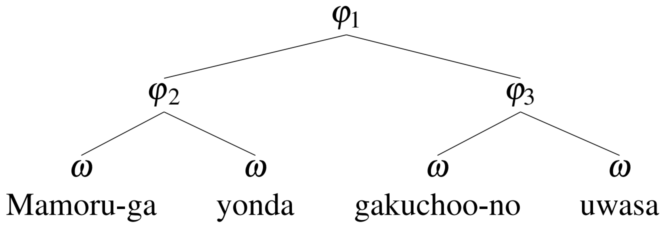
Rebracketing occurs not only when each word is accented, but regardless of the accented or unaccented status of each individual word. In (173), the NP has the same syntactic structure as (169)—i.e., the structure shown in (172)—and maps onto the prosodic representation in (174). The only difference is that here, each word is unaccented, and so no ω projects its own unary φ.

(173) *All unaccented left-branching* *(accentless counterpart to (169))*

Mamoru-ga	yonda	gakuchoo-no	uwasa
Mamoru-NOM	invited	college.president-GEN	rumor

‘the rumor of the college president that Mamoru invited’

(174) *Prosodic representation of (173) (Ito and Mester 2013, 2017)*



Just as in the accented example, this mapping yields a mismatch; φ_3 does not correspond to a syntactic constituent. For simplicity, this chapter will deal only with unaccented cases like (173–174). The same structures with various combinations of accented and unaccented words are dealt with in the following chapter. Temporarily abstracting away from the role of accent facilitates an understanding of the mechanisms responsible for the mismatch itself, which does not depend on accent, though as we shall see, it ultimately interacts with accent in interesting ways.

4.2.1 Prospects for direct reference

Although Kubozono’s metrical restructuring results in a mismatch, the case at hand is not a knockdown argument against theories of direct reference. As Pak (2008) and Samuels (2009) point out, cyclic or phasal phonology from the bottom up predicts that certain non-constituents will behave as constituents if they form a constituent with a phase that has already been spelled out. Thus, if CP is spelled out and no longer accessible to phonology when *wain-no nioi* is reached, the remaining string is a constituent minus a phase—in effect, a derived constituent that contains an impenetrable spelled out CP.

But a phase-based account runs into trouble when we consider other constructions that display the same sort of metrical restructuring. While the example from Kubozono (1989) involves a relative clause (a phase) mapping to a φ, a four-word phrase of the same syntactic shape but lacking a relative clause behaves the same way; Shinya et al. (2004) demonstrate that a noun phrase $[_{\mathrm{NP}_4}\ [_{\mathrm{NP}_3}\ [_{\mathrm{NP}_2}\ [_{\mathrm{NP}_1}\ \mathrm{N}_1]\ \mathrm{N}_2]\ \mathrm{N}_3]\ \mathrm{N}_4]$ undergoes restructuring as well, yielding $(_{\varphi}\ \mathrm{N}_1\ \mathrm{N}_2)\ (_{\varphi}\ \mathrm{N}_3\ \mathrm{N}_4)$ with a metrical boost on N_3. This demonstrates that the category or phasal status of the relative clause in Kubozono's example is not the cause of the metrical restructuring; unlike *Mariko-ga nonda* 'Mariko drank', there is no reason to think that NP_2 is a phase, or otherwise a syntactically priviledged constituent. In fact, since every phrase in $[_{\mathrm{NP}_4}\ [_{\mathrm{NP}_3}\ [_{\mathrm{NP}_2}\ [_{\mathrm{NP}_1}\ \mathrm{N}_1]\ \mathrm{N}_2]\ \mathrm{N}_3]\ \mathrm{N}_4]$ has the same category, it follows that either all or none of these are phases, making it impossible to say that NP_2 is "subtractable" from NP_4, with the result that the non-constituent $\mathrm{N}_3\ \mathrm{N}_4$ should behave as an honorary constituent.

In the discussion below, we do not consider the possibility of a direct reference account any further, instead assuming that the mapping from (169) to (171) constitutes a true mismatch. We assume that mismatches arise due to the interplay of syntax–prosody mapping constraints and pure markedness constraints. Thus, the question is which constraints and rankings could be responsible for this unfaithful mapping.

4.3 Previous OT approaches

Selkirk (2011) suggests that Kubozono's Mismatch is the result of a constraint MaxBin dominating Match-XP. The constraint MaxBin is a binarity constraint demanding that a φ dominate no more than two ωs. Crucially, the constraint does not refer to *immediately* dominated ωs, but to ωs at any depth within φ. In SPOT, the constraint is referred to as BinMax(words) to distinguish it from BinMax(branches), a member of the maximal binarity family which examines only the local parent-child relation between φ and ω. In fact, SPOT makes a further distinction between categorical and gradient versions of BinMax. Here, the version of binarity being invoked will always be made explicit.

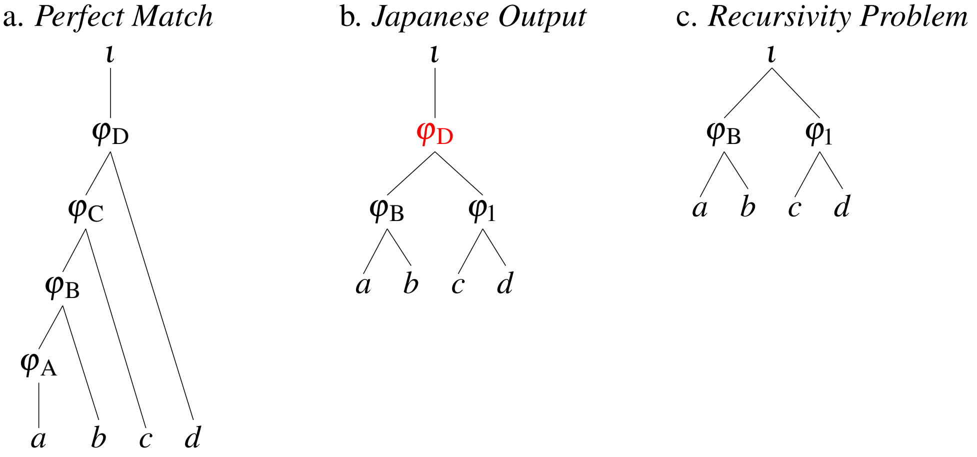
Ishihara (2014) follows up on Selkirk's idea, but concludes that these two constraints need to be supplemented with at least one more in order to yield the right result. The constraint he proposes for this purpose is the following:

(175) MatchPhrase-Max — Match(XP$_{\max}$, $\varphi_{\max}$) (Ishihara 2014)
A maximal lexical phrase in syntactic constituent structure (a lexical XP that is not immediately dominated by another lexical XP) must be matched by a corresponding maximal prosodic constituent in phonological representation (a PPhrase that is not immediately dominated by another PPhrase, $\varphi_{\max}$).

This constraint is, clearly, in the Match family, but differs from the ordinary Match-(XP,φ) in referring only to maximal XPs and φs.

To understand why Ishihara (2014) proposes this constraint, consider the following three prosodic trees, which are the three found in his tableau (17). (Since we are focusing on Kubozono's Mismatch, the syntatic input is of course uniformly left-branching.)

(176) *Ishihara's main competitors (Ishihara 2014)*


a. *Perfect Match* b. *Japanese Output* c. *Recursivity Problem*

For Ishihara, the fact that (176a) is defeated follows from MaxBin ≫ Match-XP, just as Selkirk (2011) suggested. In (176a), there are two phonological phrases that contain more than two words: φ_1 and φ_2. By contrast, in (176b) there is only one such superbinary phrase: φ_1. And in (176c), there is no superbinary φ.

The problem that Ishihara points out is that the ranking MAXBIN $\gg$ MATCH-XP selects (176c) as optimal, not (176b). That is, the minimal φs are predicted to attach directly to the intonational phrase node ι, instead of being grouped together in a maximal φ. Ishihara's solution is to add MATCH-MAX to the constraint set, and to rank it above MAXBIN. In so doing, the fact that MAXBIN prefers (c) over (b) becomes irrelevant; MATCH-MAX prefers (b) over (c), since the entire NP_{max} maps to a φ_{max} in (b) but not in (c). MATCH-MAX is of course indifferent when it comes to the choice between (a) and (b).

Ishihara's (2014) analysis is an important contribution to our understanding of Kubozono's Mismatch. He is entirely correct that MAXBIN $\gg$ MATCH-XP is insufficient, and that MATCH-MAX prefers (176b) over (176c), as desired. There is also a conceptual attractiveness to MATCH-MAX, since it merely enriches an already-established constraint family (MATCH), and invokes the distinction between maximal and minimal categories that is pervasive in current Match Theory (Elfner 2012; Ito and Mester 2013, 2017).

However, Ishihara's (2014) account falls short of capturing Kubozono's Mismatch, when every possible candidate is included in the candidate set. Below, we examine three systems—$S_{\text{Match-5}}$, $S_{\text{Match-6}}$, and $S_{\text{Match-7}}$—with constraint sets assembled from Ishihara (2014) (with the constraint names slightly adjusted to follow SPOT conventions):

(177) *Constraint sets to test from Ishihara (2014)*

a. *Selkirk's suggestion* ($\text{CON}_{\text{Match-5}}$)
   i. BINMAX$(\varphi, \omega)_{\text{categorical}}$
   ii. MATCH(XP,φ)

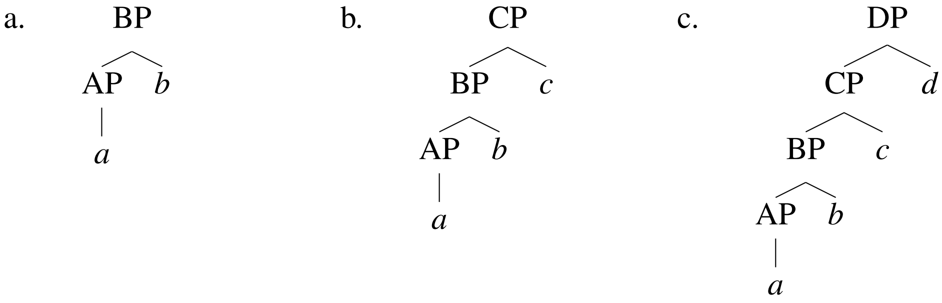
b. *Selkirk's suggestion plus minimal binarity* ($\text{CON}_{\text{Match-6}}$)
   i. BINMAX$(\varphi, \omega)_{\text{categorical}}$
   ii. MATCH(XP,φ)

iii. BinMin(φ)

c. *Every constraint from Ishihara's §3–4* (Con$_{\text{Match-7}}$)
   i. BinMax(φ, ω)$_{\text{categorical}}$
   ii. Match(XP,φ)
   iii. Match(XP$_{\text{max}}$,φ_{max})
   iv. BinMin(φ)
   v. Match(φ,XP)

For each test, we will use the same inputs:

(178) *Inputs for* $S_{\text{Match-5}}$, $S_{\text{Match-6}}$, $S_{\text{Match-7}}$



These inputs are all derived from left-branching trees with unaccented nouns, where every noun except the very rightmost bears the genitive enclitic =*no*. They do not perfectly correspond to NPs containing relative clauses as shown in (172), since *b* and *c* do not each have their own XP. In the relative clause examples above, *b* was co-exensive with the RC-internal VP (*nónda* 'drank', *yonda* 'invited') and *c* with the RC-external head noun (*wáin-no* 'wine-GEN', *gakuchoo-no* 'college president-GEN'). Instead, the inputs in (178) are based on noun-only examples like *amerika-no tomodachi-no pasokon* 'American friend's PC' from Ito and Mester (2013, 2017). The results obtained from examining all-noun sentences are somewhat simpler to discuss and understand. They will hopefully extend rather straightforwardly to examples with relative clauses, but this will have to be investigated later.

In addition, we will make the same assumptions about Gen in each system:

(179) *Definition of* GEN$_{\text{Match-5}}$, GEN$_{\text{Match-6}}$, GEN$_{\text{Match-7}}$
GEN(*sTree*) = Every prosodic tree *P* such that

a. the root node of *P* is ι;
b. every intermediate node of *P* is φ;
c. *P* has no vacuous recursion;
d. every terminal node of *P* is ω;
e. terminals are exhaustively parsed into φ;
f. every ω in *P* has a matching X^0 in *S*;
g. every X^0 in *S* has a matching ω in *P*.

It will be shown that none of the constraint sets in (177), coupled with the inputs in (178) and the GEN function in (179), suffices to generate Kubozono's Mismatch.

4.3.1 BINMAX, MATCH, and the Recursivity Problem

The constraint set CON$_{\text{Match-5}}$ from (177a) contains only two constraints: BINMAX(φ,-ω)$_{\text{categorical}}$ and MATCH(XP,φ). Let us abbreviate these as BINMAX-ω and MATCH-XP.

Since this system contains only two contraints, we know in advance that it contains either one or two languages. Since BINMAX-ω and MATCH-XP sometimes conflict, as we saw in the discussion of (176), there will be two languages rather than one. What are these two languages, and is one of them Japanese?

Testing $S_{\text{Match-5}}$ with SPOT and OTWorkplace, we find that neither language in the factorial typology is Japanese, just as Ishihara correctly showed.

(180) *FacTyp*$_{\text{Match-5}}$

	$[[a]b]$	$[[[a]b]c]$	$[[[[a]b]c]d]$	*Grammar*
L1	$((a)b)$ $((a)(b))$	$((a)b)(c)$ $((a)(b))(c)$	$((a)b)(c)(d)$ $((a)b)(c(d))$ $((a)b)((c)d)$ $((a)b)((c)(d))$ $((a)b)(cd)$ $((a)(b))(c)(d)$ $((a)(b))(c(d))$ $((a)(b))((c)d)$ $((a)(b))((c)(d))$ $((a)(b))(cd)$	BMax-$\omega \gg$ Match-XP
L2	$((a)b)$ $((a)(b))$	$(((a)b)c)$ $(((a)b)(c))$ $(((a)(b))c)$ $(((a)(b))(c))$	$((((a)b)c)d)$ $((((a)b)c)(d))$ $((((a)b)(c))d)$ $((((a)b)(c))(d))$ $((((a)(b))c)d)$ $((((a)(b))c)(d))$ $((((a)(b))(c))d)$ $((((a)(b))(c))(d))$	Match-XP $\gg$ BMax-ω

In each language, there are a number of co-optimal prosodic parses for each syntactic input. This is partially due to the fact that neither constraint cares whether any of the words *b*, *c*, or *d* projects its own φ; none of these three words is an XP, and adding a minimal phrase never alters the violation count of BinMax-ω, which is only concerned with phrases getting too big, not with phrases getting to small.

One shortcoming of this system, orthogonal to our primary concerns, is that the initial word *a* always projects its own φ. This is not Ishihara's concern when arguing for Match-Max. It will therefore be instructive to see what happens when we add BinMin(φ) to this system, in order to cut down on co-optima and eliminate some of the unary φs.

4.3.2 BinMin and the Recursivity Problem

Adding BinMin(φ), abbreviated BinMin, to (177a) yields a typology that is visually less opaque, but nonetheless fails to produce Japanese. We name the resulting system $S_{\text{Match-6}}$. Outputs which are incompatible with Japanese are shaded.

(181) *FacTyp*$_{\text{Match-6}}$

	$[[a]b]$	$[[[a]b]c]$	$[[[[a]b]c]d]$	*Grammar*
L1	$((a)b)$	$((a)b)(c)$	$((a)b)(cd)$	BMax-ω ≫ M-XP ≫ BMin
L2	$((a)b)$	$(((a)b)c)$	$((((a)b)c)d)$	M-XP ≫ BMax-ω, BMin
L3	(ab)	$(a)(bc)$ $(ab)(c)$	$(ab)(cd)$	BMax-ω ≫ BMin ≫ M-XP
L4	(ab)	$((ab)c)$	$(ab)(cd)$	BMin ≫ BMax-ω ≫ M-XP
L5	(ab)	$((ab)c)$	$(((ab)c)d)$	BMin ≫ M-XP ≫ BMax-ω

In (181), L4 comes close to exhibiting Kubozono's Mismatch, but ultimately falls short, and is exactly the sort of language that Ishihara introduces Match-Max in order to overcome.

The following tableau shows why Kubozono's Mismatch cannot be generated in this system. Every possible optimum is included as a candidate, and one harmonically bounded candidate (the actual Japanese phrasing for the four-word case) is included as well. Gen also admits 248 more harmonically bounded candidates, which are not shown here but are enumerated in this chapter's corresponding OTWorkplace file. The harmonically bounded Japanese phrasing is shown as the desired optimum in row (a), and the four optima admitted in this system (which together harmonically bound it) are shown in rows (b–e).

(182) *Japanese phrasing harmonically bounded in S*$_{\text{Match-6}}$ (4/4 optima; 1/249 HBs)

$[[[[a]b]c]d]$	BinMin	BinMax-ω	Match-XP
a. →HB $((ab)(cd))$	0	*	**
b. $(ab)(cd)$	e	**L**	***W**
c. $(((ab)c)d)$	e	****W**	***L**
d. $((a)b)(cd)$	*W	L	**e
e. $((((a)b)c)d)$	*W	**W	L

Here, we see the problem identified by Ishihara which led him to introduce Match-Max.[3] Under the ranking BinMin ≫ BinMax-ω ≫ Match-XP, it is impossible to have φs (ab) and (cd) while simultaneously grouping all four words under a maximal

[3] The tableau in our (182) is similar to Ishihara's tableau (15), in that it illustrates the maximal XP/φ problem. It differs from a simple recapitulation of Ishihara's tableau since it includes all possible optima in the system, drawn from the full candidate set generated by SPOT.

φ. This is because the real driving force behind rebracketing is BINMAX-ω, but this very constraint disfavors matching [*abcd*], since the result is just another superbinary φ. And while MATCH-XP demands that [*abcd*] be matched, it is must be ranked below BINMAX-ω to rule out the near-matching (182c).

The paradox here can quickly be gleaned by examining the 'LW' cell-sequence in row (b) and the 'WL' cell-sequence directly below it in row (c). These cells form what we might call a "paradox pinwheel", a configuration in comparative tableaux that instantly reveals a fatal flaw in the system in a visually striking way. Such pinwheels will appear in many tableaux throughout this work.

4.3.3 MATCH(φ,XP) and the Squishing Problem

We have now established that MATCH-XP, BINMAX-ω, and BINMIN-φ do not yield Japanese phonological phrasing under any ranking, and that Ishihara (2014) proposes rescuing the analysis with a new constraint MATCH-MAX. Throughout his analysis of Kubozono's Mismatch, Ishihara uses the constraints in (183), which here are $\text{CON}_{\text{Match-7}}$, the constraint set for the system $S_{\text{Match-7}}$.

(183) $\text{CON}_{\text{Match-7}}$*: Every constraint from Ishihara's (2014) analysis*

- a. *Match constraints*
  - i. MATCH(XP,φ)
  - ii. MATCH(XP_{max},φ_{max})
  - iii. MATCH(φ,XP)
- b. *Binarity constraints*
  - i. BINMAX$(\varphi, \omega)_{\text{categorical}}$
  - ii. BINMIN(φ)

It turns out that even the constraints in (183) are not a full solution of Kubozono's Mismatch. Together, they yield the following factorial typology:

(184) *FacTyp*$_{\text{Match-7}}$

	$[[a]b]$	$[[[a]b]c]$	$[[[[a]b]c]d]$
L1	$((a)b)$	$((a)b)(c)$	$((a)b)(cd)$
L2	$((a)b)$	$(((a)b)c)$	$(((a)b)cd)$
L3	$((a)b)$	$(((a)b)c)$	$((((a)b)c)d)$
L4	(ab)	$(a)(bc)$ $(ab)(c)$	$(ab)(cd)$
L5	(ab)	$((ab)c)$	$(ab)(cd)$
L6	(ab)	$((ab)c)$	$((ab)cd)$
L7	(ab)	$((ab)c)$	$(((ab)c)d)$

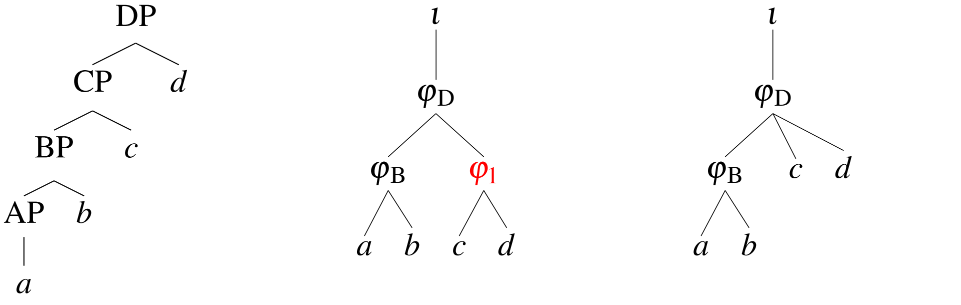
Here we encounter the Squishing Problem. The Japanese output, with its φ (cd), is individually harmonically bounded by $((ab)cd)$.

(185) *Squishing Problem in* $S_{\text{Match-7}}$ (6/6 optima; 1/147 HBs)

$[[[[a]b]c]d]$		BMin	M_{Max}	BMx-ω	M-XP	M-φ
a. →HB	$((ab)(cd))$	0	0	*	**	*
b.	$((ab)cd)$	e	e	*e	**e	L
c.	$(((ab)c)d)$	e	e	**W	*L	L
d.	$(ab)(cd)$	e	*W	L	***W	*e
e.	$(((a)b)cd)$	*W	e	*e	*L	L
f.	$((a)b)(cd)$	*W	*W	L	**e	*e
g.	$((((a)b)c)d)$	*W	e	**W	L	L

To facilitate discussion, let us zoom in on the input, the optimum (a), and the squished (b).

(186) *Squishing Problem*



The Input

a. *Japanese Output*

b. *Squishing Problem*

As shown in the tableau, MATCH(φ,XP) favors the squished output over the correct output, sealing the latter's fate. This is because φ_1 in (a) has no matching XP in the input, while (b) lacks this defect. The other φ-nodes in these trees do have input matches: BP and DP.

But why do (a) and (b) tie on every constraint other than Match-φ? Neither contains a unary φ, so both satisfy BinMin. Both satisfy Match-Max by matching DP and φ_{D}. Both violate Match-ω exactly once, due to the four-word phrase φ_{D}. And finally, both incur the same number of Match-XP violations, failing to match AP and CP while successfully matching BP and DP.

Put simply, φ_1 in (a) doesn't help on binarity or SP-matching, and only makes matters worse on PS-matching.

4.4 A Match solution

The smallest system that draws only from constraints in (166) has three constraints. Let us call this system $S_{\text{Match-8}}$.

(187) Con$_{\text{Match-8}}$

a. Match(XP,φ) (M-XP)

b. BinMin(φ) (BinMin)

c. EqualSisters (EqSis)

The system yields the following four-language typology. Henceforth, the cells of non-Japanese-compliant forms are shaded, and the symbol '$\star$' marks a language that is Japanese-compliant.

(188) *FacTyp*$_{\text{Match-8}}$

	$[[a]b]$	$[[[a]b]c]$	$[[[[a]b]c]d]$	*Grammar*
L1	$((a)b)$	$(((a)b)c)$	$((((a)b)c)d)$	M-XP $\gg$ BMin $\gg$ ES
L2	$((a)(b)$	$(((a)(b))(c))$	$((((a)(b))(c))(d))$	M-XP, ES $\gg$ BMin
L3	(ab)	$((ab)c)$	$(((ab)c)d)$	BMin $\gg$ M-XP $\gg$ ES
$\star$ L4	(ab)	(abc)	$((ab)(cd))$	BMin, ES $\gg$ M-XP

In this FacTyp, only L4 is compatible with Japanese. While L3 has Japanese (ab) and $((ab)c)$, it incorrectly predicts $*(((ab)c)d)$ instead of the correctly rebracketed

$((ab)(cd))$.

To see how the ranking [BinMin, EqSis ≫ Match-XP] yields the right results, consider the following three tableau. In (189), we see how the two-word parse (ab) is chosen.

(189) $[[a]b]$ in $S_{\text{Match-8}}$ (3/3 optima; 0/2 HBs)

$[[a]b]$	BinMin	EqSis	M-XP
a. → (ab)	0	0	*
b. $((a)(b))$	**W	e	L
c. $((a)b)$	*W	*W	L

Here, the winning candidate (189a) deprives the syntactic phrase $[_{\text{AP}}\ a]$ of a matching φ, thereby incurring a violation of Match-XP. In doing so, it avoids the violations of BinMin and EqSis incurred by (189c), the perfect match. Specifically, the locus of the BinMin violation in (189c) is the unary φ_{A}. The locus of the EqSis violation is $(\varphi_{\text{A}}\ b)$. The phrase φ_{A} is sister to the prosodic word b within the maximal phrase φ_{B}.

Like (189a), candidate (189b) avoids violating EqSis. But while (189a) demotes the unary XP to a mere ω, (189b) promotes the word b by parsing it into its own φ, despite the fact that b is not an XP. Demotion and promotion are both expected responses to pressure from EqSis: the mappings [XP $\text{Y}^0 \rightarrow \omega\omega$] and [XP $\text{Y}^0 \rightarrow \varphi\varphi$] both avoid the inequality between sisters seen in the "perfect" mapping [XP $\text{Y}^0 \rightarrow \varphi\omega$]. BinMin prefers demotion, since promotion results in the unary φ_{A}. Match-XP, by contrast, prefers promotion, since demotion results in AP going unmatched. The fact that demotion is chosen over promotion in Japanese indicates that, in the system under discussion, BinMin ≫ Match-XP.

The ERCs in tableau (189) reveal only that BinMin ≫ Match-XP (see Prince 2002; Brasoveanu and Prince 2011, for an extensive discussion of ERC logic). But considering the three-word case in (190) reveals that EqSis also outranks Match-XP.

(190) [[[*a*]*b*]*c*] *in* $S_{\text{Match-8}}$ (4/4 optima; 0/29 HBs)

[[[*a*]*b*]*c*]	BinMin	EqSis	M-XP
a. → (abc)	0	0	**
b. $((ab)c)$	e	*W	*L
c. $(((a)b)c)$	*W	**W	L
d. $(((a)(b))(c))$	***W	e	L

Candidates (190c–d) are ruled out by BinMin, leaving (190a–b) to face off. The choice is somewhat superfluous, since both (190a) and (190b) are compatible with Japanese. However, the typology of this system commits us to the optimality of the ternary-branching (190a) of Shinya et al. (2004) rather than the binary-branching (190b) of Ito and Mester (2013, 2017), as we will see when we come to the four-word case. Embracing the optimality of (abc), we see that EqSis $\gg$ Match-XP, since BinMin prefers (190a) over (190b), and Match-XP prefers (190b) over (190a).

The substantive evidence for EqSis $\gg$ Match-XP comes from (191), where BinMin and Match-XP favor phonetically distinguishable candidates. Once (191c–d) are ruled out by BinMin, we are left again with a choice between two candidates distungished by EqSis and Match-XP, namely (191a–b).

(191) [[[[*a*]*b*]*c*]*d*] *in* $S_{\text{Match-8}}$ (4/4 optima; 0/249 HBs)

[[[[*a*]*b*]*c*]*d*]	BinMin	EqSis	M-XP
a. → $((ab)(cd))$	0	0	**
b. $(((ab)c)d)$	e	**W	*L
c. $((((a)b)c)d)$	*W	***W	L
d. $((((a)(b))(c))(d))$	****W	e	L

The losing candidate (191b) violates EqSis twice: once at locus $(\varphi_{\text{B}}\ c)$, and again at locus $(\varphi_{\text{C}}\ d)$. The winning candidate (191a) satisfies EqSis fully; each ω is sister only to another ω. Turning now to Match-XP, we see that the loser (191b) is preferred over (191a). Although (191b) violates Match-XP once, by failing to match AP, it provides a matching φ for the remaning XPs. By imposing rebracketing, the winning (191a) violates Match-XP twice; it fails to match both AP and CP, though both BP and DP are respected.

The Recursivity Problem candidate is not included in (191), which contains only the optima of $S_{\text{Match-8}}$. That it is not a problem here is shown in (192).

(192) *No Recursivity Problem in* $S_{\text{Match-8}}$ (1/4 optima; 1/249 HBs)

[[[[*a*]*b*]*c*]*d*]	BinMin	EqSis	M-XP
a. → $((ab)(cd))$	0	0	**
e. HB $(ab)(cd)$	e	e	***W

Here, we see that (192a) and (192e) tie on BinMin and EqSis. The candidates are distinguished only by Match-XP, and (192e) incurs one more violation of Match-XP than does (192a). In addition to not matching AP and CP like (a), it does not match DP. This gratuitous Match-XP violation is its demise. But while DP and φ_{D} are the deciding factor here, this has nothing to do with the fact that DP is a maximal XP, or that φ_{D} is a maximal φ. No notion of maximality is needed.

4.4.1 Necessity of Match(XP,φ)

In the smallest adequate system, $S_{\text{Match-8}}$, Match-XP is lowest ranked. Nevertheless, it is crucially active. When removed, the resulting typology has only one language. The system in question is $S_{\text{Mark-1}}$, with $\text{Con}_{\text{Mark-1}} = \{\text{BinMin}, \text{EqualSisters}\}$. Its lone language is given in (193).

(193) *FacTyp*$_{\text{Mark-1}}$

	[[*a*]*b*]	[[[*a*]*b*]*c*]	[[[[*a*]*b*]*c*]*d*]	*Grammar*
L1	(ab)	(abc)	$(ab)(cd)$ $((ab)(cd))$ $(abcd)$	BinMin, EqSis

The four-word Japanese output is co-optimal with the Recursivity Problem candidate and a totally flattened candidate, where only DP is matched. This co-optimality is shown in (194).

(194) *Co-optima in L1 of* $S_{\text{Mark-1}}$ (3/3 optima; 0/250 HBs)

$[[[[a]b]c]d]$	BinMin	EqSis
a. → $((ab)(cd))$	0	0
b. $(ab)(cd)$	e	e
c. $(abcd)$	e	e

None of (194a–c) contains a unary φ or an unequal sequence $\omega\varphi$ or $\varphi\omega$. Therefore both constraints in the system, BinMin and EqSis, are satisfied by all three candidates. Although the desired output $((ab)(cd))$ is in fact among these optima, the language L1 as a whole cannot be equated with Japanese, since it predicts $*(ab)(cd)$ and $*(abcd)$ to be grammatical alongside it.

Not only does the system fall apart when Match-XP is removed; it fails even when Match-XP is replaced with Match-φ, too, as in $S_{\text{Match.9}}$ of the OTWorkplace file. When this constraint replacement is considered, the Japanese-compliant candidate is individually harmonically bounded by the flattening candidate.

(195) *Harmonic bounding in* S_{66} *(not all optima shown)*

$[[[[a]b]c]d]$	BinMin	EqSis	M-φ
a. → $((ab)(cd))$	0	0	1
b. $(abcd)$	e_0	e_0	L_0

All (195) illustrates is that (a) is harmonically bounded by (b), since Match-φ favors (a), and the two candidates tie on BinMin and EqSis. While φ_D and φ_B in (195) have matching XPs, φ_C in (195a) does not.

4.4.2 Other Match solutions

While $S_{\text{Match-8}}$ accounts for Kubozono's Mismatch with only three constraints, there are seven other non-trivial solutions drawing from the same Match–Theoretic constraint menu (166). Each of the constraint sets in (196), coupled with the usual assumptions about the inputs and Gen, yields a typology containing a Japanese-compliant language.

Each set in (196) is *irreducible* in the sense that removing any one constraint causes Japanese to disappear from the factorial typology.

(196) a. $S_{\text{Match.10}}$
{MATCH-XP, MATCH-MAX, BINMIN, BINMAX(φ,B), BINMAX(φ,ω)}

b. $S_{\text{Match.11}}$
{MATCH-φ, MATCH-MAX, BINMIN, BINMAX(φ,B), BINMAX(φ,ω)}

c. $S_{\text{Match.12}}$
{MATCH-φ, MATCH-MAX, BINMAX(φ,B), BINMAX(φ,ω), EQSIS}

d. $S_{\text{Match.13}}$
{MATCH-XP, MATCH-MAX, BINMAX(φ,B), BINMAX(φ,ω), NONREC}

e. $S_{\text{Match.14}}$
{MATCH-φ, MATCH-MAX, BINMAX(φ,B), BINMAX(φ,ω), NONREC}

f. $S_{\text{Match.15}}$
{MATCH-XP, MATCH-MAX, BINMAX(φ,B), EQSIS, NONREC}

g. $S_{\text{Match.16}}$
{MATCH-φ, MATCH-MAX, BINMAX(φ,B), EQSIS, NONREC}

The claim that (196) are the seven other irreducible systems in addition to $S_{\text{Match-8}}$ is justified in the appendix, and each factorial typology was calculated using SPOT and OTWorkplace.

Without examining each system in detail, several observations can be made at a glance. Each constraint set contains MATCH-MAX, meaning $S_{\text{Match-8}}$ is the only Match–Theoretic system that makes do without it. This is a significant point in favor of MATCH-MAX, and shows that Ishihara (2014) hit upon a very useful constraint. In fact, we learn that *either* MATCH-MAX or EQUALSISTERS is absolutely essential. The MT systems that can capture Kubozono's Mismatch either have only EQSIS ($S_{\text{Match-8}}$), have only MATCH-MAX ($S_{\text{Match.10}}$, $S_{\text{Match.11}}$, $S_{\text{Match.13}}$, $S_{\text{Match.14}}$), or have both ($S_{\text{Match.12}}$, $S_{\text{Match.15}}$, $S_{\text{Match.16}}$).

In addition, we learn that every MT system that can handle Kubozono's Mismatch uses at least one binarity constraint—but perhaps counter-intuitively, one successful system ($S_{\text{Match-8}}$) includes BINMIN and lacks a BINMAX constraint, while certain other successful systems include a BINMAX constraint but not a BINMIN constraint ($S_{\text{Match.12}}$, $S_{\text{Match.13}}$, $S_{\text{Match.14}}$, $S_{\text{Match.15}}$, $S_{\text{Match.16}}$). Others ($S_{\text{Match.10}}$, $S_{\text{Match.11}}$) include both.

4.5 An Align/Wrap solution

As mentioned in the introduction to this chapter, we consider not only Match–Theoretic approaches to the problem, but also what might be called Align/Wrap Theory developed by Truckenbrodt (1995, 1999) as an OT adaptation of Selkirk's (1986) Edge-Based Approach. The constraints considered were the two mapping constraints and five markedness constraints in (197).

(197) *Align/Wrap–Theoretic constraint menu*

a. *Align/Wrap constraints*

i. ALIGN(XP,R,φ,R) (AR)

ii. WRAP(XP,φ) (WR)

b. *Markedness constraints*

i. BINMIN(φ) (P2)

ii. BINMAX(φ,b) (PB)

iii. BINMAX(φ, ω) (PW)

iv. EQUALSISTERS (ES)

v. NONRECURSIVITY (NR)

The markedness constraints in (197b) are the same as those studied here in the Match–Theoretic systems.[4] As a reminder, the ALIGNMENT constraints from Truckenbrodt (1995, 1999) are categorical in the sense that they do not count intervening elements between edges, hence assign 1 violation for every right edge of XP that does not align to the right edge of some φ. For further details, see the constraint definition section of the introductory chapter.

[4] These markedness constraints are somewhat anachronistic when used within an Align/Wrap Theory, but this is not reason not to consider the interaction of these two constraint sets.

ALIGN(XP,L,φ,L) was left out of (197) only because no candidate in the candidate set as defined by the inputs (178) and GEN (179) violates the constraint. This is due to a combination of two factors: (i) the left edge of every XP in (178) is the left edge of the entire tree, and (ii) the leftmost word in every output admitted by GEN is at the left edge of a φ. If we were considering inputs that contained non-left-aligned XPs, and/or if GEN allowed non-exhaustive ω-parsing, ALIGN-L would be violated by some candidates, hence entirely worthy of inclusion in the constraint menu.

Testing combinations of the constraints in (197) reveals that this theory's smallest solution to Kubozono's Mismatch (163) involves four constraints: the mapping constraints ALIGN-R and WRAP, and the markedness constraints BINMIN and EQSIS. Let us call the system they form $S_{\text{Align-9}}$, by analogy with its MT-counterpart $S_{\text{Match-8}}$. The constraint sets $S_{\text{Match-8}}$ and $S_{\text{Align-9}}$ have much in common, with exactly the same markedness constraints. (Its name in the Align/Wrap OTWorkplace file is S_{A9}.) The systems differ in that MATCH-XP suffices as the lone mapping constraint in $S_{\text{Match-8}}$, while $S_{\text{Align-9}}$ needs ALIGN-R and WRAP working in concert.

The factorial typologies of $S_{\text{Align-9}}$ and $S_{\text{Match-8}}$ are also quite similar. Both contain a perfect matching language (L1), a near-perfect matching language which prohibits unary φ (L3), and a Japanese-compliant language (L4).[5] The typology of $S_{\text{Align-9}}$ is given in (198).

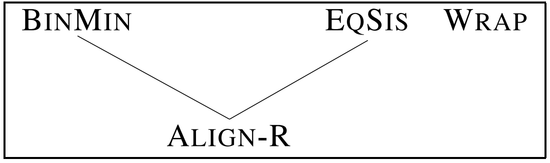
(198) *FacTyp*$_{\text{Align-9}}$

[5] N.B. Whe comparing languages across systems, one must keep in mind that the languages are defined extensionally as sets of input–output pairs, where the inputs are *only* the inputs in (178). Adding more inputs results in an entirely new system, even when GEN and CON are held constant, and unless a system happens to constitute a *universal base* (Alber et al. 2016), adding an input can result in refining (expanding) of the factorial typology. Thus, the inter-system equivalencies pointed out here apply only to the particular systems in question, not to the systems' constraint sets.

	$[[a]b]$	$[[[a]b]c]$	$[[[[a]b]c]d]$	*Comparison with* *FacTyp*$_{\text{Match-8}}$
L1	$((a)b)$	$(((a)b)c)$	$((((a)b)c)d)$	$=\text{L1}_{\text{Match-8}}$
L2	$((a)(b))$	$((a)(b)(c))$ $((a)((b)(c)))$ $(((a)(b))(c))$	$((a)(b)(c)(d))$ $((a)(b)((c)(d)))$ $((a)((b)(c))(d))$ $((a)((b)(c)(d)))$ $((a)((b)((c)(d))))$ $((a)(((b)(c))(d)))$ $(((a)(b))(c)(d))$ $(((a)(b))((c)(d)))$ $(((a)(b)(c))(d))$ $(((a)((b)(c)))(d))$ $((((a)(b))(c))(d))$	$\notin \text{FacTyp}_{\text{Match-8}}$
L3	(ab)	$((ab)c)$	$(((ab)c)d)$	$=\text{L3}_{\text{Match-8}}$
⋆ L4	(ab)	(abc)	$((ab)(cd))$	$=\text{L4}_{\text{Match-8}}$

The Japanese-compliant language L4 arises under the ranking in (199):

(199) *Hasse diagram for L4's grammar in* $S_{\text{Align-9}}$



The subranking BINMIN ≫ ALIGN-R is revealed by the ERC in (200c). The optimum does not align the right edge of AP with the right edge of a φ, violating ALIGN-R, but does avoid the two violations of BINMIN incurred by $((a)(b))$. This conflict is essentially the same as that between MATCH-XP and BINMIN seen for AP in $S_{\text{Match-8}}$.

(200) $[[a]b]$ *in* $S_{\text{Align-9}}$ (3/3 optima; 0/2 HBs)

$[_{\text{BP}}\ [_{\text{AP}}\ a]\ b]$	WRAP	BINMIN	EQSIS	ALIGN-R
a. → (ab)	0	0	0	*
b. $((a)b)$	e	*W	*W	L
c. $((a)(b))$	e	**W	e	L

The role of EQSIS is revealed in the three-word case. Just as in $S_{\text{Match-8}}$, here EQSIS must dominate the mapping constraint that favors mapping $b]_{\text{BP}}$ to $b)_{\varphi}$. Here, that constraint is ALIGN-R. The relevant ERC is shown in (201b).

(201) $[[[a]b]c]$ *in* $S_{\text{Align-9}}$ (6/6 optima; 0/27 HBs)

$[_{\text{CP}}\ [_{\text{BP}}\ [_{\text{AP}}\ a]\ b]\ c]$	Wrap	BinMin	EqSis	Align-R
a. → (abc)	0	0	0	**
b. $((ab)c)$	e	e	*W	*L
c. $(((a)b)c)$	e	*W	**W	L
d. $((a)(b)(c))$	e	***W	e	L
e. $((a)((b)(c)))$	e	***W	e	L
f. $(((a)(b))(c))$	e	***W	e	L

The ranking [BinMin, EqSis ≫ Align-R], with Wrap not crucially ranked, assures the correct winner in the four-word case as well.

(202) $[[[[a]b]c]d]$ *in* $S_{\text{Align-9}}$ (14/14 optima; 0/239 HBs)

$[_{\text{DP}}\ [_{\text{CP}}\ [_{\text{BP}}\ [_{\text{AP}}\ a]\ b]\ c]\ d]$	Wrap	BinMin	EqSis	Align-R
a. → $((ab)(cd))$	0	0	0	**
b. $(((ab)c)d)$	e	e	**W	*L
c. $((((a)b)c)d)$	e	*W	***W	L
d. $((a)(b)(c)(d))$	e	****W	e	L
e. $((a)(b)((c)(d)))$	e	****W	e	L
f. $((a)((b)(c))(d))$	e	****W	e	L
g. $((a)((b)(c)(d)))$	e	****W	e	L
h. $((a)((b)((c)(d))))$	e	****W	e	L
i. $((a)(((b)(c))(d)))$	e	****W	e	L
j. $(((a)(b))(c)(d))$	e	****W	e	L
k. $(((a)(b))((c)(d)))$	e	****W	e	L
l. $(((a)(b)(c))(d))$	e	****W	e	L
m. $(((a)((b)(c)))(d))$	e	****W	e	L
n. $((((a)(b))(c))(d))$	e	****W	e	L

All of candidates (c–n) fail on BinMin, since each contains at least one unary φ, namely φ_{A}, due to pressure from Align-R. The near-matching (b) is ruled out by EqualSisters, with violation loci (φ_{B} c) and (φ_{C} d). The only remaining candidate is the balanced $((ab)(cd))$, which incurs two non-fatal violations of Align-R: one for AP and another for CP. Here too, Align-R is playing a role very similar to that played by Match-XP above. The two are both dissatisfied by the treatment of AP and CP in the Japanese output, but are powerless to stop this disregard for syntax.

It is striking that no optimum violates Wrap here. The reason for this is that although WRAP is responsible for filtering out a large number of harmonic bounds, it is never in conflict with BINMIN, EQSIS, or ALIGN-R. The absolute necessity of WRAP is on full display when we consider the harmonically bounded Recursivity Problem candidate which Ishihara (2014) uses MATCH-MAX to eliminate. The Japanese output is shown defeating this candidate in (203), as well as defeating the Squishing Problem candidate, which is also harmonically bounded.

(203) *Four-word optimum vs. "problems" in* $S_{\text{Align-9}}$ (1/14 optima; 2/239 HBs)

$[[[[a]b]c]d]$		WRAP	BMIN	EQSIS	AR	*Comment*
a. →	$((ab)(cd))$	0	0	0	**	*Japanese*
b. HB	$((ab)cd)$	e	e	*W	***W	*Squishing Problem*
c. HB	$(ab)(cd)$	*W	e	e	**e	*Recursivity Problem*

The role of WRAP here is very similar to that of Ishihara's MATCH-MAX. It demands that DP be entirely encompassed by some phonological phrase. But unlike MATCH-MAX, it does not demand that this phrase equal φ_{D}, only demanding that each of *a*, *b*, *c*, and *d* be contained within it. But since the phrase contains only these four words, the two appear equivalent here.

The Squishing Problem candidate $((ab)cd)$ is ruled out in this system by EQSIS and ALIGN-R: EQSIS for the reasons described in the discussion of $S_{\text{Match-8}}$ above, and ALIGN-R due to the non-right-alignment of CP=$[abc]$. As usual, MATCH-XP and ALIGN-R do the same work.

4.6 Command Theory

So far we have seen solutions in Match Theory and Align/Wrap Theory to Kubozono's Mismatch. But can Command Theory, the novel theory proposed in the previous chapter, account for the same pattern, without constraints on constituent-matching? The answer is yes—at least for the basic pattern discussed in this chapter. Things become more difficult when additional accentual factors are introduced (for both CT and Align/Wrap).

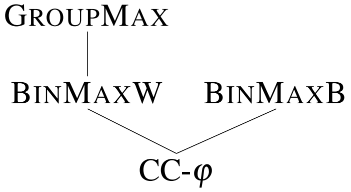
To see how CT handles the facts, we consider a small system $S_{\text{Com.4}}$, with the same Gen as usual, and the following constraints:

(204) $\text{Con}_{\text{Com.4}}$

a. GroupMax
b. CC-φ
c. BinMax(φ, ω)
d. BinMax(φ, branches)

The inputs are the same three used throughout this chapter. The ranking needed for Kubozono's Mismatch is the following:

(205) *Hasse diagram for Kubozono's Mismatch (L2) in $S_{\text{Com.4}}$*



The correct two-word phrasing, [[*a*] *b*]→(*a b*) is the sole optimum of its candidate set in the typology; clearly, CC-φ wants (*a b*), and none of the other constraints oppose this.

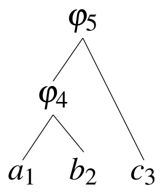
In the three-word case, the competitor (*a b*) (*c*) is ruled out by GroupMax, since *c* c-commands *a* and *b* but is not contained in a φ with them. The ternary branching (*a b c*) is ruled out by BinMaxB. The remaining question, then, is how CC-φ causes the mismatching (*a* (*b c*)) to be harmonically bounded by the winning ((*a b*) *c*).

(206) *Three word phrasing in KM: $S_{\text{Com.4}}$ L2*

[[[a] b] c]		GroupMax	BinMaxB	BinMaxW	CC-φ
a. →	((a b) c)	0	0	*	**
b. HB	(a (b c))	e	e	*e	***W
c.	(a b c)	e	*W	*e	L
d.	(a b) (c)	**W	e	L	****W

The winning candidate violates CC-φ exactly twice. The precise reason are summarized in the following example.

(207) CC-φ *violations for winning [[[a] b] c] → ((a b) c)*

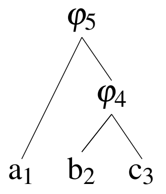


C-pair	*CC-φ Violation Loci*
(a_1,b_2)	none
(b_2,a_1)	none
(c_3,a_1)	φ_4
(c_3,b_2)	φ_4

There are four c-pains, given the syntactic input. The first two words are mutually c-commanding, and the third word asymmetrically c-commands the first two. In the winning tree, *a* and *b* are not separated by a φ-boundary from each other, but they are from *c*, resulting in two violations. This is of course worse than the zero violations incurred by the ternary-branching loser (*a b c*). But why is it better than *(*a* (*b c*))?

Below, we see that *(*a* (*b c*)) violates CC-φ three times: *twice* because *a* and *b* are separated by φ_4, and once because *a* and *c* are separated. Thus, in this circumstance, CC-φ acts like MATCH.

(208) CC-φ *violations for harmonically bounded [[[a] b] c] → (a (b c))*



C-pair	*CC-φ Violation Loci*
(a_1,b_2)	φ_4
(b_2,a_1)	φ_4
(c_3,a_1)	φ_4
(c_3,b_2)	none

While it desirable for CC-φ to "act like MATCH" in harmonically bounding *(*a* (*b c*)), we still need to make sure that it does not prevent Kubozono's Mismatch in the four-word case. That it does not is shown below.

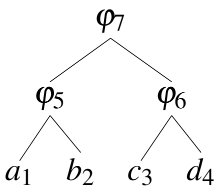
(209) *Four word phrasing in KM: $S_{\text{Com.4}}$ L2*

[[[[*a*] *b*] *c*] *d*]	GROUP$_{\text{Max}}$	BMAXB	BMAXW	CC-φ
a. → ((*a b*) (*c d*))	0	0	*	********
b. (((*a b*) *c*) *d*)	e	e	**W	*******L
c. (*a b c d*)	e	*W	*e	L
d. (*a b*) (*c d*)	****W	e	L	********e

Candidate (d), which lacks a stem φ, is ruled out by GROUPMAX, and ternary branching candidate (c) is ruled out by BINMAXB. We now see that BINMAXW must dominate CC-φ in order for the KM candidate to win. In the matching candidate (b), there are two phonological phrases with more than two words: $((a\ b)\ c)$ and $(((a\ b)\ c)\ d)$. In the winning candidate, there is only one such phrase: $((a\ b)\ (c\ d))$ itself.

Unless one is very adept at counting CC-φ violations, the fact that CC-φ favors the matching candidate $*(((a\ b)\ c)\ d)$ over the winning $((a\ b)\ (c\ d))$ may not be obvious. That the winning candidate incurs 8 violations of CC-φ is shown below.

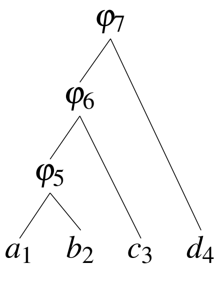
(210) CC-φ *violations for winning [[[a] b] c] d] → ((a b) (c d))*



C-pair	*CC-φ Violation Loci*
(a_1,b_2)	none
(b_2,a_1)	none
(c_3,a_1)	φ_5, φ_6
(c_3,b_2)	φ_5, φ_6
(d_4,a_1)	φ_5, φ_6
(d_4,b_2)	φ_5, φ_6
(d_4,c_3)	none

The losing candidate of interest violates CC-φ only seven times.

(211) CC-φ *violations for losing [[[a] b] c] d] → (((a b) c) d)*



C-pair	*CC-φ Violation Loci*
(a_1,b_2)	none
(b_2,a_1)	none
(c_3,a_1)	φ_5
(c_3,b_2)	φ_5
(d_4,a_1)	φ_5, φ_6
(d_4,b_2)	φ_5, φ_6
(d_4,c_3)	φ_6

Thus, BINMAXW $\gg$ CC-φ, as shown in the Hasse diagram for L2 in $S_{\text{Com.4}}$.

4.7 Conclusion

In this chapter, we have examined a syntax–phonology mismatch in Japanese, Kubozono's Mismatch (Kubozono 1989). The analysis offered by Ishihara (2014), based on the constraint MATCH-MAX, solves what he calls the Recursivity Problem: the need for $((ab)(cd))$ to win out over $*(ab)(cd)$. A similar Align/Wrap solution is shown to involve WRAP. However, there is another possible output that must be dispatched before all is said and done, namely $*((ab)cd)$, which I name the Squishing Problem. With Ishihara's constraint set, this harmonically bounds the intended winner, $((ab)(cd))$. I show that this problem can be solved in Match Theory with the constraint EQUALSISTERS from Myrberg (2013).

We have also seen that Command Theory can handle Kubozono's Mismatch, at least as long as we are dealing with unaccented words, as we do in this chapter. It is interesting to note, however, that the Command–Theoretic analysis does not involve the constraints specific to CT, but rather works with the markedness constraints familiar from MT and Align/Wrap, which do the heavy lifting in deriving Kubozono's Mismatch.

In this chapter, only forms consisting exclusively of unaccented words were considered. In the following chapter, we examine all combinations of accented and unaccented words discussed by Ito and Mester (2013, 2017). It is shown that Match Theory, essentially as proposed by Ito and Mester (2013, 2017), captures the facts well, but that Command Theory runs into difficulties.

Chapter 5

Mismatches and Accent Effects

In the previous chapter, we developed an analysis of Kubozono's Mismatch, a syntax–prosody mismatch found (at least) in Tokyo Japanese and North Kyungsang Korean. Kubozono's Mismatch is only one of various puzzles considered by Ito and Mester (2013, 2017), henceforth IM, in their analyses of 36 different phonological phrasings in Japanese. These phrasings are dependent both on accentual properties of words and on syntactic structure. This chapter deals with the derivation of the 36 mappings discussed between the two IM papers.

Words in Japanese can either be accented or unaccented. In this chapter, I will refer to a binary feature [±accented], and follow IM in abbreviating $\omega_{[+\text{accented}]}$ as "a" and $\omega_{[-\text{accented}]}$ as "u". No matter what its position in the prosodic tree, an accented word has a high tone, but a word receives a high tone only in specific prosodic environments. IM observe that fully L-toned unaccented words are not found in Japanese, and that "extra" phonological phrases are inserted to ensure that every word is linked to a high tone. (I follow Alber & Prince (in prep.) in abbreviating a fully L-toned ω as "ů".) IM posit a constraint NoLapseL, penalizing ů. In addition, IM invoke a constraint AccentAsHead, which demands that every "a" be the head of a φ. IM make impressive progress in accounting for deviations from the syntax by positing these two purely phonological markedness constraints, and allowing them to interleave with syntax–prosody mapping constraints. However, the constraints are not quite sufficient to account for all 36 phrasings.

In this chapter, I discuss a shortcoming of IM's tonal NoLapseL, and propose that it be replaced by a constraint NoPostAccW, which assigns a violation for every ω that follows a [+accented] constituent. The constraint does not refer to tonal lapses *per se*, and is violated by some structures that contain no ů—that is, the constraint is stricter than IM's NoLapseL. While NoLapseL refers only to surface tonal melodies, NoPostAccW requires an entirely abstract notion of accent-projection; a phonological phrase φ is [+accented] iff it contains a word ω that is [+accented]. I show that accent-percolation and NoPostAccW allows us to circumvent entirely the problems that befall NoLapseL. The constraint has the additional benefit of allowing us to dispense entirely with the constraint EqualSisters-2, a constraint which IM introduced as a patch, and envisaged eventually replacing.

The syntax exerts its influence via Match constraints, which crucially include Ishihara's (2014) MatchMax, and a prosody–syntax mapping constraint Match-($\varphi_{[-\text{min}]}$,XP). These special Match constraints do the brunt of the work in Japanese, with the classic Match(XP,φ) ranked at the very bottom of the hierarchy. We will see below that command theory faces some challenges in dealing with the full range of Japanese data, but that these are likely surmountable.

5.1 Inputs and Outputs

The inputs and outputs considered in this chapter are from Ito and Mester (2013, 2017). There are four syntactic structures considered:

(212) *Syntactic templates from IM's Japanese*

a. [[w] x] (2ω L-branching)

b. [[[w] x] y] (3ω L-branching)

c. [[w] [[x] y]] (3ω R-branching)
d. [[[[w] x] y] z] (4ω L-branching)

In the actual inputs, each word is either accented or unaccented. This means that, for a syntactic template with n words, there are 2^n inputs. There are therefore $2^2 = 4$ inputs of form (212a); $2^3 = 8$ inputs of form (212b); 8 inputs of form (212c); and 2^3 inputs of form (212d), making for a total of 36 inputs. Ito and Mester (2013) focus on (212a–c), i.e. on the phrases with two or three words. Ito and Mester (2017) deal with (212a,b,d), but not the right-branching inputs of form (212c). Considering all 36 of these inputs at once is a contribution of this chapter. As it turns out, a ranking issue becomes apparent only when the full range of candidates from the two IM papers are considered at once.

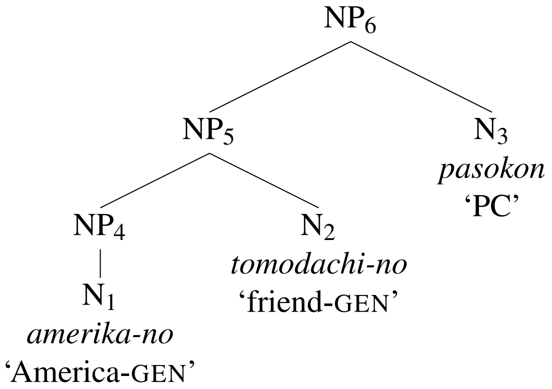
The two-word candidates of form (212a) are possessives like *tomodachi-no pasokon* '(my) friend's computer'. Here, we follow Ito and Mester (2013, 2017) and Saito et al. (2008) in assuming a syntax of the form [$_{\text{NP}}$ [$_{\text{NP}}$ tomodachi-no] pasokon]. From the usual Match–Theoretic perspective (Selkirk 2011; Elfner 2012), it does not matter whether the possessor NP *tomodachi-no* is a complement or a specifier of the possessum *pasokon*. If *tomodachi-no* is its specifier, then *pasokon* is of level N′, not NP, hence invisible to MATCH(XP,φ). An if *tomodachi-no* is its complement, *pasokon* is just a head N^0, clearly not subject to phrasal MATCH.

Something must also be said about the genitive enclitic *no*, which attaches to the last word of the possessor. Especially with the emergence of Distributed Morphology (Halle and Marantz 1993), but even on lexicalist assumptions, syntacticians have been prone to treat such particles as autonomous syntactic units (though see Saito et al. (2008) who argue for morphological insertion of *no*). This means that *no* should project a phrase, presumably of category K, giving *tomodachi-no pasokon* the underlying structure [$_{\text{NP}}$ [$_{\text{KP}}$ [$_{\text{NP}}$ tomodachi] no] pasokon]. Since *no* is a clitic, I follow IM in abstracting away from the possibility that it projects a phrase visible to MATCH. Thus, I not only exclude candidates in which *no* fails to attach to the proper host, but do not include a level like KP in the input seen by the phrase-level Match constraints. That is, the structure as seen by the constraints (in the theory, and as checked by SPOT) is really that in (212a).

Of course, *tomodachi-no pasokon*, of form [[u] u], is only one of four candidates of form (212a). The other three are formed by substituting accented *kurasuméeto-no* 'classmate's' for *tomodachi-no* and *rapputóppu* 'laptop' for *pasokon*.

The left-branching three-word candidates of form (212b) are of the same shape, but with the possessor-possessive NP itself a possessor within a larger NP, as in (213).

(213)



The accented and unaccented words for inputs of this shape are those in (214).

(214) *Words for template (212b)*

	ω_1	ω_2	ω_3
Unaccented	*amerika-no* America-GEN	*tomodachi-no* friend-GEN	*pasokon* PC
Accented	*isuráeru-no* Israel-GEN	*kurasuméeto-no* classmate-GEN	*rapputóppu* laptop

Combined, these yield the following:

(215) *Three-word left-branching examples*

a. amerika-no tomodachi-no pasokon [[[u] u] u]
'my American friend's PC'

b. amerika-no kurasuméeto-no rapputóppu [[[u] a] a]
'my American classmate's laptop'

c. amerika-no kurasum**é**eto-no pasokon [[[u] a] u]
'my American classmate's PC'

d. amerika-no tomodachi-no rapput**ó**ppu [[[u] u] a]
'my American friend's laptop'

e. isur**á**eru-no kurasum**é**eto-no rapput**ó**ppu [[[a] a] a]
'my Israeli classmate's laptop'

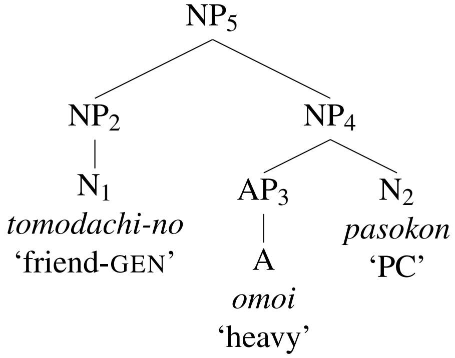
f. isur**á**eru-no kurasum**é**eto-no pasokon [[[a] a] u]
'my Israeli classmate's PC'

g. isur**á**eru-no tomodachi-no rapput**ó**ppu [[[a] u] a]
'my Isreali friend's laptop'

h. isur**á**eru-no tomodachi-no pasokon [[[a] u] u]
'my Israeli friend's PC'

The next template, (212c), is right-branching. Although Japanese is a right-headed language, right-branching is of course possible in structures like (216), where the possessor is one word and the possessum is modified.[1]

(216)



The accented words that can be substituted for those in (216) are *isuráeru-no* 'Israeli', *kurasuméeto-no* 'classmate's', and *rapputóppu* 'laptop'. Combined, these yield (217).

(217) *Three-word right-branching examples*

a. tomodachi-no omoi pasokon [[u] [[u] u]
'my friend's heavy PC'

b. tomodachi-no atarash**í**i rapput**ó**ppu [[u] [[a] a]
'my friend's new laptop'

[1] It is likely that *pasokon* in (216) should project (count as) an NP, rather than just an N^0. This structure is also inconsistent with the assumption that possessors are specifiers or complements, in that it treats *tomodachi-no* as an adjunct. These details turn out not to matter for the main points of this chapter, in large part due to BinMin. I therefore use IM's exact structures for ease of comparison.

c. tomodachi-no atarash**í**i pasokon [[u] [[a] u]
‘my friend’s new PC’

d. tomodachi-no omoi rapput**ó**ppu [[u] [[u] a]
‘my friend’s heavy laptop’

e. kurasum**é**eto-no atarash**í**i rapput**ó**ppu [[a] [[a] a]
‘my classmate’s new laptop’

f. kurasum**é**eto-no atarash**í**i pasokon [[a] [[a] u]
‘my classmate’s new PC’

g. kurasum**é**eto-no omoi rapput**ó**ppu [[a] [[u] a]
‘my classmate’s heavy laptop’

h. kurasum**é**eto-no omoi pasokon [[a] [[u] u]
‘my classmate’s heavy PC’

Four-word examples for the template (212d) can be constructed along similar lines. (See also Kubozono (1989).)

This completes the tour of the syntactic inputs. But what of the prosodic phrasings? In the two-word left-branching examples, the phrasing depends on the accentedness of ω_1, the possessor, and not at all on that of ω_2, the possessum. When ω_1=u, the possessor and possessum share a single minimal φ. When ω_1=a, each occupies a minimal φ of its own, but are both contained in a maximal φ as well, as shown in (218).

(218) *Left-branching* 2ω (Ito and Mester 2013, 2017)
a. [[u] u] → (u u)
b. [[u] a] → (u a)
c. [[a] a] → ((a) (a))
d. [[a] u] → ((a) (u))

The three-word left-branching outputs of form [[[w] x] y] are all phrased as if by a bottom-up, cyclic prodecure: first phrase [[w] x] just as you would in isolation (see (218)), and then adjoin *y*. When either word of [[w] x] is accented, *y* is placed in its own minimal φ. Otherwise, *y* is a bare ω, sister to φ. Concretely, the input-output mappings are those in (219).

(219) *Left-branching 3ω* (Ito and Mester 2013, 2017)
a. [[[u] u] u] → ((u u) u)
b. [[[u] a] a] → ((u a) (a))
c. [[[u] a] u] → ((u a) (u))
d. [[[u] u] a] → ((u u) (a))
e. [[[a] a] a] → (((a) (a)) (a))
f. [[[a] a] u] → (((a) (a)) (u))
g. [[[a] u] a] → (((a) (u)) (a))
h. [[[a] u] u] → (((a) (u)) (u))

The right-branching trees turn out to be, in some sense, the "mirror images" of the left-branching ones. The second and third word phrase as they would in isolation, and the first word is adjoined to this structure, either with a φ of its own (if it is accented) or not. This is shown in (220).

(220) *Right-branching 3ω* (Ito and Mester 2013, 2017)
a. [[u] [[u] u]] → (u (u u))
b. [[u] [[a] a]] → (u ((a) (a)))
c. [[u] [[a] u]] → (u ((a) (u)))
d. [[u] [[u] a]] → (u (u a))
e. [[a] [[a] a]] → ((a) ((a) (a)))
f. [[a] [[a] u]] → ((a) ((a) (u)))
g. [[a] [[u] a]] → ((a) (u a))
h. [[a] [[u] u]] → ((a) (u u))

Finally, the four-word left-branching structures are always parsed according to Kubozono's mismatch, but each half (i.e. words 1 and 2, or words 3 and 4) are phrased as they would be *as a constituent* in isolation. This is of course interesting, since words 3 and 4 do not form a syntactic constituent at all.

(221) *Left-branching 4ω* (Ito and Mester 2013, 2017)

a. [[[[u] u] u] u] → ((u u) (u u))
b. [[[[u] u] u] a] → ((u u) (u a))
c. [[[[u] u] a] a] → ((u u) ((a) (a)))
d. [[[[u] u] a] u] → ((u u) ((a) (u)))
e. [[[[u] a] u] u] → ((u a) (u u))
f. [[[[u] a] u] a] → ((u a) (u a))
g. [[[[u] a] a] a] → ((u a) ((a) (a)))
h. [[[[u] a] a] u] → ((u a) ((a) (u)))
i. [[[[a] a] u] u] → (((a) (a)) (u u))
j. [[[[a] a] u] a] → (((a) (a)) (u a))
k. [[[[a] a] a] a] → (((a) (a)) ((a) (a)))
l. [[[[a] a] a] u] → (((a) (a)) ((a) (u)))
m. [[[[a] u] u] u] → (((a) (u)) (u u))
n. [[[[a] u] u] a] → (((a) (u)) (u a))
o. [[[[a] u] a] a] → (((a) (u)) ((a) (a)))
p. [[[[a] a] a] u] → (((a) (u)) ((a) (u)))

We can summarize the four-word facts with "Kubozono's Generalized Mismatch" in (222).

(222) *Kubozono's Generalized Mismatch*
An input [[[[w] x] y] z] maps to an output (P Q), where P is the prosodic output of [[w] x] in isolation and Q is the prosodic output of [[y] z] in isolation.

We have now reviewed all 36 input–output mappings and can turn to IM's Match–Theoretic analysis.

5.2 NoLapseL, EqualSisters-2, and Match Theory

The IM analysis offers a number of important insights regarding matching, binarity, and φ-headedness in Japanese, which will remain untouched in my subsequent re-interpretation. In addition, we will see exactly where NoLapseL and EqualSisters-2 fall short, and thereby set the stage for the introduction of Accent Percolation and NoPostAccW.

5.2.1 GEN and CON

GEN for IM is the same as it is for SPOT: Weaking Layering with recursion, but with exhaustive parsing. CON is the following:

(223) CON *from* Ito and Mester (2017)

a. MATCH($XP_{[+max]}$,φ)
b. MATCH(XP,φ)
c. MATCH($\varphi_{[-min]}$,XP)
d. BINMIN
e. BINMAXBRANCHES
f. BINMAXWORDS
g. ACCENTASHEAD
h. NOLAPSEL
i. EQUALSISTERS
j. EQUALSISTERS-2

We have already encountered these constraints, with the exception of ACCENTASHEAD, NOLAPSEL, and EQUALSISTERS-2. ACCASHD is defined as follows:

(224) ACCENTASHEAD
Every accent is the head of a minimal phrase φ_{min}. Assign one violation for each accent that is not the head of a φ_{min}.

The constraint makes reference to "heads", and on a theoretical level, we might posit a head-marking algorithm in GEN, along the following lines:

(225) *φ-Heads and* GEN
For every node φ, one of φ's daughter nodes is designated as the head by GEN. φ-headedness needs not be explicitly indicated by GEN here,[2] but the following conditions hold (which are necessary for evaluation of ACCENTASHEAD):

a. If φ's daughters are all ω, and at least one daughter is accented, then the head of φ is not an unaccented word.
b. If φ has a daughter of category φ, then the head of φ is not an ω.

[2] That is to say, SPOT's GEN does not label nodes as heads and non-heads. "Knowledge" of headedness theory is confined to the constraint ACCENTASHEAD.

However, SPOT's Gen does not need to implement head-marking, since AccAsHd really just amounts to saying that no two accented words can occupy the same minimal φ. Examples of AccAsHd violations are given in (226).

(226) *Evaluation of* AccentAsHead (Ito and Mester 2013, 2017)

	AccentAsHead
a. $(\varphi$ a)	$*$
b. (a $\varphi)$	$*$
c. (a u)	0
d. (u a)	0
e. (a a)	$*$
f. (a a a)	**
g. (a a a a)	***
h. (a a a a a)	$****$

In addition, IM propose that the surface tonal properties of words can affect the phrasing. In Japanese, lexical accent specification is related to surface tone, but the tone of unaccented words is variable on the surface. When a ω_{u} is φ-initial, it exhibits a tonal rise, meaning that the word is linked to at least one H tone. However, when ω_{u} occurs elsewhere in the phrase, it will simply pick up the tone of the preceding element. If the preceding word is ω_{a}, then the accented mora will have induced a fall, meaning that a ω_{u} links to an L tone but to no H. This is summarized in (227).

(227) *Distribution of Fully L-Toned Words*
$\text{u} \rightarrow \mathring{\text{u}} \,/\, (_{\varphi} \ldots \text{a} \ldots \_\_ \ldots)$

In other words, ω_{u} can only get a high tone by having no ω_{a} to its left within the same minimal φ. NoLapseL simply penalizes the configurations in which unaccented words have no H at all:

(228) NoLapse-L
No tonal lapses. Assign one violation for each fully L-toned ω in φ.

The only two-word parse that violates NoLapse-L is (a ů). The first word has a rise and fall, meaning that the poor unaccented word is left with only low tone.

Anticipating the analysis to some extent, IM notice an issue which prompts them to introduce the final new constraint, EQUALSISTERS-2. They observe that [[[u] u] u]→((u u) u) and [[[a] u] u]→(((a) (u)) (u)), both seen in Japanese, are not possible under the same ranking. For some reason, the final word of [[[a] u] u] needs to project a phrase of its own. The phonetic effect of this is that it gets a rise that it would otherwise lack, in virtue of being at the left edge of φ. But trying to square this with ((u u) u), where the final word is simply bare, turns out to be impossible without some additional constraint.

BINMIN does not want the third word to have a φ of its own, but EQUALSISTERS does, since the sister to the final word or its projection is of category φ.

(229) *Contradiction observed by IM*

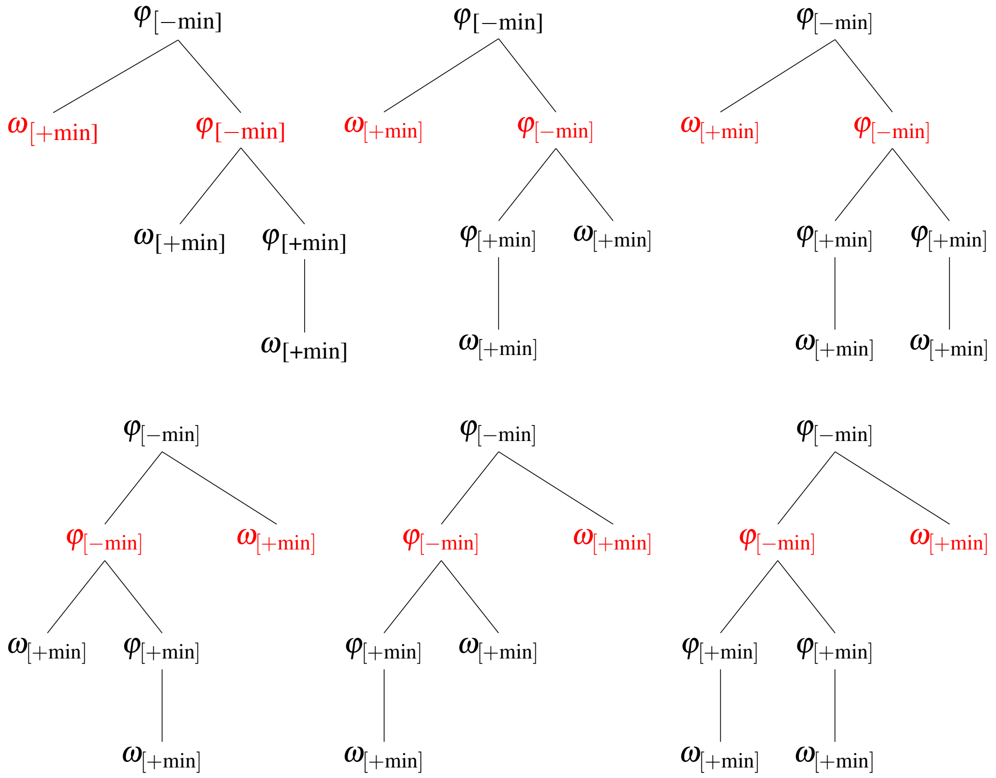
[[[ω] u] u]	BINMIN	EQUALSISTERS
a. ((u u) u) ∼ ((u u) (u))	W	L
b. (((a) (u)) (u)) ∼ (((a) (u)) u)	L	W

None of the other constraints assign anything but “e” to these comparisons. That is, they cannot resolve the contradiction. To solve the problem, IM propose a constraint EQUALSISTERS-2.

(230) EQUALSISTERS-2 (Ito and Mester 2017, pp. 14-15)
“Let us assume, for concreteness, that besides the general EQUALSISTERS constraint ... penalizing any difference in category between sister nodes, there is a more stringent constraint penalizing a situation where a category inequality is aggravated by a concomitant projection level inequality. We might call the more stringent constraint EQUALSISTERS-2, violated when λ^j is sister to κ^i, with $\lambda > \kappa$ and $j > i$.”

Although IM use numerical superscripts to distinguish projection levels, the constraint itself (when we are not considering recursive prosodic words) needs only the distinction [±min]. Out of all thirty-three tree-shapes containing three words, six violate EQUALSISTERS-2:

(231) *The 6 out of 33 three-ω trees that violate* EQUALSISTERS-2


$\varphi_{[-\text{min}]}$
$\omega_{[+\text{min}]}$
$\varphi_{[-\text{min}]}$
$\varphi_{[+\text{min}]}$
$\omega_{[+\text{min}]}$

Clearly, (((a) (u)) u) violates EQSIS-2 while ((u u) u) does not. Thus, the ranking EQSIS-2 ≫ BINMIN ≫ EQSIS resolves the contradiction.

As IM point out, EQSIS-2 assigns a subset of the violations assigned by the more general EQSIS. The constraints are compared with respect to all three-word trees in (232).

(232) *Comparison of* EQUALSISTERS *and* EQUALSISTERS-2

		EQUALSISTERS	EQUALSISTERS-2
1.	$(\omega_1)\,(\omega_2)\,(\omega_3)$	0	0
2.	$(\omega_1)\,(\omega_2\,(\omega_3))$	$*\ (\omega_2\varphi)$	0
3.	$(\omega_1)\,((\omega_2)\,\omega_3)$	$*\ (\varphi\omega_3)$	0
4.	$(\omega_1)\,((\omega_2)\,(\omega_3))$	0	0
5.	$(\omega_1)\,(\omega_2\,\omega_3)$	0	0
6.	$(\omega_1\,(\omega_2))\,(\omega_3)$	$*\ (\omega_1\varphi)$	0
7.	$((\omega_1)\,\omega_2)\,(\omega_3)$	$*\ (\varphi\omega_2)$	0

8. $((\omega_1)\ (\omega_2))\ (\omega_3)$	0	0
9. $(\omega_1\ \omega_2)\ (\omega_3)$	0	0
10. $(\omega_1\ (\omega_2)\ \omega_3)$	$**\ (\omega_1\varphi,\ \varphi\omega_3)$	0
11. $(\omega_1\ (\omega_2)\ (\omega_3))$	$*\ (\omega_1\varphi)$	0
12. $(\omega_1\ (\omega_2\ (\omega_3)))$	$**\ (\omega_1\varphi,\ \omega_2\varphi)$	$*\ (\omega_1\varphi)$
13. $(\omega_1\ ((\omega_2)\ \omega_3))$	$**\ (\omega_1\varphi,\ \varphi\omega_3)$	$*\ (\omega_1\varphi)$
14. $(\omega_1\ ((\omega_2)\ (\omega_3)))$	$*\ (\omega_1\varphi)$	$*\ (\omega_1\varphi)$
15. $(\omega_1\ (\omega_2\ \omega_3))$	$*\ (\omega_1\varphi)$	0
16. $((\omega_1)\ \omega_2\ (\omega_3))$	$**\ (\varphi\omega_2,\ \omega_2\varphi)$	0
17. $((\omega_1)\ (\omega_2)\ \omega_3)$	$*\ (\varphi\omega_3)$	0
18. $((\omega_1)\ (\omega_2)\ (\omega_3))$	0	0
19. $((\omega_1)\ \omega_2\ \omega_3)$	$*\ (\varphi\omega_2)$	0
20. $((\omega_1)\ (\omega_2\ (\omega_3)))$	$*\ (\omega_2\varphi)$	0
21. $((\omega_1)\ ((\omega_2)\ \omega_3))$	$*\ (\varphi\omega_3)$	0
22. $((\omega_1)\ ((\omega_2)\ (\omega_3)))$	0	0
23. $((\omega_1)\ (\omega_2\ \omega_3))$	0	0
24. $(\omega_1\ \omega_2\ (\omega_3))$	$*\ (\omega_2\varphi)$	0
25. $((\omega_1\ (\omega_2))\ \omega_3)$	$**\ (\omega_1\varphi,\ \varphi\omega_3)$	$*\ (\varphi\omega_3)$
26. $((\omega_1\ (\omega_2))\ (\omega_3))$	$*\ (\omega_1\varphi)$	0
27. $(((\omega_1)\ \omega_2)\ \omega_3)$	$**\ (\varphi\omega_2,\ \varphi\omega_3)$	$*\ (\varphi\omega_3)$
28. $(((\omega_1)\ \omega_2)\ (\omega_3))$	$*\ (\omega_1\varphi)$	0
29. $(((\omega_1)\ (\omega_2))\ \omega_3)$	$*\ (\varphi\omega_3)$	$*\ (\varphi\omega_3)$
30. $(((\omega_1)\ (\omega_2))\ (\omega_3))$	0	0
31. $((\omega_1\ \omega_2)\ \omega_3)$	$*\ (\varphi\omega_3)$	0
32. $((\omega_1\ \omega_2)\ (\omega_3))$	0	0
33. $(\omega_1\ \omega_2\ \omega_3)$	0	0

5.2.2 Analytical Successes

IM's full system, by distinguishing EqualSisters and EqualSisters-2, is able to have [[[u] u] u]→((u u) u) and [[[a] u] u]→(((a) (u)) (u)) in the same language—a major success in light of the contradictory ranking of EqSis and BinMin in the absence of EqSis-2. The IM system has several other points in its favor as well.

5.2.2.1 Two-Word Phrases

When a two-word phrase is entirely unaccented, syntactic structure is flattened; although the first word of [[u] u] constitutes its own XP, the ranking BINMIN $\gg$ MATCH-XP means that the these two words are grouped in a single minimal φ. A pure ERC showing only this ranking is seen in the tableau row (233c).

(233) *Two Unaccented Words for IM* (3/3 optima; 0/30 HBs)

[[u] u]		MM-XP	BMaxB	AxHd	ES-2	NLL	BMaxW	M-φ-nm	BMin	M-XP	ES
a. →	(u u)	0	0	0	0	0	0	0	0	*	0
b.	((u) u)	e	e	e	e	e	e	e	*W	L	*W
c.	((u) (u))	e	e	e	e	e	e	e	**W	L	e

Here, we see that BINMIN must dominate MATCH(XP,φ, since the initial word does not get a phrase of its own.

The same situation holds when an unaccented word precedes an accented one:

(234) *Unaccented-Accented for IM* (3/3 optima; 0/30 HBs)

[[u] a]		MM-XP	BMaxB	AxHd	ES-2	NLL	BMaxW	M-φ-nm	BMin	M-XP	ES
a. →	(u a)	0	0	0	0	0	0	0	0	*	0
b.	((u) (a))	e	e	e	e	e	e	e	**W	L	e
c.	((u) a)	e	e	*W	e	e	e	e	*W	L	*W

In (u a), the accented word is designated the head, and does not need to project its own φ.

A high ranknig of NOLAPSEL ensures that *(a u) is eschewed in favor of ((a) (u)):

(235) *Accented–Unaccented for IM* (4/4 optima; 0/29 HBs)

[[a] u]		MM-XP	BMaxB	AxHd	ES-2	NLL	BMaxW	M-p[-min]	BMin	M-XP	ES
a. →	((a) (u))	0	0	0	0	0	0	0	**	0	0
b.	((a) u)	e	e	e	e	*W	e	e	*L	e	*W
c.	(a u)	e	e	e	e	*W	e	e	L	*W	e
d.	(a (u))	e	e	*W	e	e	e	e	*L	*W	*W

Here, AccentAsHead rules out (a (u)), since an ω sister to φ is never the head. NoLapse rules out ((a) u) and (a u). Since an accented word includes a fall, the unaccented word following it will lack a high tone unless it is placed at the beginning of its own φ. This means that the phrasal accent word must project its own φ, and that the non-phrasal second word must do so as well. Both projections are for pure markedness reasons, not to better satisfy the Match constraints.

A high ranking of AccentAsHead ensures that ((a) (a)) beats *(a a).

(236) *Accented-Unaccented for IM* (3/3 optima; 0/30 hbs)

[[a] a]	MM-XP	BMaxB	AxHd	ES-2	NLL	BMaxW	M-φ-nm	BMin	M-XP	ES
a. → ((a) (a))	0	0	0	0	0	0	0	**	0	0
b. ((a) a)	e	e	*W	e	e	e	e	*L	e	*W
b. (a a)	e	e	*W	e	e	e	e	L	*W	e

The two-word phrasings show the main aspects of IM's use of AccentAsHead and NoLapse. Below, we see that their constraint set is also effective in predicting Kubozono's Mismatch.

5.2.2.2 Kubozono's Mismatch

IM's analysis deals readily with Kubozono's Mismatch. This is shown in the following tableau, which includes all 21 optima for [[[[u] u] u] u] in FacTyp$_{\text{Match-19}}$

(237) *Kubozono's Mismatch in $S_{\text{Match-18}}$* (21/21 optima; 0/232 hbs)

[[[[u] u] u] u]	MM-XP	BMaxB	AxHd	ES-2	NLL	BMaxW	M-φ-nm	BMin	M-XP	ES
203. ((u u) (u u))	0	0	0	0	0	*	*	0	^{2}	0
187. (((u) u) (u u))	e	e	e	e	e	*e	*e	*W	*L	*W
195. (((u) (u)) (u u))	e	e	e	e	e	*e	*e	^{2}W	*L	e
242. ((((u) u) (u)) (u))	e	e	e	e	e	^{2}W	L	^{3}W	L	*W
246. ((((u) (u)) (u)) (u))	e	e	e	e	e	^{2}W	L	^{4}W	L	e
248. (((u u) u) (u))	e	e	e	e	e	^{2}W	L	*W	*L	*W
250. (((u u) (u)) (u))	e	e	e	e	e	^{2}W	L	?W	*L	e

239.	((((u) u) u) u)	e	e	e	^{2}W	e	^{2}W	L	*W	L	^{3}W
247.	(((u u) u) u)	e	e	e	*W	e	^{2}W	L	e	*L	^{2}W
181.	(((u) u) (u) u)	e	*W	e	e	e	*e	L	^{2}W	*L	^{2}W
190.	(((u) (u)) (u) (u))	e	*W	e	e	e	*e	L	^{4}W	*L	e
199.	((u u) u u)	e	*W	e	e	e	*e	L	e	^{2}e	*W
253.	(u u u u)	e	*W	e	e	e	*e	L	e	^{3}W	e
183.	(((u) u) u u)	e	*W	e	*W	e	*e	L	*W	*L	^{2}W
39.	((u) u) (u) (u)	*W	e	e	e	e	L	L	^{3}W	^{2}e	*W
43.	((u) u) (u u)	*W	e	e	e	e	L	*e	*W	^{2}e	*W
44.	((u) (u)) (u) (u)	*W	e	e	e	e	L	L	^{4}W	^{2}e	e
48.	((u) (u)) (u u)	*W	e	e	e	e	L	*e	^{2}W	^{2}e	e
49.	(u u) (u) (u)	*W	e	e	e	e	L	L	^{2}W	^{3}W	e
53.	(u u) (u u)	*W	e	e	e	e	L	*e	e	^{3}W	e
75.	((u u) u) (u)	*W	e	e	e	e	*e	L	*W	^{2}e	*W

Without going through the arguments in depth, binarity and Match(XP$_{[+\text{max}]}$,φ) play the leading role, overriding Match(φ,XP$_{[-\text{min}]}$ (the anti-mismatch constraint), Match(XP,φ), and EqualSisters. The constraint EqualSisters-2 appears to help as well, but plays little role, essentially chiming in approvingly at the effects of BinMaxB and BinMaxW. There is, however, a remaining challenge for the IM analysis.

5.2.3 A Remaining Challenge

Above, we saw that without ES-2, the constraint ES and BinMin enter into an irresolvable conflict, making it impossible to capture every Japanese phrasing with the same grammar. One winner-loser pair insists on ES $\gg$ BinMin, while another insists on BinMin $\gg$ ES. To solve the conflict, IM introduced ES-2. But it turns out that EqSis-2 has exactly the same problem as EqSis when we consider right-branching inputs as well.

The full IM typology contains two languages that are extremely close to Japanese: L99 and L104. In L99, everything but pair 12, [[[a] u] u]→(((a) (u)) (u)), comes out as it should. Here, we are faced with the same problem as before, with the nagging competitor *(((a) (u)) u) beating the desired (((a) (u)) (u)).

(238) *L99 in $S_{\text{Match-19}}$: Not Quite Japanese-Compliant*

1.	[[u] u]	→	(u u)	
2.	[[u] a]	→	(u a)	
3.	[[a] a]	→	((a) (a))	
4.	[[a] u]	→	((a) (u))	
5.	[[[u] u] u]	→	((u u) u)	
6.	[[[[u] a] a]	→	((u a) (a))	
7.	[[[u] a] u]	→	((u a) (u))	
8.	[[[u] u] a]	→	((u u) (a))	
9.	[[[a] a] a]	→	(((a) (a)) (a))	
10.	[[[a] a] u]	→	(((a) (a)) (u))	
11.	[[[a] u] a]	→	(((a) (u)) (a))	
12.	[[[a] u] u]	→	*(((a) (u)) u)	*Desired:* (((a) (u)) (u))
13.	[[u] [[u] u]	→	(u (u u))	
14.	[[u] [[a] a]	→	((u) ((a) (a)))	
15.	[[u] [[a] u]	→	((u) ((a) (u)))	
16.	[[u] [[u] a]	→	(u (u a))	
17.	[[a] [[a] a]	→	((a) ((a) (a)))	
18.	[[a] [[a] u]]	→	((a) ((a) (u)))	
19.	[[a] [[u] a]	→	((a) (u a))	
20.	[[a] [[u] u]]	→	((a) (u u))	
21.	[[[[u] u] u] u]	→	((u u) (u u))	
22.	[[[[u] u] u] a]	→	((u u) (u a))	
23.	[[[[u] u] a] a]	→	((u u) ((a) (a)))	
24.	[[[[u] u] a] u]	→	((u u) ((a) (u)))	
25.	[[[[u] a] u] u]	→	((u a) (u u))	
26.	[[[[u] a] u] a]	→	((u a) (u a))	
27.	[[[[u] a] a] a]	→	((u a) ((a) (a)))	
28.	[[[[u] a] a] u]	→	((u a) ((a) (u)))	
29.	[[[[a] a] u] u]	→	(((a) (a)) (u u))	
30.	[[[[a] a] u] a]	→	(((a) (a)) (u a))	
31.	[[[[a] a] a] a]	→	(((a) (a)) ((a) (a)))	
32.	[[[[a] a] a] u]	→	(((a) (a)) ((a) (u)))	
33.	[[[[a] u] u] u]	→	(((a) (u)) (u u))	
34.	[[[[a] u] u] a]	→	(((a) (u)) (u a))	
35.	[[[[a] u] a] a]	→	(((a) (u)) ((a) (a)))	
36.	[[[[a] u] a] u]	→	(((a) (u)) ((a) (u)))	

In L104, the problem with candidate 12 is resolved, but now candidates 14 and 15 are overexuberant in giving words their own minimal φ. These are right-branching candidates in which the first word should not project its own φ.

(239) *L104 in* $S_{\text{Match-19}}$*: Not Quite Japanese-Compliant Either*

1.	[[u] u]	→	(u u)	
2.	[[u] a]	→	(u a)	
3.	[[a] a]	→	((a) (a))	
4.	[[a] u]	→	((a) (u))	
5.	[[[u] u] u]	→	((u u) u)	
6.	[[[[u] a] a]	→	((u a) (a))	
7.	[[[u] a] u]	→	((u a) (u))	
8.	[[[u] u] a]	→	((u u) (a))	
9.	[[[a] a] a]	→	(((a) (a)) (a))	
10.	[[[a] a] u]	→	(((a) (a)) (u))	
11.	[[[a] u] a]	→	(((a) (u)) (a))	
12.	[[[a] u] u]	→	(((a) (u)) (u))	
13.	[[u] [[u] u]	→	(u (u u))	
14.	[[u] [[a] a]	→	*((u) ((a) (a)))	Desired: (u ((a) (a)))
15.	[[u] [[a] u]	→	*((u) ((a) (u)))	Desired: (u ((a) (u)))
16.	[[u] [[u] a]	→	(u (u a))	
17.	[[a] [[a] a]	→	((a) ((a) (a)))	
18.	[[a] [[a] u]]	→	((a) ((a) (u)))	
19.	[[a] [[u] a]	→	((a) (u a))	
20.	[[a] [[u] u]]	→	((a) (u u))	
21.	[[[[u] u] u] u]	→	((u u) (u u))	
22.	[[[[u] u] u] a]	→	((u u) (u a))	
23.	[[[[u] u] a] a]	→	((u u) ((a) (a)))	
24.	[[[[u] u] a] u]	→	((u u) ((a) (u)))	
25.	[[[[u] a] u] u]	→	((u a) (u u))	
26.	[[[[u] a] u] a]	→	((u a) (u a))	
27.	[[[[u] a] a] a]	→	((u a) ((a) (a)))	
28.	[[[[u] a] a] u]	→	((u a) ((a) (u)))	
29.	[[[[a] a] u] u]	→	(((a) (a)) (u u))	
30.	[[[[a] a] u] a]	→	(((a) (a)) (u a))	
31.	[[[[a] a] a] a]	→	(((a) (a)) ((a) (a)))	
32.	[[[[a] a] a] u]	→	(((a) (a)) ((a) (u)))	
33.	[[[[a] u] u] u]	→	(((a) (u)) (u u))	
34.	[[[[a] u] u] a]	→	(((a) (u)) (u a))	
35.	[[[[a] u] a] a]	→	(((a) (u)) ((a) (a)))	
36.	[[[[a] u] a] u]	→	(((a) (u)) ((a) (u)))	

The difference between L99 and L104 has exclusively to do with the relative ranking of BinMin and EqSis-2:

(240) *Difference between L99 and L104*
L99: BinMin ≫ EqSis-2
L104 EqSis-2 ≫ BinMin

A contradiction therefore arises for Japanese. The only constraint favoring the correct winner for [[u] [[a] a]]→(u ((a) (a))) is BinMin. Match-XP, EqSis, and EqSis-2 all favor *((u) ((a) (a))) instead. But BinMin must be ranked below both EqSis and EqSis-2 in order to still account for [[[a] u] u]→(((a) (u)) (u)).

(241) *Contradiction in IM system*

L-branching 12, R-branching 14	M-XP$_{[+max]}$	BMaxB	AxHd	*LL	BMaxW	M-$\varphi_{[-min]}$	BMin	M-XP	ES	ES-2
12: (((a) (u)) (u)) ∼ (((a) (u)) u)	e	e	e	e	e	e	L	e	W	W
14: (u ((a) (a))) ∼ ((u) ((a) (a)))	e	e	e	e	e	e	W	L	L	L

To solve the problem, I propose replacing EqualSisters-2 and NoLapseL with a new constraint, NoPostAccentWord.

5.3 NoPostAccW and Accent Percolation

A full solution to Japanese (i.e., for the 36 Japanese phrasings considered in this chapter) involves accent percolation:

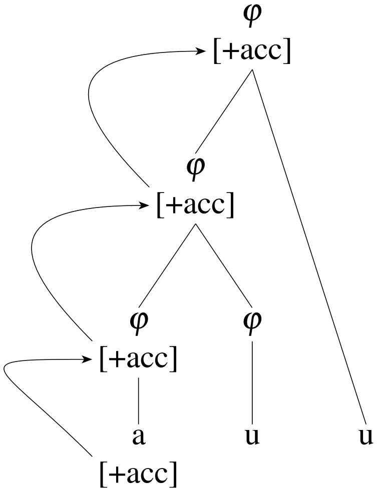
(242) *Accent Percolation*
A φ is [+accented] iff it contains an ω that is [+accented].

Once accent percolation is assumed, we can replace NoLapseL with NoPostAccentWord:

(243) NOPOSTACCENTWORD (NOPOSTACCW)
$*\pi_{[+\text{acc}]}\ \omega$, where π, ω are adjacent sisters. π is any prosodic category.

The constraint is violated by *(((a) (u)) u), since the [+accented] feature of the first word percolates up to every φ above it.

(244) *Accent Percolation*



The second-highest φ, and the third word, are adjacent sisters $\varphi_{[+\text{acc}]}\omega$, clearly running afoul of NOPOSTACCW. By placing the third word in a minimal φ, the violation is avoided.

NOPOSTACCW, like NOLAPSEL, accounts for [[a] u]→((a) (u)), *(a ů). However, the third word in (((a) (u)) u) does not violate NOLAPSEL, since it rides along for free on the high tone introduced by the preceding φ-initial unaccented word. The added strictness of NOPOSTACCW successfully removes (((a) (u)) u) from the running, while NOLAPSEL alone cannot. Details of the ranking are shown in the next subsection.

5.3.1 Japanese with NoPostAccW

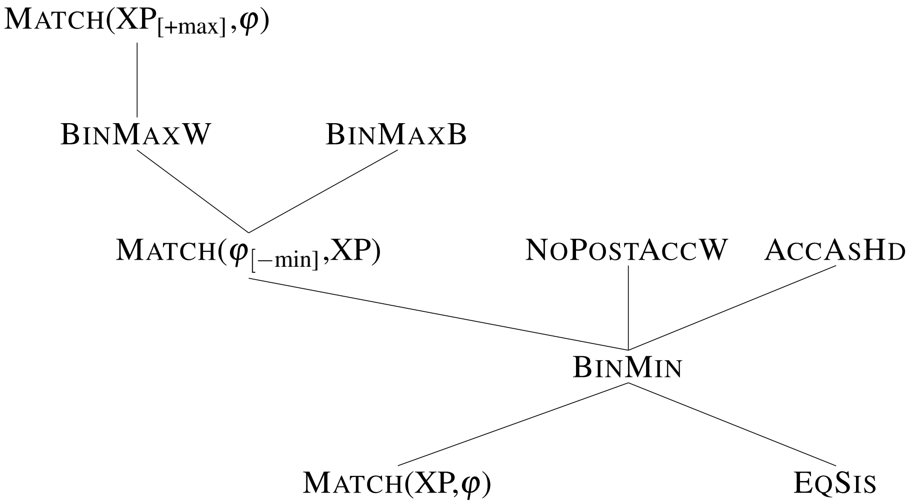
We saw above that a contradiction arises in IM's system when we consider left-branching [[[a] u] u]→(((a) (u)) (u)) on the one hand, and right-branching [[u] [[a] a]]→ (u ((a) (a))) on the other. Below, we see that replacing EqualSisters-2 and NoLapseL with NoPostAccW sovel the problem entirely.

(245) *Replacing ambivalent* NoLapseL *with* NoPostAccW

L-branching 12 R-branching 14		MM-XP	BMaxB	AxHd	**NPAW**	BMaxW	M-φ-nm	BMin	M-XP	ES
12: ∼	(((a) (u)) (u)) (((a) (u)) u)	e	e	e	**W**	e	e	L	e	W
14: ∼	(u ((a) (a))) ((u) ((a) (a)))	e	e	e	e	e	e	W	L	L

The Hasse diagram for Japanese in this system is shown below.

(246) *Hasse Diagram for Japanese (L257) in* $S_{\text{Match-20}}$



To sum up, IM propose an ingenious solution for much of the Japanese data relating accent and phrasing. Leaving much of their analysis intact, we can replace NoLapseL and EqualSisters-2 with NoPostAccW to deal with some obstinate remaining challenges.

5.4 Command Theory and Accent: Remaining Challenges

Unfortunately, I still do not have a complete Command–Theoretic solution to the full array of Japanese data. In this section, I will discuss a language with many of the correct mappings, and show just where it goes wrong. The system is $S_{\text{Com.5}}$, with the following constraint set:

(247) CON$_{\text{Com.5}}$
a. NOPOSTACCW
b. ACCENTASHEAD
c. GROUPMAX
d. BINMAXB
e. BINMAXW
f. BINMIN
g. MUTUALSPLIT
h. EQUALSISTERS
i. CC-φ

The only new constraint here is MUTUALSPLIT, a stricter version of ANTI-CC-φ:

(248) MUTUALSPLIT
If ω_i and ω_{i+1} are **not mutually** commanding, then assign a violation if there is no φ containing ω_i and excluding ω_{i+1}, and a violation if there is no φ containing ω_{i+1} and excluding ω_i.

The definition differs from that of ANTI-CC-φ only in that "not" scopes over "mutually". It is worth including this constraint since ANTI-CC-φ itself is not violated by any candidates, given that every word is in at least one c-pair with every other, given the inputs.

Unfortunately, Japanese is not included in the factorial typology of this system. One language (L161) comes fairly close, but exhibits six incorrect mappings out of thirty-six:

(249) *L161 in $S_{\text{Com.5}}$: 6 of 36 are incorrect*

1.	[[u] u]	→	(u u)	
2.	[[u] a]	→	(u a)	
3.	[[a] a]	→	((a) (a))	
4.	[[a] u]	→	((a) (u))	
5.	[[[u] u] u]	→	((u u) u)	
6.	[[[[u] a] a]	→	((u a) (a))	
7.	[[[u] a] u]	→	((u a) (u))	
8.	[[[u] u] a]	→	*(u (u a))	*Desired*: ((u u) (a))
9.	[[[a] a] a]	→	(((a) (a)) (a))	
10.	[[[a] a] u]	→	(((a) (a)) (u))	
11.	[[[a] u] a]	→	*((a) (u a))	*Desired*: (((a) (u)) (a))
12.	[[[a] u] u]	→	*((a) (u u))	*Desired:* (((a) (u)) (u))
13.	[[u] [[u] u]	→	(u (u u))	
14.	[[u] [[a] a]	→	*((u a) (a))	*Desired*: ((u) ((a) (a)))
15.	[[u] [[a] u]	→	*((u a) (u))	*Desired*: ((u) ((a) (u)))
16.	[[u] [[u] a]	→	(u (u a))	
17.	[[a] [[a] a]	→	((a) ((a) (a)))	
18.	[[a] [[a] u]]	→	((a) ((a) (u)))	
19.	[[a] [[u] a]	→	((a) (u a))	
20.	[[a] [[u] u]]	→	((a) (u u))	
21.	[[[[u] u] u] u]	→	((u u) (u u))	
22.	[[[[u] u] u] a]	→	((u u) (u a))	
23.	[[[[u] u] a] a]	→	((u u) ((a) (a)))	
24.	[[[[u] u] a] u]	→	((u u) ((a) (u)))	
25.	[[[[u] a] u] u]	→	((u a) (u u))	
26.	[[[[u] a] u] a]	→	((u a) (u a))	
27.	[[[[u] a] a] a]	→	((u a) ((a) (a)))	
28.	[[[[u] a] a] u]	→	((u a) ((a) (u)))	
29.	[[[[a] a] u] u]	→	(((a) (a)) (u u))	
30.	[[[[a] a] u] a]	→	(((a) (a)) (u a))	
31.	[[[[a] a] a] a]	→	(((a) (a)) ((a) (a)))	
32.	[[[[a] a] a] u]	→	(((a) (a)) ((a) (u)))	
33.	[[[[a] u] u] u]	→	(((a) (u)) (u u))	
34.	[[[[a] u] u] a]	→	(((a) (u)) (u a))	
35.	[[[[a] u] a] a]	→	(((a) (u)) ((a) (a)))	
36.	[[[[a] u] a] u]	→	*((a) (u a)) (u)	*Desired*: (((a) (u)) ((a) (u)))

The problem here is that a subphrasing (u a) is preferred over ((a) (a)) and ((a) (u)), leading to unobserved mismatches. To see why, consider the following comparative tableau (where AH is AccentAsHead, GM is GroupMax, MS is MutualSplit, and C is CC-φ):

(250) *Ranking paradox in* $\mathrm{S}_{\mathrm{Com.5}}$

Input	Wins	Loses	NPWA	AH	GM	BMB	BMW	BMin	MS	ES	C
[[a] u]	((a) (u))	(a u)	W					L			L
[[a] a]	((a) (a))	(a (a))		W				L		W	L
[[[u] u] u]	((u u) u)	(u u) (u)			W		L	W	L	L	W
[[[[u] u] a] a]	((u u) ((a) (a)))	(u (u a) (a))				W		L	W	W	L
[[[u u] a] a]	((u u) ((a) (a)))	((u (u a)) (a))					W	L	W	W	L
[[u u] u]	((u u) u)	((u u) (u))						W	L	L	W
[[[a u] u] a]	(((a) (u)) (u a))	((a) (u u)) (a)							W		L
[[u u] a]	((u u) (a))$_{J}$	(u (u a))$_{L161}$						**L**	W	W	W
[[a u] a]	(((a) (u)) (a))$_{J}$	((a) (u a))$_{L161}$						**L**	W		L

In L161, most of the Japanese phrasings depend on the ranking on display in the top part of this tableau. Looking at two of the problematic cases, in the bottom two rows, we see that BinMin favors incorrect winners which fare equally well on all higher ranked constraints. Ranking MS, ES, or C above BinMin would of course ruin other mappings. More research is needed to determine how this problem for CT can be overcome.

5.5 Conclusion

In conclusion, I have shown that NoPostAccentWord should replace NoLapseL and EqualSisters-2 in Ito and Mester (2013, 2017)'s Match–Theoretic analysis of Japanese phrasing, but that their analysis is correct in all other respects. In trying to develop a Command–Theoretic analysis of the same facts, we find that the data is recalcitrant.

Chapter 6

Conclusion

In Chapters 1 and 2, I argued that my Command Theory of the syntax–prosody interface is better suited than MT to deal with the Ditransitive Mismatch, and equally capable of dealing with Kubozono's Mismatch. These results suggest that the syntax–prosody mapping constraints want words that c-command each other to phrase together. In these chapters, it is shown to be possible, and perhaps even desirable, to replace MATCH(XP,φ) and MATCH(φ,XP) with CC-φ and ANTI-CC-φ.

In Chapter 3, we saw that Command Theory in its current form cannot handle all of the facts in the large-scale analysis of Japanase. Ito and Mester (2013, 2017)'s analysis also falls slightly short, but can be successfully amended by replacing NOLAPSEL and EQUALSISTERS-2 with my constraint NOPOSTACCENTWORD. As of yet, I do not have a similar solution for the problem that arises for Command Theory.

What is clear is that this is not the last word, even on these narrow questions. Whether the syntax–prosody mapping constraints refer to c-command or to actual constituents remains to be determined, but I have shown that c-command is worth paying close attention to, and that c-command constraints are a promising approach to syntax–prosody mismatches.

Appendix: The SPOT Interface

The Syntax–Prosody in Optimality application SPOT (Bellik et al. 2016) has two levels. On the one hand, there is a graphical user interface with user-friendly buttons and options for GEN and CON, as well as a tree-building tool for constructing syntactic inputs. An alternative to using the interface is to write one's own script to accomplish the same tasks of generation, evaluation, and the construction of a violation tableau. Here, we discuss each in turn.

The current SPOT interface has 20 constraints, of which 17 require an argument from either {CP, XP, X^0} or {ι, φ, ω}; in the JavaScript, these correspond to the node IDs 'cp', 'xp', 'x0', 'i', 'phi', and 'w'. For this dissertation, these arguments are set to the XP/φ level, with the exception of STRONGSTART, which takes the argument ω.

(251) *Syntax-prosody mapping constraints*

a. *Align/Wrap*

i. Align-Left
JS function name: alignLeft
Argument options: CP, XP, X^0
Discussed in: Ch. 1–4

ii. Align-Right
JS function name: alignRight
Argument options: CP, XP, X^0
Discussed in: Ch. 1–4

iii. Wrap
JS function name: wrap
Argument options: CP, XP, X^0
Discussed in: Ch. 1–4

b. *Match Theory*

i. MatchSP
JS function name: matchSP
Argument options: CP, XP, X^0
Discussed in: Ch. 1–5

ii. MatchPS
JS function name: matchPS
Argument options: ι, φ, ω
Discussed in: Ch. 1–5

(252) *Binarity Constraints*

a. *Counting branches*

i. BinMin(branches)
JS function name: binMinBranches
Argument options: ι, φ, ω

ii. BinMax(branches) - *categorical*
JS function name: binMaxBranches
Argument options: ι, φ, ω

b. *Counting words*[1]

i. BinMin(words)
JS function name: binMin2Words *Argument options*: ι, φ, ω

ii. BinMax(words) - *categorical*
JS function name: binMax2Words
Argument options: ι, φ, ω

iii. BinMax(words) - *gradient*
JS function name: binMax2WordsGradient
Argument options: ι, φ, ω

(253) *Markedness constraints on horizontal relationships*

a. *EqualSisters*

i. EqualSisters (adjacent)
JS function name: equalSistersAdj
Argument options: ι, φ, ω

ii. EqualSisters (pairwise)
JS function name: equalSistersPairwise
Argument options: ι, φ, ω

[1] Although not discussed, BinMin(words) yields exactly the same violation counts as BinMin(branches) when all terminal nodes are of category ω, as is the case for SPOT's current GEN functions.

iii. EqualSisters (first privilege)
JS function name: equalSistersFirstPrivilege
Argument options: ι, φ, ω

b. *StrongStart*

i. StrongStart
JS function name: strongStart_Elfner
Argument options: ι, φ, ω

(254) *Markedness constraints on vertical relationships*

a. Exhaustivity
JS function name: exhaust1
Argument options: none

b. Non-recursivity, assessed by dominated node
JS function name: nonRec1
Argument options: ι, φ, ω

c. Non-recursivity, assessed by non-overlapping leaves
JS function name: nonRecTruckenbrodt
Argument options: ι, φ, ω

(255) *Japanese: constraints on accentedness*

a. AccentAsHead
JS function name: accentAsHead
Argument options: none

b. NoLapse-L
JS function name: noLapseL
Argument options: none

References

Abney, S. P. (1987). *The English Noun Phrase in its Sentential Aspect*. Ph. D. thesis, MIT.

Abu-Mansour, M. H. (2011). The phonology-syntax interface: Phrasal syncope in Makkan Arabic. In E. Broselow and H. Ouali (Eds.), *Perspectives on Arabic Linguistics: Papers from the annual symposia on Arabic Linguistics*, Volume XXII-XXIII: College Park, Maryland, 2008 and Milwaukee, Wisconsin, 2009, pp. 35–56. John Benjamins Publishing Company.

Ackema, P. and A. Neeleman (2003). Context-sensitive spell-out. *Natural Language & Linguistic Theory 21*(4), 681–735.

Alber, B., N. DelBusso, and A. Prince (2016). From intensional properties to universal support. *Language 92*(2), e88–e116.

Baker, M. (1988). *Incorporation: A Theory of Grammatical Function Changing*. University of Chicago Press.

Barss, A. and H. Lasnik (1986). A note on anaphora and double objects. *Linguistic Inquiry 17*(2), 347–354.

Bellik, J., O. Bellik, and N. Kalivoda (2016). Syntax-Prosody in Optimality Theory.

Bickmore, L. (1989). *Kinyambo Prosody*. Ph. D. thesis, University of California, Los Angeles.

Bickmore, L. (1990). Branching nodes and prosodic categories. In S. Inkelas and D. Zec (Eds.), *The Phonology-Syntax Connection*, pp. 1–18. University of Chicago Press.

Bollinger, D. L. (1965). *Pitch accent and sentence rhythm*. Harvard University Press / Houkou Publishing Co.

Brasoveanu, A. and A. Prince (2011). Ranking and necessity: the fusional reduction algorithm. *Natural Language & Linguistic Theory 29*, 3–70.

Bruening, B. (2014). Precede-and-command revisited. *Language 90*(2), 342–388.

Büring, D. (2000). Let's phrase it! Focus, word order, and prosodic phrasing in German double object constructions. In G. Müller and W. Sternefeld (Eds.), *Competition in Syntax*, pp. 69–106. De Gruyter Mouton.

Cassimjee, F. and C. Kisseberth (1998). Optimal domains theory and Bantu tonology. In C. Kisseberth and L. Hyman (Eds.), *Theoretical Aspects of Bantu Tone*, pp. 265–314. CSLI.

Chametzky, R. A. (2000). *Phrase structure*. Blackwell Publishing.

Chen, M. Y. (1987). The syntax of Xiamen tone sandhi. *Phonology Yearbook 4*, 109–150.

Cheng, L. L.-S. and L. J. Downing (2007). The prosody and syntax of Zulu relative clauses. In N. C. Kula and L. Marten (Eds.), *SOAS Workping Papers in Linguistics*, Volume 15, pp. 51–63.

Cheng, L. L.-S. and L. J. Downing (2016). Phasal syntax = cyclic phonology? *Syntax 19*(2), 156–191.

Cho, Y. (1990). Syntax and phrasing in Korean. In S. Inkelas and D. Zec (Eds.), *The Phonology-Syntax Connection*, pp. 47–62. University of Chicago Press.

Chomsky, N. (1981). *Lectures on Government and Binding*. Dordrecht: Foris Publications.

Chomsky, N. (1986). *Barriers*. MIT Press.

Chomsky, N. (1995a). Bare phrase structure. In G. Webelhuth (Ed.), *Government and Binding Theory and the Minimalist Program*. Blackwell Publishing.

Chomsky, N. (1995b). *The Minimalist Program*. MIT Press.

Chomsky, N. and M. Halle (1968). *The Sound Pattern of English*. MIT Press.

Cinque, G. (1993). A null theory of phrase and compound stress. *Linguistic Inquiry 24*(2), 239–297.

Clemens, L. E. (2014). *Prosodic Noun Incorporation and Verb-Initial Syntax*. Ph. D. thesis, Harvard University.

Clements, G. N. (1978). Tone and syntax in Ewe. In D. J. Napoli (Ed.), *Elements of stress, tone, and intonation*, pp. 21–99. Georgetown University Press.

Collins, C. (1993). *Topics in Ewe Syntax*. Ph. D. thesis, MIT.

Cowper, E. A. and K. D. Rice (1987). Are phonosyntactic rules necessary? *Phonology Yearbook 4*, 185–194.

Demuth, K. and C. Harford (1999). Verb raising and subject inversion in Bantu relatives. *Journal of African Languages and Linguistics 20*(1), 41–61.

den Besten, H. (1983). On the interaction of root transformations and lexical deletive rules. In A. Werner (Ed.), *On the Formal Syntax of Westgermania: Papers from the 3rd Groningen Grammar Talks (3e Groninger Grammatikgespräche)*, Volume 3, pp. 47–131. John Benjamins Publishing Company.

Dobashi, Y. (2003). *Phonological Phrasing and Syntactic Derivation*. Ph. D. thesis, Cornell University.

Elfner, E. (2012). *Syntax-Prosody Interactions in Irish*. Ph. D. thesis, University of Massachusetts - Amherst.

Elfner, E. (2014). Syntax-prosody mismatches in Irish and English verb-initial structures. ET13: Prosody and Constituent Structure, May 8, 2014.

Embick, D. (2010). *Localism versus Globalism in Morphology and Phonology*. MIT Press.

Epstein, S. D. (1999). *Un-principled syntax: The derivation of syntactic relations*, pp. 317–45. MIT Press.

Ernst, T. (1994). M-command and precedence. *Linguistic Inquiry 25*(2), 327–335.

Féry, C. (2011). German sentence accents and embedded prosodic phrases. *Lingua 121*, 1906–1922.

Fukui, N. and M. Speas (1986). Specifiers and projections. In N. Fukui, T. Rappaport, and E. Sagey (Eds.), *MIT Working Papers in Linguistics 8*.

Gjersøe, S. M. (2015). Downstep and phonological phrases in Kikuyu. Master's thesis, Humboldt–Universität zu Berlin.

Goodman, M. (1967). Prosodic features of Bravanese, a Swahili dialect. *Journal of African Languages 6*, 278–284.

Grimshaw, J. (2005). Extended projection. In *Words and structure*. Stanford: CSLI.

Güneş, G. (2015). *Deriving prosodic structures*. Ph. D. thesis, University of Groningen.

Gussenhoven, C. (2005). Procliticized phonological phrases in English: Evidence from rhythm. *Studia Linguistica 59*(2), 174–193.

Hale, K. and E. Selkirk (1987). Government and tonal phrasing in Papago. *Phonology Yearbook 4*(151-183).

Halle, M. and A. Marantz (1993). Distributed morphology and the pieces of inflection. In K. Hale and S. J. Keyser (Eds.), *The View from Building 20: Essays in Linguistics in Honor of Sylvain Bromberger*. MIT Press.

Harley, H. and S. Miyagawa (2016). Syntax of ditransitives. In M. Aronoff (Ed.), *Oxford Research Encyclopedia in Linguistics*. Oxford University Press.

Hayes, B. (1989). The prosodic hierarchy in meter. In P. Kiparsky and G. Youmans (Eds.), *Rhythm and Meter*, pp. 201–260. Academic Press.

Hayes, B. (1990). Precompiled phrasal phonology. In S. Inkelas and D. Zec (Eds.), *The Phonology-Syntax Connection*, pp. 85–108. University of Chicago Press.

Henderson, R. (2012). Morphological alternations at the intonational phrase edge: The case of K'ichee'. *Natural Language & Linguistic Theory 30*, 741–787.

Ishihara, S. (2014). Match theory and the recursivity problem. In S. Kawahara and M. Igarashi (Eds.), *Proceedings of FAJL 7: Formal Approaches to Japanese Linguistics*, pp. 69–88.

Ito, J. and A. Mester (2013). Prosodic subcategories in Japanese. *Lingua 124*, 20–40.

Ito, J. and A. Mester (2017). Match theory and prosodic wellformedness constraints. In H. Zhang (Ed.), *Proceedings of Tianjin prosody conference*. Routledge.

Jackendoff, R. (1972). *Semantic interpretation in generative grammar*. MIT Press.

Jokweni, M. W. (1995). *Aspects of IsiXhosa phrasal phonology*. Ph. D. thesis, University of Illinois at Urbana-Champaign.

Jun, S.-A. (1998). The accentual phrase in the Korean prosodic hierarchy. *Phonology 15*(2), 189–226.

Kaisse, E. M. (1985). *Connected Speech: The Interaction of Syntax and Phonology*. Academic Press.

Kanerva, J. M. (1990). Focusing on phonological phrases in Chicheŵa. In S. Inkelas and D. Zec (Eds.), *The Phonology-Syntax Connection*, pp. 145–162. University of Chicago Press.

Kayne, R. (1994). *The Antisymmetry of Syntax*. MIT Press.

Kenstowicz, M. and C. Kisseberth (1977). *Topics in Phonological Theory*. Academic Press.

Kenstowicz, M. and C. Kisseberth (1990). Chizigula tonology: the word and beyond. In S. Inkelas and D. Zec (Eds.), *The Phonology-Syntax Connection*, pp. 163–194. University of Chicago Press.

Kenstowicz, M. and H.-S. Sohn (1996). Phrasing and focus in Northern Kyungsang Korean. In *PF: Papers at the interface*, Volume 30 of *MIT Working Papers in Linguistics*, pp. 25–47.

Kim, N.-J. (1997). *Tone, Segments, and their Interaction in North Kyungsang Korean: A Correspondence Theoretic Account*. Ph. D. thesis, Ohio State University.

Kisseberth, C. and M. Abasheikh (1974). Vowel length in Chi Mwiːni – a case study of the role of grammar in phonology. In A. Bruck, R. A. Fox, and M. W. L. Galy (Eds.), *Papers from the Parasession on Natural Phonology*, pp. 193–209. Chicago Linguistics Society.

Kisseberth, C. W. (2016, July). The prosody of sentential complementation in chimiini. Paper presented at The Effects of Constituency on Sentence Phonology, UMass Amherst.

Kisseberth, C. W. and M. I. Abasheikh (2011). Chimwiini phonological phrasing revisited. *Lingua 121*, 1987–2013.

Kubozono, H. (1989). Syntactic and rhythmic effects on downstep in Japanese. *Phonology 6*(1), 39–67.

Langacker, R. (1969). On pronominalization and the chain of command. In D. A. Reibel and S. A. Schane (Eds.), *Modern studies in English*, pp. 160–86. Prentice-Hall.

Larson, R. K. (1988). On the double object construction. *Linguistic Inquiry 19*(3), 335–391.

Lasnik, H. (1976). Remarks on coreference. *Linguistic Analysis 2*, 1–22.

Liberman, M. and A. Prince (1977). On stress and linguistic rhythm. *Linguistic Inquiry 8*(2), 249–336.

Marantz, A. (1997). No escape from syntax: Don't try morphological analysis in the privacy of your own lexicon. *University of Pennsylvania Working Papers in Linguis-*

tics 4(2).

McCarthy, J. J. and A. Prince (1993). Generalized alignment. In G. Booij and J. van Marie (Eds.), *Yearbook of Morphology 1993*, pp. 79–153. Kluwer.

McCarthy, J. J. and A. Prince (1995). Faithfulness and reduplicative identity. In J. Beckman, S. Urbanczyk, and L. W. Dickey (Eds.), *University of Massachusetts Occasional Papers in Linguistics 18: Papers in Optimality Theory*.

McHugh, B. (1990a). *Cyclicity in the phrasal phonology of Kivunjo Chaga*. Ph. D. thesis, University of California Los Angeles.

McHugh, B. D. (1990b). The phrasal cycle in Kivunjo Chaga tonology. In S. Inkelas and D. Zec (Eds.), *The Phonology-Syntax Connection*, pp. 217–242. University of Chicago Press.

McPherson, L. (2014). *Replacive grammatical tone in the Dogon languages*. Ph. D. thesis, University of California Los Angeles.

Merchant, N. and A. Prince (2016, July). The mother of all tableaux.

Myrberg, S. (2013). Sisterhood in prosodic branching. *Phonology 30*(1), 73–124.

Myrberg, S. and T. Riad (2015). The prosodic hierarchy of Swedish. *Nordic Journal of Linguistics 38*(2), 115–147.

Nespor, M. and I. Vogel (1986). *Prosodic Phonology*. Foris Publications.

Ngonyani, D. (2002). Sentential negation and verb movement in Bantu languages. In *Annual Meeting of the Berkeley Linguistics Society*, pp. 201–212.

Odden, D. (1987). Kimatuumbi phrasal phonology. *Phonology Yearbook 4*, 13–36.

Oehrle, R. (1976). *The Grammatical Status of the English Dative Alternation*. Ph. D. thesis, MIT.

Pak, M. (2008). *The Postsyntactic Derivation and its Phonological Reflexes*. Ph. D. thesis, University of Pennsylvania.

Pesetsky, D. (1995). *Zero syntax: Experiencers and cascades*. MIT Press.

Pollock, J.-Y. (1989). Verb movement, universal grammar, and the structure of IP. *Linguistic Inquiry 20*(3), 365–424.

Prieto, P. (2005). Syntactic and eurhythmic constraints on phrasing decisions in Catalan. *Studia Linguistica 59*(2), 194–222.

Prince, A. (2002). Arguing optimality. In A. Coetzee, A. Carpenter, and P. de Lacy (Eds.), *Papers in Optimality Theory II*. GLSA, UMass Amherst.

Prince, A. and P. Smolensky (1993/2004). *Optimality Theory: Constraint Interaction in Generative Grammar*. Blackwell Publishing.

Prince, A., B. Tesar, and N. Merchant (2018). OTWorkplace.

Reinhart, T. (1976). *The Syntactic Domain of Anaphora*. Ph. D. thesis, MIT.

Richards, N. (2016). *Contiguity Theory*. MIT Press.

Rizzi, L. (1990). *Relativized Minimality*. MIT Press.

Rotenberg, J. (1978). *The Syntax of Phonology*. Ph. D. thesis, MIT.

Saito, M., T.-H. J. Lin, and K. Murasugi (2008). N$'$ ellipsis and the structure of noun phrases in Chinese and Japanese. *Journal of East Asian Linguistics 17*(3), 2008.

Samuels, B. D. (2009). *The Structure of Phonological Theory*. Ph. D. thesis, Harvard University.

Selkirk (1974). French liaison and the $\bar{\text{X}}$ notation. *Linguistic Inquiry 5*, 573–590.

Selkirk, E. (1986). On derived domains in sentence phonology. *Phonology Yearbook 3*, 371–405.

Selkirk, E. (2000). The interaction of constraints on prosodic phrasing. In M. Horne (Ed.), *Prosody: Theory and Experiment: Studies Presented to Gösta Bruce*, pp. 231–261. Kluwer Academic Publishers.

Selkirk, E. (2011). The syntax-phonology interface. In J. Goldsmith, J. Riggle, and A. C. L. Yu (Eds.), *The Handbook of Phonological Theory*, pp. 435–484. Blackwell Publishing.

Selkirk, E. and T. Shen (1990). Prosodic domains in Shanghai Chinese. In S. Inkelas and D. Zec (Eds.), *The Phonology-Syntax Connection*, pp. 313–338. University of Chicago Press.

Selkirk, E. O. and K. Tateishi (1991). Syntax and downstep in Japanese. In C. Georgopoulos and R. Ishihara (Eds.), *Interdisciplinary approaches to language: Essays in honor of S.-Y. Kuroda*, pp. 519–544. Dordrecht: Kluwer.

Shinya, T., E. Selkirk, and S. Kawahara (2004). Rhythmic boost and recursive minor phrase in Japanese. In *Proceedings of the second international conference on speech prosody*, pp. 345–348.

Sohn, H.-S. (2001). What looks left-branching is right-branching: Evidence from phonological phrasing in North Kyungsang Korean. *Language Research 37*(4), 841–868.

Tokizaki, H. (1999). Prosodic phrasing and bare phrase structure. In P. N. Tamanji, M. Hirotani, and N. Hall (Eds.), *NELS 29: Proceedings of the Twenty-Ninth Annual Meeting of the North East Linguistic Society*.

Truckenbrodt, H. (1995). *Phonological Phrases: Their Relation to Syntax, Focus, and Prominence*. Ph. D. thesis, MIT.

Truckenbrodt, H. (1999). On the relation between syntactic phrases and phonological phrases. *Linguistic Inquiry 30*(2), 219–255.

Wagner, M. (2005). *Prosody and Recursion*. Ph. D. thesis, MIT.

Zerbian, S. (2004). Phonological phrases in Xhosa (Southern Bantu). *ZAS Papers in Linguistics 37*, 71–99.