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Matching, C-Command, and Basic Sentence Prosody

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ABSTRACT. This paper discusses two theories of syntax-prosody mapping: Match Theory and Command Theory. I show that both theories generate the attested phonological phrasing patterns for two simple sentence-types, three-word VOO ditransitives and three-word SVO transitives, but that Command Theory is more restrictive. This is demonstrated by examining the factorial typologies of four Optimality-Theoretic systems.*

Keywords: syntax-prosody mapping, Match Theory, Command Theory, Optimality Theory

1. Introduction

Syntactic and phonological constituents are sometimes isomorphic, and sometimes mismatched. A major goal of indirect reference approaches to syntax-prosody mapping is determining the principles responsible for matches and mismatches. In this paper, I discuss two simple left-headed syntactic structures and their attested phonological phrasings: ditransitives (VOO) and transitives (SVO) consisting of three prosodic words each. The former consistently display syntax-prosody mismatching, while the latter consistently display syntax-prosody matching.

A successful theory of syntax-prosody mapping will predict mismatching (but not matching) for VOO, and matching (but not mismatching) for SVO. Below, I compare the predictions for these structures made by two theories of syntax-prosody mapping: Match Theory (Selkirk 2011) and Command Theory (Kalivoda 2018). I show that both theories account for the attested phrasings of three-word VOO and SVO, but that Command Theory is more restrictive, predicting only attested phrasings for three-word VOO and only syntax-

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prosody mapping for SVO, while Match Theory predicts unattested matches for VOO and an unattested (and perhaps impossible) mismatch for SVO.

Since each of these theories is based in Optimality Theory (Prince & Smolensky 1993/2004), differing in assumptions about representations and constraints but not OT evaluation per se, the analysis proceeds via the construction and exploration of distinct *OT systems*. An OT system S is a formal object ⟨S.GEN, S.CON⟩, where S.GEN defines the candidate sets of S, and S.CON is a set of constraints (Alber, DelBusso, & Prince 2016; Prince 2017). For each system, we can generate a factorial typology, S.TYP, the set of languages produced by S. The contents of S.TYP can then be compared to the empirical landscape of attested languages. I use two computational tools to study the OT systems in this paper: SPOT (Bellik, Bellik, & Kalivoda 2015-2021), which generates candidate sets and evaluates constraints, and OTWorkplace (Prince, Merchant, & Tesar 2007-2021), which calculates factorial typologies and grammars.

2. Phrasing of Three-Word Ditransitives

As I discuss in Kalivoda (2018), I am aware of only four phonological phrasing patterns for ditransitives consisting of a verb followed by two nouns.[1] These are presented in (1), along with an example of a language for each pattern.

(1) Attested Phonological Phrasings of Ditransitives

a.	($_{\varphi}$ V N_1) ($_{\varphi}$ N_2)	Chimwiini
b.	($_{\varphi}$ V N_1 N_2)	Zulu
c.	($_{\varphi}$ ($_{\varphi}$ V N_1) N_2)	Kimatuumbi
d.	($_{\varphi}$ V) ($_{\varphi}$ N_1) ($_{\varphi}$ N_2)	Ewe

Evidence that Chimwiini has the phrasing in (1a) comes from vowel length (Goodman 1967; Kisseberth & Abasheikh 1974; Kenstowicz & Kisseberth 1977) and accent (Kisseberth & Abasheikh 2011). The phrasing in (1b) is attributed to Zulu by Cheng & Downing (2016) on the basis of penultimate lengthening within the φ. The recursive phrasing in Kimatuumbi is Truckenbrodt's (1995, 1999) account of Odden's (1987) data, based on Cowper & Rice's (1987) proposal for φ-non-final vowel shortening, and Truckenbrodt's own prosodic

[1] I am ignoring proclitic determiners and prepositions in this description, since these generally form a single prosodic word with the following noun.

interpretation of phrasal tone insertion. Finally, Clements (1978) argues for the Ewe pattern in (1d) on the basis of tone sandhi (see also Selkirk 1986). Kalivoda (2018) provides citations for a number of other languages displaying the patterns in (1a-b). Selkirk (2011), using data from Kisseberth (1994) and Cassimjee & Kisseberth (1998), argues that Xitsonga displays the same pattern as Kimatuumbi in (1c). The Ewe pattern in (1d) is the only one that has not been proposed for another language, as far as I know.

The phrasings in (1) are theoretically interesting because they do not mirror the syntactic structure commonly assumed for ditransitives. According to Larson's (1988) influential "VP Shell" proposal, the two objects in a ditransitive form a surface constituent that excludes the verb. A minimalist interpretation of Larson's proposed structure is given in (2), with *v* as the higher verbal projection to which V moves.[2]

(2) Ditransitive Syntax with V-to-*v* movement

$[_{vP}$ DP$_{\text{subject}}$ $[_{v'}$ V+v $[_{\text{VP}}$ DP$_{\text{object}}$ $[_{\text{V}'}$ t$_{\text{V}}$ DP$_{\text{object}}]]]]$

The constituent structures in (1) and (2) are strikingly non-isomorphic. In (1a) and (1b), the verb forms a prosodic constituent with the first object and without the second: ($_{\varphi}$ V N$_1$). None of the attested phrasings in (1) contains a φ that matches the VP in (2), i.e. ($_{\varphi}$ N$_1$ N$_2$). If (2) is in fact the correct syntax for ditransitives, there is pervasive syntax-phonology mismatching cross-linguistically, which a successful theory of syntax-prosody mapping should account for.[3]

2.1 A Match-Theoretic System for Ditransitives

The first system we explore is a Match-Theoretic system called MT.VOO, based in all its essentials on the proposals of Selkirk & Lee (2017). The first step in defining MT.VOO is laying out MT.VOO.GEN. The system contains a single candidate set (cset). Each candidate

[2] Although a subject is shown in Spec,*v*P in (2), this paper deals only with cases in which the subject is pro, though the conclusions largely generalize to cases with overt subjects.

[3] It is of course possible that (2) is *not* the correct structure for ditransitives. Oehrle (1976) proposed a ternary-branching [$_{\text{VP}}$ V NP NP], while Chomsky (1981) treated the first object as the complement of V and the second as a rightward specifier: [$_{\text{VP}}$ [$_{\text{V}'}$ V NP] NP]. However, the sorts of asymmetries between the two objects in anaphor licensing, variable binding, etc. pointed out by Barss & Lasnik (1986), and arguments from Larson (1988), point toward (2) being correct (see Harley & Miyagawa 2016 for an overview of the debate). While it would be interesting to consider the implications for syntax-prosody mapping of a ternary or left-branching structure for ditransitives, this is outside the scope of this paper.

takes the form ⟨*in*,*out*,*corr*⟩, where *in* is a syntactic tree, *out* is a prosodic tree, and *corr* is a correspondence relation between the terminal nodes of *in* and the terminal nodes of *out*. The input for the lone cset of MT.VOO is given in (3).[4]

(3) Input according to MT.VOO.GEN
   a. Input with full complexity
      $[_{vP}$ V+*v* $[_{VP}$ $[_{NP}$ N$]$ $[_{V'}$ t_V $[_{NP}$ N$]]]]$
   b. Input as seen by constraints of MT.VOO.CON
      $[_{LP}$ V $[_{FP}$ $[_{LP}$ N$]$ $[_{LP}$ N$]]]$

The input in (3) is presented in two versions. In (3a), I provide a detailed syntactic representation showing a trace, the V′ level, a head-adjunction structure, and full syntactic category labels. For the purposes of MT.VOO, much of this information is irrelevant or invisible, and (3b) is a version of (3a) that has been pared down to its essentials. As in Selkirk & Lee (2017) and Truckenbrodt (1995, 1999), lexical and functional XPs (LPs and FPs, respectively) are distinguished, but otherwise the category label of each XP is ignored. Each NP is an LP. Although V is lexical and *v* functional, the VP becomes an honorary FP and the *v*P an honorary LP due to the head-movement of V to *v* (cf. Truckenbrodt's 1995, 1999 Lexical Category Condition). The V′ is simply ignored. From here on, we set aside (3a) and simply take (3b) as the input tree for the system.

The outputs of MT.VOO's lone cset are prosodic trees that meet the conditions in (4). I assume a minimal hierarchy of prosodic interface categories, [ι > φ > ω], which can be recursive, though in the systems in this paper only the φ is recursive. This hierarchy, and the principles of Weak Layering that admit prosodic recursion, are drawn from the work of Ito & Mester (1992/2003, 2007, 2009a, 2009b, 2013, *et seq.*).[5]

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[4] All syntactic and prosodic trees presented in this paper are fully linearized. Even if linear order turns out not to be relevant in narrow syntax (Chomsky 1995), I am assuming that syntactic trees are linearized by the point at which they serve as inputs to prosody. While it is worth exploring the possibility that syntactic inputs to prosody are not yet linearized, I do not do so here.

[5] The GEN functions in this paper do not fully adopt Weak Layering, since they require exhaustive parsing of ωs into φs. It is likely that this condition should be relaxed, and that ωs can be parsed directly into ιs, but adopting EXHAUSTIVITY is a useful simplifying assumption here, since I have no evidence for nonexhaustive parsing in attested phrasings of transitives and ditransitives.

(4) Outputs according to MT.VOO.GEN

An output is any prosodic tree with three terminal nodes such that:

a. The root node is an intonational phrase ι.

b. Intermediate nodes are phonological phrases φ.

c. Every terminal node is a prosodic word ω.

d. Every ω is contained in at least one φ (EXHAUSTIVITY).

Finally, (5) defines the correspondence relation between the terminal nodes of the input and outputs.

(5) Correspondence relation for MT.VOO.GEN

The n^{th} terminal node of the input corresponds to the n^{th} terminal node of the output, and vice versa.

The relation in (5) ensures that terminal nodes are not reordered, inserted, or deleted. For visual simplicity, correspondence indices are excluded, except when it is useful to refer to the first noun as N_1 and the second as N_2. Since terminals are not reordered, inserted, or deleted in this system, this convention does not give rise to any ambiguity. The terminal string of the input is V N N, and the terminal string of every output is V N N as well (though in the input, each terminal is an X^0, while in the output, each is an ω).

Given the definition of MT.VOO.GEN in (3)-(5), the system's lone cset contains candidates ⟨*in*,*out*,*corr*⟩ in which the following 33 prosodic trees are the outputs:

(6) The 33 outputs according to MT.VOO.GEN

a. {(V N N)}
b. {((V N) (N))}
c. {((V N) N)}
d. {(((V) (N)) (N))}
e. {(((V) (N)) N)}
f. {(((V) N) (N))}
g. {(((V) N) N)}
h. {((V (N)) (N))}
i. {((V (N)) N)}
j. {(V N (N))}
k. {((V) (N N))}
l. {((V) ((N) (N)))}
m. {((V) ((N) N))}
n. {((V) (N (N)))}
o. {((V) N N)}
p. {((V) (N) (N))}
q. {((V) (N) N)}
r. {((V) N (N))}
s. {(V (N N))}
t. {(V ((N) (N)))}
u. {(V ((N) N))}
v. {(V (N (N)))}
w. {(V (N) (N))}
x. {(V (N) N)}
y. {(V N) (N)}
z. {((V) (N)) (N)}
aa. {((V) N) (N)}
ab. {(V (N)) (N)}
ac. {(V) (N N)}
ad. {(V) ((N) (N))}
ae. {(V) ((N) N)}
af. {(V) (N (N))}
ag. {(V) (N) (N)}

Here and elsewhere, curly braces indicate boundaries of intonational phrases, and parentheses indicate boundaries of phonological phrases. Thus, (6a) is shorthand for $\{_{\iota}\ (_{\varphi}$ V N N)}, where V and both Ns are ωs. Since every output is rooted in an ι node, the outer curly braces will often be omitted, with no loss of precision.

The constraint set MT.VOO.CON, based on the theory of Selkirk & Lee (2017) is presented in (7).

(7) MT.VOO.CON (cf. Selkirk & Lee 2017)

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

e. BINMIN(φ,branches)
   Assign a violation for every φ that immediately dominates fewer than two nodes.

f. BINMAX(φ,branches)
   Assign a violation for every φ that immediately dominates more than two nodes.

g. STRONGSTART
   Assign one violation for every φ beginning ($_\varphi$ ω φ...

MT.VOO.CON, like all the constraint sets in this paper, contains two types of constraints: mapping constraints, which scrutinize relations between input and output constituents, and markedness constraints, which assess candidates based purely on their output characteristics. The mapping constraints are the four MATCH constraints in (7a-d), while the markedness are the binarity constraints and STRONGSTART in (7e-g). The MATCH constraints all refer to the notion of *matching*, which is defined in (8), following Elfner (2012, 2015).

(8) Definition of Matching (based on Elfner 2012, 2015)
    Two constituents α, β are *matching* iff every terminal node in α corresponds to a terminal node in β and every terminal node in β corresponds to a terminal node in α.

While the MATCH constraints in (7a-d) all refer to XPs and φs, there are four of them, because each is either syntax-to-prosody or prosody-to-syntax (Selkirk 2011), and each refers either specifically to lexical phrases (LPs) or to all XPs (both LPs and FPs) (Selkirk & Lee 2017). One of Selkirk & Lee's (2017) many insights is that matching the VP should not be a high priority, and that this could follow from its being an FP (due to being headed by a trace) rather than an LP.[6]

Of the 33 candidates in MT.VOO's lone cset, 9 are possible optima and 24 are harmonically bounded. The violation tableau (VT) in (9) shows how each of the optima is

[6] Having only the LP-oriented MATCH constraints and ignoring FPs altogether would simplify the analysis of ditransitives, where the honorarily functional VP seems to never matter, but this option does not appear viable, as Elfner (2012, 2015) argues that MATCH constraints must see functional projections like TP.

evaluated by the constraints in (7). (The Appendix contains a VT that includes all 33 candidates.)[7]

(9) VT including MT.VOO optima (excluding 24 harmonic bounds)

[LP V [FP [LP N] [LP N]]	MATCH (XP,φ)	MATCH (φ,XP)	MATCH (LP,φ)	MATCH (φ,LP)	BMIN (φ,b)	BMAX (φ,b)	ST ST
a. (V N N)	3		2			1	
b. ((V N) (N))	2	1	1	1	1		
c. ((V N) N)	3	1	2	1			
d. (V N (N))	2		1		1	1	
e. ((V) ((N) (N)))		1		2	3		
f. ((V) (N) (N))	1	1		1	3	1	
g. (V (N N))	2		2	1			1
h. (V ((N) (N)))				1	2		1
i. (V (N) (N))	1				2	1	1

The factorial typology of MT.VOO consists of the nine languages with one of the optima in (9), as shown in (10).

[7] The names of the markedness constraints are abbreviated slightly (as they are in subsequent tableaux as well), but these abbreviations should be transparent. I frequently shorten "branches" to "b", and will occasionally write BINMIN and BINMAX without "(φ,branches)" or "(φ,b)", since these are the only binarity constraints used in this paper.

(10) Factorial typology of MT.VOO

	[LP V [FP [LP N] [LP N]]	Attestation
L.1	(V N N)	Zulu
L.2	((V N) (N))	Chimwiini
L.3	((V N) N)	Kimatuumbi
L.4	(V N (N))	*none*
L.5	((V) ((N) (N)))	Ewe
L.6	((V) (N) (N))	Ewe
L.7	(V (N N))	*none*
L.8	(V ((N) (N)))	*none*
L.9	(V (N) (N))	*none*

Of these nine languages, five correspond to one of the four attested phrasings discussed above. L.1 corresponds to the flat phrasing reported for Zulu, in which the *v*P is matched but no other XPs are; L.2 corresponds to the Chimwiini phrasing, in which the *v*P and second NP are matched, while the V and first N are phrased together in a φ that has no syntactic match; L.3 corresponds to the recursive parse proposed for Kimatuumbi (and Xitsonga), which displays the same unmatched φ as L.2; and L.5 and L.6 are both compatible with the reported phrasing for Ewe, since they place each of the three prosodic words in separate φs. The remaining four languages in (10) are not compatible with any attested phrasings that I am currently aware of.

The grammars for each of the language's in (10) (and in OT more generally) can be represented as a *Skeletal Bases*, collections of Elementary Ranking Conditions (ERCs), represented as arrays of W's, L's, and e's (Brasoveanu & Prince 2011; Merchant & Prince to appear), with the same meaning as in normal comparative tableaux. The Skeletal Basis for each language in the typology of MT.VOO is given in (11) (with e-cells left blank for visual ease).

Each row of a Skeletal Basis is interpreted as follows: at least one of the row's W-constraints dominates all of the row's L-constraints in the grammar in question. For example, the first row of (11a) states that MATCH(φ,XP) or MATCH(φ,LP) dominates BINMAX(φ,b); the second row states that MATCH(φ,LP) or STRONGSTART dominates both MATCH(XP,φ) and BINMAX(φ,b); and the third row states that BINMIN(φ,b) dominates both MATCH(XP,φ) and MATCH(LP,φ). Together, these three Elementary Ranking Conditions make up the grammar of L.1.

(11) Skeletal Bases for Grammars of MT.VOO

a. L.1: (V N N) – compatible with Zulu

MATCH (φ,XP)	MATCH (φ,LP)	BINMIN (φ,b)	STRONG START	MATCH (XP,φ)	MATCH (LP,φ)	BINMAX (φ,b)
W	W					L
	W		W	L		L
		W		L	L	

b. L.2: ((V N) (N)) – compatible with Chimwiini

BINMAX (φ,b)	STRONG START	MATCH (φ,XP)	MATCH (φ,LP)	MATCH (XP,φ)	MATCH (LP,φ)	BINMIN (φ,b)
W		L	L			
	W	L		L	L	
			W	L	L	
				W	W	L

c. L.3: ((V N) N) – compatible with Kimatuumbi

BINMIN (φ,b)	BINMAX (φ,b)	STRONG START	MATCH (XP,φ)	MATCH (φ,XP)	MATCH (LP,φ)	MATCH (φ,LP)
W			L		L	
	W			L		L
		W	L	L		

d. L.4: (V N (N)) – unattested

MATCH (φ,XP)	MATCH (φ,LP)	STRONG START	MATCH (XP,φ)	MATCH (LP,φ)	BINMAX (φ,b)	BINMIN (φ,b)
W	W		L	L	L	
	W	W			L	
		W	L	L		
			W	W		L

e. L.5: ((V) ((N) (N))) – compatible with Ewe

MATCH (XP,φ)	MATCH (LP,φ)	BINMAX (φ,b)	STRONG START	MATCH (φ,XP)	MATCH (φ,LP)	BINMIN (φ,b)
W		W			L	
W	W				L	L
W	W	W		L		
			W	L	L	L

f. L.6: ((V) (N) (N)) – compatible with Ewe

MATCH (LP,φ)	STRONG START	MATCH (φ,XP)	MATCH (φ,LP)	BINMIN (φ,b)	MATCH (XP,φ)	BINMAX (φ,b)
W		L	L	L		
	W	L	L	L		
			W		L	L

g. L.7: (V (N N)) – unattested

MATCH (φ,XP)	BINMIN (φ,b)	BINMAX (φ,b)	MATCH (XP,φ)	MATCH (LP,φ)	MATCH (φ,LP)	STRONG START
W			W			L
	W		L	L		
		W	W		L	L

h. L.8: (V ((N) (N))) – unattested

MATCH (XP,φ)	MATCH (φ,XP)	MATCH (LP,φ)	BINMAX (φ,b)	MATCH (φ,LP)	BINMIN (φ,b)	STRONG START
W		W	W			L
W			W	L		
W		W			L	
W	W	W				L
	W			W	W	L

i. L.9: (V (N) (N)) – unattested

MATCH (φ,XP)	MATCH (LP,φ)	MATCH (φ,LP)	MATCH (XP,φ)	BINMIN (φ,b)	BINMAX (φ,b)	STRONG START
W		W		W		L
	W		W	L		L
		W	L		L	

The main takeaway from these grammars, which will become particularly relevant in the discussion of MT.SVO below, is the crucial role played in MT.VOO by the three markedness constraints BINMIN(φ,b), BINMAX(φ,b), and STRONGSTART. In the grammar in (11c) for Kimatuumbi-compatible L.3, each of these markedness constraints dominates two of the MATCH constraints, meaning that without these constraints present, the system would not generate L.3. BINMIN(φ,b) also dominates the two syntax-to-prosody MATCH constraints in Zulu-compatible L.1, while BINMAX(φ,b) and STRONGSTART dominate certain MATCH constraints in Chimwiini-compatible L.2 and Ewe-compatible L.5, and STRONGSTART dominates three constraints in Ewe-compatible L.6.

2.2 A Command-Theoretic System for Ditransitives

Having examined the Match-Theoretic system MT.VOO, we now turn to a system using Command Theory, CT.VOO. The system is based on work in Kalivoda (2018), but is intended to supersede it.

The central idea of Command Theory (CT) is that the syntax-prosody mapping constraints consider c-command relations (or lack thereof) between overt syntactic terminals. Loosely put, the intuition behind CT is that syntactic words should phrase together when they are related by c-command, and should phrase apart when they are not. Constraints favoring such phrasings interact with markedness constraints to produce prosodic outputs, just like MATCH constraints in Match Theory.[8] The theory is based in part on work by Kim (1997).

[8] In Kalivoda (2018), I point out that CT is interesting not only because of its success with ditransitives, but also because it helps explain what I call Tokizaki's Generalization (TG): Tokizaki (1999) observes that syntactically left-headed languages tend to align the right edges of XPs to the right edges of φs, while syntactically right-headed languages tend to align the left edges of XPs to the left edges of φs. Tokizaki provides a compelling explanation in a non-OT theory with boundary symbol deletion, but CT could also shed light onto why TG should hold, since it predicts that heads should phrase with their complements, regardless of directionality.

CT.VOO.GEN is extremely similar to MT.VOO.GEN, differing slightly only in the interpretation of the input syntactic structure. In CT, what matters in the input are the c-command relations between the overt syntactic words that map to output prosodic words. The definition of c-command operative here is that of Reinhart (1976, p. 32).

(12) C-command (Reinhart 1976, p. 32)

Node *A* c-commands node *B* if neither *A* nor *B* dominates the other and the first branching node which dominates *A* dominates *B*.

Like the Match-Theoretic system discussed above, CT.VOO contains only one candidate set, with a single input. This is given in (13).

(13) Input according to CT.VOO.GEN

a. Input with full complexity

$[_{vP}$ V+v $[_{VP}$ $[_{DP}$ D $[_{NP}$ $N_1]]$ $[_{V'}$ t_V $[_{DP}$ D $[_{NP}$ $N_2]]]]]$

b. Input as seen by constraints of CT.VOO.CON

[V [[(D) N_1] [(D) N_2]]]

c. C-command relations between overt words

(V,N_1), (V,N_2), and no others

For reasons which will become apparent, it is crucial that neither N_1 nor N_2 c-command the other. To ensure this, I take there to universally be some head (whether D, as in (13), on some other functional material) above N. When this material is silent or proclitic, as in the cases considered here, it does not count as a syntactic word that is visible to the CT mapping constraints, but it does suffice to insulate the nouns so that they do not c-command any material (unless they take a complement, which they do not in the three-word case at hand). In (13b) and elsewhere, I show a parenthesized D in gray to emphasize that the node above each N is syntactically branching, though this D is either silent or proclitic in outputs. The Ds are not shown in output trees and are ignored by the *corr* relation.

The other two components of CT.VOO.GEN are identical to those of MT.VOO.GEN. The possible outputs in candidates of the form ⟨*in*,*out*,*corr*⟩ are the same 33 admitted in MT.VOO, and the correspondence relation between overt syntactic terminals (i.e. excluding silent and/or proclitic functional material, i.e. D) is also the same.

(14) Outputs according to CT.VOO.Gen:
Same as in (4) (see (6) for list)

(15) Correspondence according to CT.VOO.Gen:
Same as in (5), restricted to the overt terminals V, N_1, and N_2

The constraint set for this system, CT.VOO.CON, is presented in (16). It contains three CT mapping constraints: TOGETHER, APART, and STRICTAPART.[9] While Kalivoda (2018) uses these constraints, the names TOGETHER and APART are from Branan (to appear), and the name of STRICTAPART is inspired by Branan's naming of APART. In the definitions of these mapping constraints, X and Y are syntactic terminals, while ω_X and ω_Y are their output correspondents. There are also three markedness constraints: the two binarity constraints from MT.VOO, plus a constraint *φ favoring economy of φ-structure (used by Truckenbrodt 1995, 1999, among others).

(16) CT.VOO.CON

a. TOGETHER
If X c-commands Y, assign a violation for every φ that dominates ω_X or ω_Y but not both.

b. APART
If neither X nor Y c-commands the other, assign a violation if there is no φ dominating ω_X and excluding ω_Y, and a violation if there is no φ dominating ω_Y and excluding ω_X.

c. STRICTAPART
If X and Y are not mutually c-commanding, assign a violation if there is no φ

[9] The constraint APART is closely related to Kim's (1997, p. 182) constraint C-Command, which states "If α and β form a single P-phrase, β must c-command α."

dominating ω_X and excluding ω_Y, and a violation if there is no φ dominating ω_Y and excluding ω_X.

d. BINMIN(φ,branches)
Assign a violation for every φ that immediately dominates fewer than two nodes.

e. BINMAX(φ,branches)
Assign a violation for every φ that immediately dominates more than two nodes.

f. *φ
Assign a violation for every φ.

To illustrate how candidates are evaluated with respect to the CT constraints in (16), the violation tableau in (17) includes the four possible optima in the system CT.VOO, i.e. the four candidates which can win under some ranking of the constraints. The additional 29 candidates admitted by CT.VOO.GEN but not shown in (17) are harmonically bounded, winning under no ranking of the constraints.

(17) VT containing CT.VOO optima (excluding 29 harmonic bounds)

[V [[(D) N_1] [(D) N_2]]]	TOGETHER	APART	STRICT APART	BINMIN (φ,b)	BINMAX (φ,b)	*φ
a. (V N_1 N_2)		2	6		1	1
b. ((V N_1) N_2)	1	1	4			2
c. (V N_1) (N_2)	2		2	1		2
d. (V) (N_1) (N_2)	4			3		3

C-command relations between overt words in input: (V,N_1), (V,N_2), and no others

As stated directly under the tableau in (17), there are two c-command relations in the input (ignoring the silent and/or proclitic Ds); V c-commands N_1 and N_2, but no other overt syntactic word c-commands another. (Crucially, neither N c-commands out of its containing DP, meaning neither c-commands anything overt.)

Given the c-command relations in (17), the constraint TOGETHER demands that V occupy the same minimal φ as both N_1 and N_2. Candidate (17a) satisfies TOGETHER perfectly, since there is a single φ that contains all three words. In (17b), V and N_1 occupy a minimal phrase together, but there is a φ containing V and excluding N_2, which results in a single violation of TOGETHER. In (17c), like in (17b), V and N_1 are in a minimal φ together, and there is a φ containing V but excluding N_2. However, (17c) receives one more violation, since N_2 is contained in a φ that excludes V. Finally, (17d) incurs four violations: one for the φ containing V and excluding N_1, one for the φ containing N_1 and excluding V, one for the φ containing V and excluding N_2, and one for the φ containing N_2 and excluding V.

Turning now to APART, that constraint demands that N_1 and N_2 be phrased entirely separately, and is violated once if there is no φ containing N_1 and excluding N_2, and again if there is no φ containing N_2 and excluding N_1. Since V c-commands both N_1 and N_2, its phrasing is irrelevant to APART. Candidate (17a) violates APART twice, since no φ containing N_1 excludes N_2, and since no φ containing N_2 excludes N_1. Candidate (17b) violates APART only once: while there is a φ containing N_1 and excluding N_2, there is none containing N_2 that excludes N_1. Neither (17c) nor (17d) violates APART at all, since these phrase N_1 and N_2 entirely separately.

Finally, STRICTAPART works like APART, but only accepts phrasing two words together if they are mutually c-commanding. For the input to CT.VOO, no two words are mutually c-commanding; although V c-commands N_1 and N_2, neither N_1 nor N_2 c-commands V. STRICTAPART is perfectly satisfied by (17d), where each word is in its own minimal φ. Candidate (17c) violates it twice: once because there is no φ containing V and excluding N_1, and once because there is no φ containing N_1 and excluding V. Candidate (17b) has the same two violations as (17c), plus two more: one because there is no φ containing N_2 and excluding V, and another because there is no φ containing N_2 and excluding N_1. Finally, (17a) fares maximally poorly on STRICTAPART, due to the six pairs (V,N_1), (V,N_2), (N_1,V), (N_1,N_2), (N_2,V), and (N_2,N_1) all occupying the same minimal φ.

The factorial typology of CT.VOO is given in (18). The four languages account for all and only the attested phrasings of left-headed three-word ditransitives.

(18) Factorial typology of CT.VOO

	[V [[(D) N] [(D) N]]	Attestation
L.1	(V N N)	Zulu
L.2	((V N) N)	Kimatuumbi
L.3	(V N) (N)	Chimwiini
L.5	(V) (N) (N)	Ewe

The grammars of these four languages are given in the following Skeletal Bases.

(19) Skeletal Bases for Grammars of CT.VOO

a. L.1: (V N N)

TOGETHER	BINMIN	*φ	APART	STRICTAPART	BINMAX
W		W	L	L	L

b. L.2: ((V N) N)

BINMIN	BINMAX	TOGETHER	APART	STRICTAPART	*φ
W		W	L	L	
	W	L	W	W	L

c. L.3: (V N) (N)

APART	BINMAX	TOGETHER	BINMIN	*φ	STRICTAPART
W	W			L	
W		L	L		W
		W	W	W	L

d. L.4: (V) (N) (N)

APART	STRICTAPART	BINMAX	TOGETHER	BINMIN	*φ
	W		L	L	L

CT.VOO, unlike MT.VOO, has a typology consisting of all and only the attested phonological phrasings for left-headed three-word ditransitives. If these are in fact the only possible phrasings for such sentences, then this can be counted as a success for Command Theory. (Of course, if any additional phrasings are discovered, the theory would be too limited, at least as it is instantiated in CT.VOO.)

3. Phrasing of Three-Word Transitives

Dobashi (2003, p. 38) points out that the phonological phrasing of SVO sentences is severely limited cross-linguistically. Setting aside branchingness effects and limiting our attention to cases where S and O are each a single noun, there are only two possibilities:

(20) SVO phrasings with 1ω arguments (Dobashi 2003 and references therein)
a. $(_{\varphi}$ S) $(_{\varphi}$ V) $(_{\varphi}$ O) Ewe, French
b. $(_{\varphi}$ S) $(_{\varphi}$ V O) Kimatuumbi, Kinyambo

As Samuels (2009) also observes, the phrasing $(_{\varphi}$ S V) $(_{\varphi}$ O) is conspicuously missing, at least when each argument is just a single prosodic word.[10]

A theory of syntax-prosody mapping should therefore predict that $[_{XP}\ [_{XP}\ N_1]\ [_{XP}\ V\ [_{XP}\ N_2]]]$ phrases each word separately in some languages and phrases the V with the N_2 in others, but that no language phrases N_1 with V to the exclusion of N_2. Below, we show that Match-Theoretic and Command-Theoretic systems using the same constraint sets as MT.VOO and CT.VOO both generate the attested patterns, but that the MT system also predicts a language with the putatively impossible phrasing in which the subject phrases with the verb.

3.1 A Match-Theoretic System for Transitives

In this subsection, we define a Match-Theoretic system for three-word transitives, MT.SVO. Like MT.VOO, the system has just a single input, given in (21).

(21) Input according to MT.SVO.GEN
a. Input with full complexity
$[_{TP}\ [_{NP}\ N]\ [_{T'}\ T\ [_{vP}\ t_{NP}\ [_{v'}\ V{+}v\ [_{VP}\ t_V\ [_{NP}\ N]]]]]]$
b. Input as seen by constraints of MT.VOO.CON
$[_{FP}\ [_{LP}\ N]\ [_{LP}\ V\ [_{LP}\ N]]]$

[10] It is not the case that (S V) (O) is unattested when S is one word and O is multiple words. Prieto (2007) provides Spanish examples such as $(_{\varphi}$ *Javier visitó*) $(_{\varphi}$ *la Galicia de sus sueños*), i.e. $(_{\varphi}$ *Javier visited*) $(_{\varphi}$ *the Galicia of his dreams*). In this paper, I restrict my attention to SVO sentences of the form NVN (possibly including proclitic Ds, not shown here), where, to the best of my knowledge, Dobashi's generalizations hold.

The simplified input [$_{FP}$ [$_{LP}$ N] [$_{LP}$ V [$_{LP}$ N]]] in (21b) derives straightforwardly from the complex input in (21a), where the verb has only moved as high as *v*. However, (21b) also makes sense if V moved higher, as long as it does not move to the head whose specifier hosts the subject, for instance if V moved to an Asp projection between *v* and T, or if it moved to T and the subject occupied the specifier of a head higher than T. In a language where the verb occupies the head for which the subject is the specifier, the simplified representation as far as the MATCH constraints are concerned would instead be [$_{LP}$ [$_{LP}$ N] V [$_{LP}$ N]]] (or [$_{LP}$ [$_{LP}$ N] [$_{LP}$ V [$_{LP}$ N]]]] if bar-levels are counted as phrasal), a significant departure from (21b). Thus, the system MT.SVO may not be fitting for all SVO languages, but it presumably is for very many.

The outputs of MT.SVO are the same trees as for MT.VOO, but with terminal string N V N instead of V N N.

(22) Outputs according to MT.SVO.GEN

An output is any prosodic tree with three terminal nodes such that:

a. The root node is an intonational phrase (ι).
b. Intermediate nodes are phonological phrases (φ).
c. Every terminal node is a prosodic word ω.
d. Every ω is contained in at least one φ (EXHAUSTIVITY).

The correspondence relation of MT.SVO.GEN is the same as in the other systems:

(23) Correspondence relation for MT.SVO.GEN

The n^{th} terminal node of the input corresponds to the n^{th} terminal node of the output, and vice versa.

Similarly, the constraint set for MT.SVO is exactly that for MT.VOO:

(24) MT.SVO.CON = MT.VOO.CON in (7)

That is, MT.SVO.CON includes MATCH(XP,φ), MATCH(φ,XP), MATCH(LP,φ), MATCH(φ,LP), BINMIN(φ,branches), BINMAX(φ,branches), and STRONGSTART, defined exactly as in (7).

The violation tableau in (25) includes the nine optima of MT.SVO, and shows their violation counts for each of the constraints in the system.

(25) VT including MT.SVO optima (excluding 24 harmonic bounds)

[FP [LP N] [LP V [LP N]]]	MATCH (XP,φ)	MATCH (φ,XP)	MATCH (LP,φ)	MATCH (φ,LP)	BMIN (φ,b)	BMAX (φ,b)	ST ST
a. (N V N)	3		3	1		1	
b. ((N V) N)	3	1	3	2			
c. ((N) (V N))	1		1	1	1		
d. ((N) ((V) (N)))		1		2	3		
e. ((N) (V (N)))				1	2		1
f. (N (V N))	2		2	1			1
g. (N) (V N)	2		1		1		
h. (N) ((V) (N))	1	1		1	3		
i. (N) (V (N))	1				2		1

The factorial typology for MT.SVO is given in (26).

(26) Factorial typology of MT.SVO

	[FP [LP N] [LP V [LP N]]	Attestation
L.1	(N V N)	*none*
L.2	((N V) N)	*none: believed to be impossible*
L.3	((N) (V N))	Kimatuumbi
L.4	((N) ((V) (N)))	Ewe
L.5	((N) (V (N)))	*none*
L.6	(N (V N))	*none*
L.7	(N) (V N)	Kimatuumbi
L.8	(N) ((V) (N))	Ewe
L.9	(N) (V (N))	*none*

Four of these languages correspond to the attested phonological phrasings discussed by Dobashi (2003). L.3 and L.7 phrase the subject alone, and the verb and object together, as seen in languages like Kimatuumbi and Kinyambo. They differ in the presence or absence of a larger φ containing these minimal φs, which we currently have no evidence for or against. Similarly, L.4 and L.8 are both compatible with the Ewe phrasing in which each word—subject noun, verb, and object noun—occupies its own unary φ.

The other five languages in (26) show unattested phrasing patterns. Four of these—L.1, L.5, L.6, and L.9—seem fairly plausible, as they contain no φ which lacks a matching input XP, and thereby resemble attested patterns to some extent. However, L.2 is rather remarkable, as it phrases the subject and verb together to the exclusion of the object, violating the putative universal discussed above (Dobashi 2003, Samuels 2009). If it is indeed the case that ((N V) N) is an impossible phrasing for a three-word SVO sentence, then this is a bad prediction of MT.SVO. But of course, if such a phrasing were ever discovered, it would be striking support for Match Theory in this particular formulation.

The grammars of the languages in (26) are given in (27) in the form of Skeletal Bases.

(27) Skeletal Bases for Grammars of MT.SVO

a. L.1: (N V N) – unattested

MATCH (φ,XP)	BINMIN (φ,b)	STRONG START	MATCH (XP,φ)	MATCH (LP,φ)	MATCH (φ,LP)	BINMAX (φ,b)
W					W	L
	W		L	L	L	L
		W	L	L		L

b. L.2: ((N V) N) – unattested, believed to be impossible

BINMIN (φ,b)	BINMAX (φ,b)	STRONG START	MATCH (XP,φ)	MATCH (φ,XP)	MATCH (LP,φ)	MATCH (φ,LP)
W			L	L	L	L
	W			L		L
		W	L	L	L	L

c. L.3: ((N) (V N)) – compatible with Kimatuumbi

MATCH (φ,XP)	BINMAX (φ,b)	STRONG START	MATCH (XP,φ)	MATCH (LP,φ)	BINMIN (φ,b)	MATCH (φ,LP)
W			L	L	L	
	W		W	W	L	
		W	L	L	L	
			W			L

d. L.4: ((N) ((V) (N))) – compatible with Ewe

MATCH (XP,φ)	MATCH (LP,φ)	BINMAX (φ,b)	STRONG START	MATCH (φ,XP)	MATCH (φ,LP)	BINMIN (φ,b)
W					L	
W	W			L		L
			W	L	L	L

e. L.5: ((N) (V (N))) – unattested

MATCH (XP,φ)	MATCH (φ,XP)	MATCH (LP,φ)	BINMAX (φ,b)	MATCH (φ,LP)	BINMIN (φ,b)	STRONG START
W				L		
W		W			L	L
	W			W	W	L

f. L.6: (N (V N)) – unattested

MATCH (φ,XP)	BINMIN (φ,b)	BINMAX (φ,b)	MATCH (XP,φ)	MATCH (LP,φ)	MATCH (φ,LP)	STRONG START
W			W	W	W	L
	W		L	L	L	L
		W	W	W		L

g. L.7: (N) (V N) – compatible with Kimatuumbi

MATCH (φ,XP)	MATCH (φ,LP)	BINMAX (φ,b)	STRONG START	MATCH (XP,φ)	MATCH (LP,φ)	BINMIN (φ,b)
W	W				L	L
	W		W			L
	W			L		
	W	W			W	L
			W	L	L	W

h. L.8: (N) ((V) (N)) – compatible with Ewe

MATCH (LP,φ)	BINMAX (φ,b)	STRONG START	MATCH (φ,XP)	MATCH (φ,LP)	BINMIN (φ,b)	MATCH (XP,φ)
W			L	L	L	
		W	L	L	L	
				W		L

i. L.9: (N) (V (N)) – unattested

MATCH (φ,XP)	MATCH (LP,φ)	MATCH (φ,LP)	BINMAX (φ,b)	MATCH (XP,φ)	BINMIN (φ,b)	STRONG START
W		W			W	L
	W			W	L	L
		W		L		

The grammar of L.2, with its putatively impossible phrasing ((N V) N), is shown in (27b). In this grammar, the markedness constraints take priority: STRONGSTART and BINMIN(φ,b) dominate all four MATCH constraints, and BINMAX(φ,b) dominates the two prosody-to-syntax MATCH constraints (while its ranking with respect to the syntax-to-prosody MATCH constraints is irrelevant). ((N V) N) satisfies all three of these constraints perfectly, since each of its two φs is perfectly binary branching, and neither begins with an ω followed by a φ. We saw in MT.VOO above that these systems' markedness constraints, which are responsible for this potentially unfortunate prediction of MT.SVO, are all needed to derive several of the attested phrasings of three-word ditransitives. They therefore cannot simply be expunged from Match Theory to eliminate the ((N V) N) phrasing of L.2 in MT.SVO.

3.2 A Command-Theoretic System for Transitives

The final system to consider in this paper is a Command-Theoretic system for three-word SVO sentences, CT.SVO. The input is the following:

(28) Input according to CT.SVO.GEN

a. Input with full complexity

$[_{TP}\ [_{DP}\ D\ [_{NP}\ N_1]]\ [_{T'}\ T\ [_{vP}\ t_{NP}\ [_{v'}\ V{+}v\ [_{VP}\ t_V\ [_{DP}\ D\ [_{NP}\ N_2]]]]]]]$

b. Input as seen by constraints of CT.SVO.CON

$[[(D)\ N_1]\ [V\ [(D)\ N_2]]]$

c. C-command relations between overt words

(V,N_2), and no others

Like in CT.VOO, it is crucial that there be a functional head like D taking NP as its complement, so that neither N c-commands any other overt words. As stated in (28c), V c-commands N_2, but not N_1, and neither N_1 nor N_2 c-commands anything. Note that the gross constituency in (28b) from which (28c) is derived would not be altered if (28a) involved movement of the verbal complex to T, meaning that the conclusions reached for CT.SVO are somewhat less brittle than those for MT.SVO, where changes in syntactic assumptions about the input would lead to a different factorial typology.

The remainder of CT.SVO.GEN is exactly the same as MT.SVO.GEN. The outputs are the same as those described in (22), and the correspondence relation between inputs and outputs is that given in (23) (applied only to the overt terminals N_1, V, and N_2).

The constraint set for CT.SVO is the same as that for CT.VOO:

(29) CT.SVO.CON = CT.VOO.CON in (16)

That is, the constraints are TOGETHER, APART, STRICTAPART, BINMIN(φ,branches), BINMAX(φ,branches), and *φ. These evaluate the four optima of this system as shown in (30), which excludes the 29 harmonic bounds found in the Appendix.

(30) VT containing the 4 CT.SVO optima (29 harmonic bounds excluded)

[[(D) N_1] [V [(D) N_2]]]	TOGETHER	APART	STRICT APART	BINMIN (φ,b)	BINMAX (φ,b)	*φ
a. (N_1 V N_2)		4	6		1	1
b. (N_1 (V N_2))		2	4			2
c. (N_1) (V N_2)			2	1		2
d. (N_1) (V) (N_2)	2			3		3

C-command relations between overt words in input: (V,N_2) and no others

The factorial typology of CT.SVO is given in (31).

(31) Factorial typology of CT.SVO

	[[(D) N] [V [(D) N]]]	Attestation
L.1	(N V N)	*none*
L.2	(N (V N))	*none*
L.3	(N) (V N)	Kimatuumbi
L.5	(N) (V) (N)	Ewe

The four languages of the typology have the grammars in (32), again represented as Skeletal Bases.

(32) Skeletal Bases for typology of CT.SVO

a. L.1: (N V N) – unattested

TOGETHER	BINMIN	*φ	APART	STRICTAPART	BINMAX
		W	L	L	L

b. L.2: (N (V N)) – unattested

TOGETHER	BINMIN	BINMAX	APART	STRICTAPART	*φ
	W		L	L	
		W	W	W	L

c. L.3: (N) (V N) – compatible with Kimatuumbi

TOGETHER	APART	BINMAX	STRICTAPART	BINMIN	*φ
W			L	W	W
	W	W	W		L
	W		W	L	

d. L.4: (N) (V) (N) – compatible with Ewe

APART	STRICTAPART	BINMAX	TOGETHER	BINMIN	*φ
	W		L	L	L

Two of the languages of the CT.SVO typology display attested phrasings. L.3 has the (N) (V N) phrasing of Kimatuumbi, and L.4 the (N) (V) (N) phrasing of Ewe. The other two languages have unattested phrasings (both also present in the MT.SVO typology). Neither has the disadvantage of phrasing the subject and verb together without the object, unlike MT.SVO which predicts the problematic phrasing ((N V) N). Since it is suspected that such a phrasing is impossible (Dobashi 2003, Samuels 2009), this appears to be a successful prediction of Command Theory as instantiated in this system.

4. Conclusion

In this paper, I have explored four Optimality-Theoretic systems to demonstrate how Match Theory (Selkirk 2011) and Command Theory (Kalivoda 2018) account for the phonological phrasings of VOO and SVO sentences containing three prosodic words. The Match-Theoretic systems use MATCH constraints, binarity constraints, and STRONGSTART, with some MATCH constraints referring specifically to lexical XPs and others referring to XPs in general, as proposed by Selkirk & Lee (2017). The Command-Theoretic systems use the mapping constraints TOGETHER, APART, and STRICTAPART, plus two binarity constraints and a structural economy constraint *φ.

Both Match Theory and Command Theory as instantiated in these systems predict the full range of attested phonological phrasings for 3ω VOO and SVO. That is, they predict flattened and mismatching phrasings for VOO in which the verb phrases with the first object, while also predicting matching or nearly-matching phrasings for SVO. However, Match Theory also predicts several unattested matching phrasings for VOO, as well as an unattested phrasing for SVO in which the subject and verb phrase together to the exclusion of the object.

Further empirical research on the typology of phonological phrasing is needed to determine whether these additional predictions constitute overgeneration. Command Theory has the interesting property of being highly restrictive while still generating the attested phrasings for these sentence-types.[11]

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[11] While both achieve empirical coverage in the simple VOO and SVO cases discussed here, it may turn out that Match Theory and Command Theory are both overly restrictive. Elsewhere, I have argued that a phonological phrasing asymmetry in Japanese is best analyzed with syntax-prosody alignment constraints, which have no place in MT or CT (Bellik, Ito, Kalivoda, & Mester to appear). I leave this question open for future research.

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Appendix

Violation tableau for MT.VOO

[LP V [FP [LP N] [LP N]]]	MATCH (XP,φ)	MATCH (φ,XP)	MATCH (LP,φ)	MATCH (φ,LP)	BINMIN (φ,b)	BINMAX (φ,b)	STRONG START
{(V N N)}	3	0	2	0	0	1	0
{((V N) (N))}	2	1	1	1	1	0	0
{((V N) N)}	3	1	2	1	0	0	0
{(((V) (N)) (N))}	1	2	0	2	3	0	0
{(((V) (N)) N)}	2	2	1	2	2	0	0
{(((V) N) (N))}	2	2	1	2	2	0	0
{(((V) N) N)}	3	2	2	2	1	0	0
{((V (N)) (N))}	1	1	0	1	2	0	1
{((V (N)) N)}	2	1	1	1	1	0	1
{(V N (N))}	2	0	1	0	1	1	0
{((V) (N N))}	2	1	2	2	1	0	0
{((V) ((N) (N)))}	0	1	0	2	3	0	0
{((V) ((N) N))}	1	1	1	2	2	0	0
{((V) (N (N)))}	1	1	1	2	2	0	1
{((V) N N)}	3	1	2	1	1	1	0
{((V) (N) (N))}	1	1	0	1	3	1	0
{((V) (N) N)}	2	1	1	1	2	1	0
{((V) N (N))}	2	1	1	1	2	1	0
{(V (N N))}	2	0	2	1	0	0	1
{(V ((N) (N)))}	0	0	0	1	2	0	1
{(V ((N) N))}	1	0	1	1	1	0	1
{(V (N (N)))}	1	0	1	1	1	0	2
{(V (N) (N))}	1	0	0	0	2	1	1
{(V (N) N)}	2	0	1	0	1	1	1
{(V N) (N)}	3	1	2	1	1	0	0
{((V) (N)) (N)}	2	2	1	2	3	0	0
{((V) N) (N)}	3	2	2	2	2	0	0
{(V (N)) (N)}	2	1	1	1	2	0	1
{(V) (N N)}	3	1	3	2	1	0	0
{(V) ((N) (N))}	1	1	1	2	3	0	0
{(V) ((N) N)}	2	1	2	2	2	0	0
{(V) (N (N))}	2	1	2	2	2	0	1
{(V) (N) (N)}	2	1	1	1	3	0	0

Violation tableau for CT.VOO

[V [[(D) N] [(D) N]]]	TOGETHER	APART	STRICTAPART	BINMIN(φ,b)	BINMAX(φ,b)	*φ
{(V N N)}	0	2	6	0	1	1
{((V N) (N))}	2	0	2	1	0	3
{((V N) N)}	1	1	4	0	0	2
{(((V) (N)) (N))}	5	0	0	3	0	5
{(((V) (N)) N)}	4	1	2	2	0	4
{(((V) N) (N))}	4	0	1	2	0	4
{(((V) N) N)}	3	1	3	1	0	3
{((V (N)) (N))}	3	0	1	2	0	4
{((V (N)) N)}	2	1	3	1	0	3
{(V N (N))}	1	1	4	1	1	2
{((V) (N N))}	4	2	2	1	0	3
{((V) ((N) (N)))}	6	0	0	3	0	5
{((V) ((N) N))}	5	1	1	2	0	4
{((V) (N (N)))}	5	1	1	2	0	4
{((V) N N)}	2	2	4	1	1	2
{((V) (N) (N))}	4	0	0	3	1	4
{((V) (N) N)}	3	1	2	2	1	3
{((V) N (N))}	3	1	2	2	1	3
{(V (N N))}	2	2	4	0	0	2
{(V ((N) (N)))}	4	0	2	2	0	4
{(V ((N) N))}	3	1	3	1	0	3
{(V (N (N)))}	3	1	3	1	0	3
{(V (N) (N))}	2	0	2	2	1	3
{(V (N) N)}	1	1	4	1	1	2
{(V N) (N)}	2	0	2	1	0	2
{((V) (N)) (N)}	5	0	0	3	0	4
{((V) N) (N)}	4	0	1	2	0	3
{(V (N)) (N)}	3	0	1	2	0	3
{(V) (N N)}	4	2	2	1	0	2
{(V) ((N) (N))}	6	0	0	3	0	4
{(V) ((N) N)}	5	1	1	2	0	3
{(V) (N (N))}	5	1	1	2	0	3
{(V) (N) (N)}	4	0	0	3	0	3

Violation tableau for MT.SVO

[FP [LP N] [LP V [LP N]]]	MATCH (XP,φ)	MATCH (φ,XP)	MATCH (LP,φ)	MATCH (φ,LP)	BINMIN (φ,b)	BINMAX (φ,b)	STRONG START
{(N V N)}	3	0	3	1	0	1	0
{((N V) (N))}	2	1	2	2	1	0	0
{((N V) N)}	3	1	3	2	0	0	0
{(((N) (V)) (N))}	1	2	1	3	3	0	0
{(((N) (V)) N)}	2	2	2	3	2	0	0
{(((N) V) (N))}	1	1	1	2	2	0	0
{(((N) V) N)}	2	1	2	2	1	0	0
{((N (V)) (N))}	2	2	2	3	2	0	1
{((N (V)) N)}	3	2	3	3	1	0	1
{(N V (N))}	2	0	2	1	1	1	0
{((N) (V N))}	1	0	1	1	1	0	0
{((N) ((V) (N)))}	0	1	0	2	3	0	0
{((N) ((V) N))}	1	1	1	2	2	0	0
{((N) (V (N)))}	0	0	0	1	2	0	1
{((N) V N)}	2	0	2	1	1	1	0
{((N) (V) (N))}	1	1	1	2	3	1	0
{((N) (V) N)}	2	1	2	2	2	1	0
{((N) V (N))}	1	0	1	1	2	1	0
{(N (V N))}	2	0	2	1	0	0	1
{(N ((V) (N)))}	1	1	1	2	2	0	1
{(N ((V) N))}	2	1	2	2	1	0	1
{(N (V (N)))}	1	0	1	1	1	0	2
{(N (V) (N))}	2	1	2	2	2	1	1
{(N (V) N)}	3	1	3	2	1	1	1
{(N V) (N)}	3	1	2	1	1	0	0
{((N) (V)) (N)}	2	2	1	2	3	0	0
{((N) V) (N)}	2	1	1	1	2	0	0
{(N (V)) (N)}	3	2	2	2	2	0	1
{(N) (V N)}	2	0	1	0	1	0	0
{(N) ((V) (N))}	1	1	0	1	3	0	0
{(N) ((V) N)}	2	1	1	1	2	0	0
{(N) (V (N))}	1	0	0	0	2	0	1
{(N) (V) (N)}	2	1	1	1	3	0	0

Violation tableau for CT.SVO

[[(D) N] [V [(D) N]]]	TOGETHER	APART	STRICTAPART	BINMIN(φ,b)	BINMAX(φ,b)	*φ
{(N V N)}	0	4	6	0	1	1
{((N V) (N))}	2	2	2	1	0	3
{((N V) N)}	1	3	4	0	0	2
{(((N) (V)) (N))}	3	0	0	3	0	5
{(((N) (V)) N)}	2	1	2	2	0	4
{(((N) V) (N))}	2	1	1	2	0	4
{(((N) V) N)}	1	2	3	1	0	3
{((N (V)) (N))}	3	1	1	2	0	4
{((N (V)) N)}	2	2	3	1	0	3
{(N V (N))}	1	3	4	1	1	2
{((N) (V N))}	0	0	2	1	0	3
{((N) ((V) (N)))}	2	0	0	3	0	5
{((N) ((V) N))}	1	0	1	2	0	4
{((N) (V (N)))}	1	0	1	2	0	4
{((N) V N)}	0	2	4	1	1	2
{((N) (V) (N))}	2	0	0	3	1	4
{((N) (V) N)}	1	1	2	2	1	3
{((N) V (N))}	1	1	2	2	1	3
{(N (V N))}	0	2	4	0	0	2
{(N ((V) (N)))}	2	2	2	2	0	4
{(N ((V) N))}	1	2	3	1	0	3
{(N (V (N)))}	1	2	3	1	0	3
{(N (V) (N))}	2	2	2	2	1	3
{(N (V) N)}	1	3	4	1	1	2
{(N V) (N)}	2	2	2	1	0	2
{((N) (V)) (N)}	3	0	0	3	0	4
{((N) V) (N)}	2	1	1	2	0	3
{(N (V)) (N)}	3	1	1	2	0	3
{(N) (V N)}	0	0	2	1	0	2
{(N) ((V) (N))}	2	0	0	3	0	4
{(N) ((V) N)}	1	0	1	2	0	3
{(N) (V (N))}	1	0	1	2	0	3
{(N) (V) (N)}	2	0	0	3	0	3