Overtly Headed XPs and Irish Syntax–Prosody Mapping*

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1 Introduction

- Phonological phrasing reflects syntactic phrasing, but imperfectly.
- Match Theory (Selkirk 2011) explains this within the framework of Optimality Theory (Prince & Smolensky 1993/2004): mapping constraints demanding isomorphism interact with prosodic well-formedness constraints that motivate mismatches.
- A number of recent analyses of Irish phonological phrasing (Elfner 2012, 2015; Bennett et al. 2016, 2019) have been influential in shaping Match Theory.
- Elfner (2012) notices a ranking paradox in the Irish phrasing of V-S-OO compared to V-SS-O, and offers an analysis using Harmonic Grammar (Legendre et al. 1990).
- The present study: Provide a parallel OT solution with strict ranking, using the full candidate set.
- Roadmap:
  - Background and Irish data (§2)
  - Puzzle 1 and solution: Matching overtly headed phrases (§3.1)
  - Puzzle 2 and solution: Refining StrongStart (§3.2)
  - Putting it all together: A complete OT system (§4)
  - Discussion and conclusion (§5)

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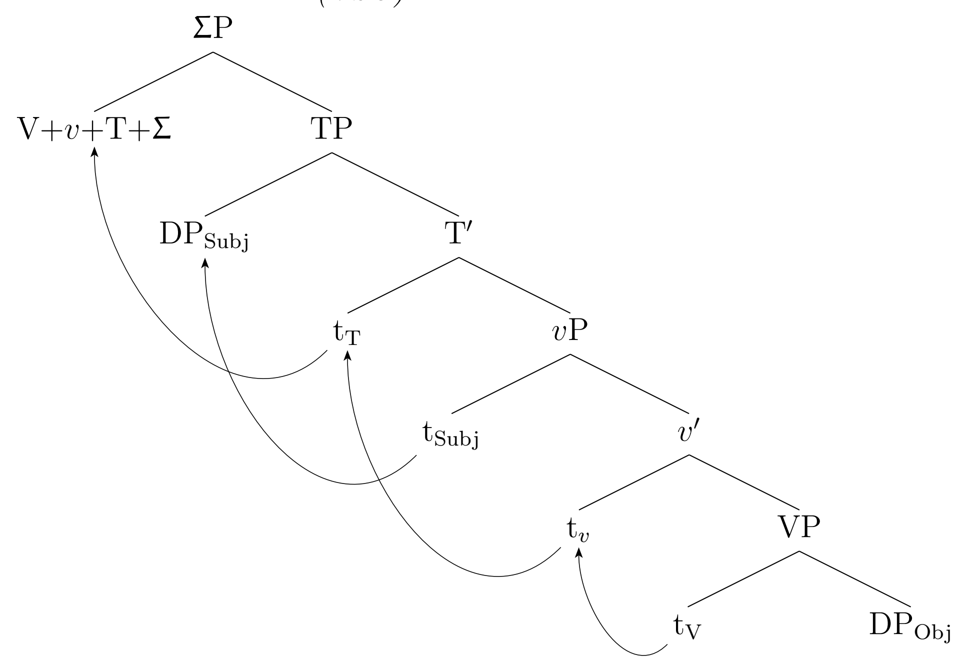
2 Background on Irish

2.1 Irish syntax

We follow Elfner (2012, 2015) in adopting the syntactic analysis of Irish clause structure developed by Chung & McCloskey (1987) and McCloskey (1991, 1996, 2001, 2011).

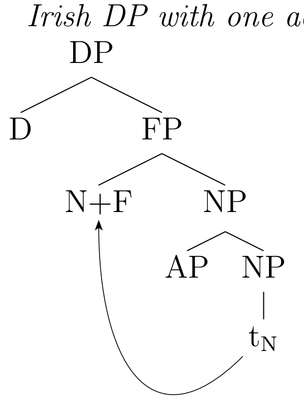
- In a finite main clause, the verb undergoes successive head-movement through v and T to a polarity head Σ.
- The subject moves to Spec,TP, and if there is an object, it remains *in situ*.[1]

(1) *Irish clause structure (VSO)*

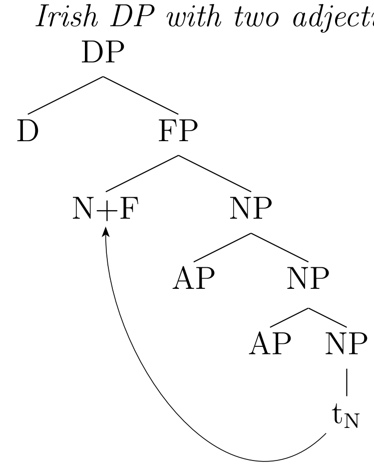


- Within the DP, we follow Elfner (2012, 2015) and McCloskey (p.c.) in positing a functional head F between D and N, to which N obligatorily moves, deriving the correct noun-adjective word order.[2]

(2) *Irish DP with one adjective*



(3) *Irish DP with two adjectives*



2.2 Visibility of syntax to phonology

We follow previous work in assuming that the phonology's view of the syntax is simplified in three major ways:

1. Syntactic projections that are [+min, +max] (non-branching XPs) are treated as X^0s (4a).[3]

2. Two XPs with the same overt terminal string are counted as a single XP by the MATCH constraints, and an XP that dominates no overt terminals is ignored by the MATCH constraints Elfner (2012) (4b).[4]

3. XP labels such as TP, NP, and VP play no role in the phonology, and are replaced by the labels OhP (= overtly headed phrase) and ShP (silently headed phrase) (see Nespor & Vogel 1986) (4c).

   - Of the branching XPs in the input trees in this study, every ΣP and FP is overtly headed: ΣP is headed by the moved verb, and FP is headed by the moved noun.
   - All other branching XPs (TPs, DPs, NPs, *v*Ps, VPs) are covertly headed. They either have inherently silent heads, or lexical heads that have moved.[5]

(4) a. Removing unary XPs: $[_{\Sigma P}$ V+v+T+Σ $[_{TP}$ N_i $[_{T'}$ t_T $[_{vP}$ t_i $[_{v'}$ t_v $[_{VP}$ t_V $(N_j)]]]]]]$

b. After pruning and conflation: $[_{\Sigma P}$ V $[_{TP}$ N N$]]$

c. Eliminating category labels: $[_{OhP}$ V $[_{ShP}$ N N$]]$

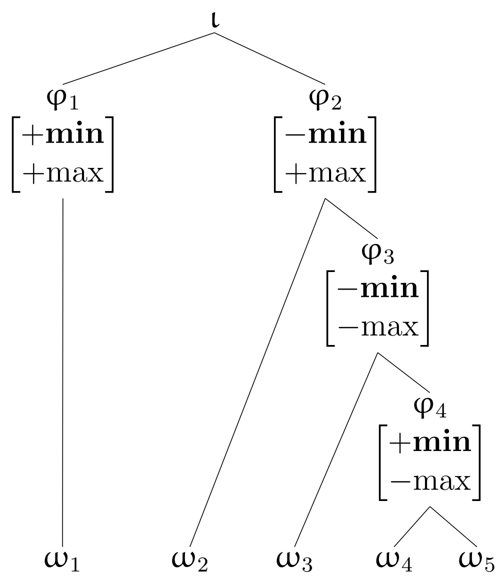
2.3 Irish prosody

- We follow Elfner (2012, 2015) in adopting the restricted inventory of prosodic categories posited by Ito & Mester (2007, 2009a,b, 2010, 2013), with prosodic recursion being permitted and sometimes giving rise to different phonological phenomena at different levels of embedding (also see: Ladd (1986), Gussenhoven (1991, 2005))

	ι	(the intonational phrase)
>	φ	(the phonological phrase)
>	ω	(the prosodic word)

- A prosodic constituent π bears two features determined by its hierarchical relation to other constituents of the same category: [±minimal] and [±maximal].

(5) *Minimality and maximality of phonological phrases*



- Elfner (2012, 2015) presents a theory of phonological phrasing in Irish within Match Theory, analyzing data like (6) and (7). (Additional Irish sentences corresponding to (9a–g) are given in Appendix A.)

- We adopt Elfner's phrasing diagnostics in (8).

(6) *V-SS-O* (Elfner 2012, p. 62)

díofaidh^{LH}	rúnaí^{LH}	dathúil^{HL}	blathanna^{HL}
sell.FUT	secretary	handsome	flowers

'A handsome secretary will sell flowers.'

(7) *V-S-OO* (Elfner 2015, p. 1198)

cheannaigh^{LH}	múinteoirí^{HL}	málaí	bána^{HL}
bought	teachers	bags	white

'Teachers bought white bags.'

(8) *Elfner's phrasing diagnostics for Irish*

a. LH leftmost ω of [−min] φ

b. HL rightmost ω of φ

- These diagnostics yield the phrasings in (9). Irish φ's are usually isomorphic to XPs, but sometimes deviate from perfect syntax–prosody matching to satisfy certain prosodic markedness constraints, primarily StrongStart and Binarity.

(9) *Phrasings proposed by Elfner (2012, 2015)*

a.	V-SS	→	((V^{LH} S^{HL}) S^{HL})	(mismatch)
b.	V-S-O	→	(V^{LH} (S O^{HL})), ((V^{LH} S^{HL}) O^{HL})	(match, mismatch)
c.	V-SS-O	→	(V^{LH} ((S^{LH} S^{HL}) O^{HL}))	(match)
d.	V-S-OO	→	((V^{LH} S^{HL}) (O O^{HL}))	(mismatch)
e.	V-SS-OO	→	(V^{LH} ((S^{LH} S^{HL}) (O O^{HL})))	(match)
f.	V-SSS-OO	→	(V^{LH} ((S^{LH} (S S^{HL})) (O O^{HL})))	(match)
g.	V-SS-OOO	→	(V^{LH} ((S^{LH} S^{HL}) (O^{LH} (O O^{HL}))))	(match)

3 Analytical Puzzles

3.1 Puzzle 1: Overt Headedness

The puzzle noticed by Elfner (2012):

- V-SS (9a) and V-S-OO (9d) are rebracketed to ((V S) S) and ((V S)(O O)) in order to avoid having an initial phonological word be sister to a φ, which would violate StrongStart.
  - StrongStart ≫ Match(XP,φ)
  - Elfner's StrongStart(ω) (paraphrased): Assign one violation for every node whose leftmost daughter is an ω, and is lower in the prosodic hierarchy than its sister constituent immediately to its right.
- But rebracketing is blocked in V-SS-O (9c). Why don't we see *((V S)(S O))?
  - Match(XP,φ) ≫ StrongStart
  - This is a ranking paradox; the Elementary Ranking Conditions (ERCs; Prince 2002) (12) for these two winners are contradictory.

(10) *Contradictory ERCs*

Input	Winner	Loser	St St	Match (XP,φ)	Max Bin
$[_{XP}$ V $[_{XP}$ $[_{XP}$ N A] N]]	(V_{LH} ((N^{LH} A^{HL}) N^{HL}))	(((V^{LH} N^{HL}) A^{HL}) N_{HL}) ((V_{LH} N^{HL}) (A N^{HL}))	$L_{1>0}$	$W_{0<2}$	$e_{0=0}$
$[_{XP}$ V $[_{XP}$ N $[_{XP}$ N A]]]	((V_{LH} N_{HL}) (N A_{HL}))	(V_{LH} (N_{LH} (N A_{HL})))	$W_{0<2}$	$L_{1>0}$	$e_{0=0}$

- To resolve this paradox, we need a constraint that penalizes mismatching the subject in V-SS-O more than it penalizes mismatching the TP containing both subject and object.
- One difference between these XPs: the matched subject FP is overtly headed, the mismatched TP is not. We therefore define...

(11) Match($XP_{OvertlyHeaded}$,φ) (henceforth Match(OhP,φ))
Violated by an input OhP (overtly headed XP) that does not have a matching φ in the output.

- This constraint is also proposed by Van Handel (ms.) for Italian.
- The paradox is resolved with the introduction of Match(OhP,φ).[6]

(12) *Contradiction resolved*

Input	Winner	Loser	Match (OhP,φ)	St St	Match (XP,φ)	Max Bin
$[_{OhP}$ V $[_{ShP}$ $[_{OhP}$ N A] N]]	(V_{LH} ((N^{LH} A^{HL}) N^{HL}))	(((V^{LH} N^{HL}) A^{HL}) N_{HL}) ((V_{LH} N^{HL}) (A N^{HL}))	$W_{0<1}$	$L_{1>0}$	$W_{0<2}$	$e_{0=0}$
$[_{OhP}$ V $[_{ShP}$ N $[_{OhP}$ N A]]]	((V_{LH} N_{HL}) (N A_{HL}))	(V_{LH} (N_{LH} (N A_{HL})))	$e_{0=0}$	$W_{0<2}$	$L_{1>0}$	$e_{0=0}$

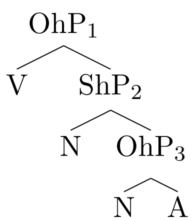
3.2 Puzzle 2: Toleration of medial "weak starts"

- Within OT, surface forms are to be optimal within the space of all candidates defined by Gen.
  - For syntax–prosody mapping, candidates are ⟨syntactic tree, prosodic tree⟩ pairs, and as a result, the candidate space grows exponentially as the number of terminals in the trees grows.
  - We surmount this problem using the Syntax Prosody in OT app (SPOT; Bellik et al. 2020) to automate candidate generation and evaluation, and OTWorkplace (Prince et al. 2020) to compute and analyze typologies.
- With the inclusion of the full candidate set, created using SPOT (Bellik et al. (2020)), we discovered a second puzzle, depicted in (13):
  - Tableaux for V-SS-O, V-S-OO, and V-SS-OO show: Match(OhP,φ) $\gg$ StrongStart $\gg$ Match(XP,φ), as established above.
  - But for the perfectly isomorphic phrasings of V-SSS-OO and V-SS-OOO, Match(XP,φ) must dominate StrongStart.

(13) *Contradictory ERCs with plain* StrongStart

<table>
<tr><th>Input</th><th>Winner-Loser Pair</th><th>Match (OhP,φ)</th><th>StSt</th><th>Match (XP,φ)</th><th>BinMax</th></tr>
<tr><td>

V-S-OO:



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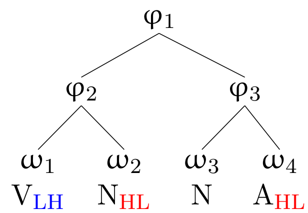
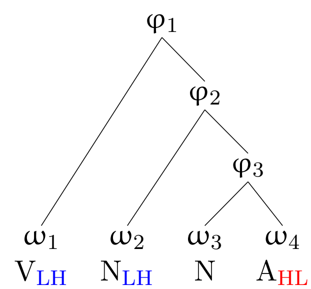
Wins:

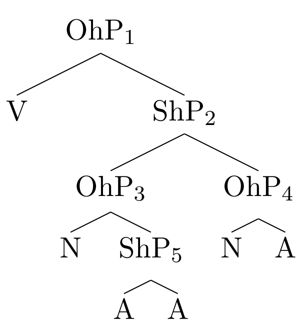


Loses:



</td><td>e</td><td>W</td><td>L</td><td>e</td></tr>
<tr><td>

V-SSS-OO



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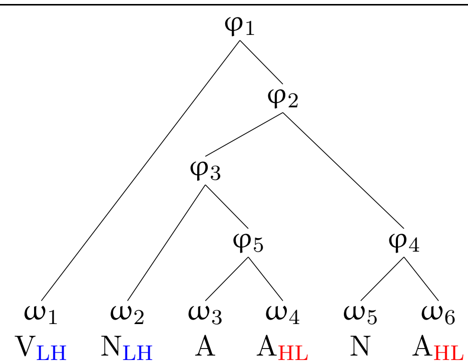
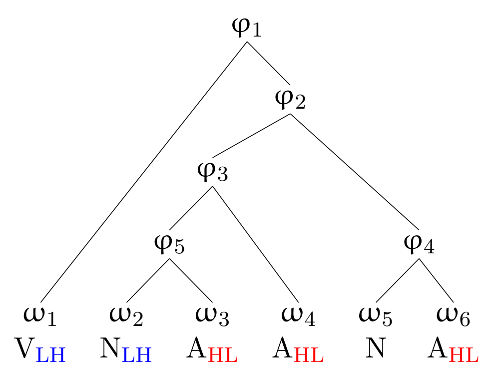
Wins:



Loses:



</td><td>e</td><td>L</td><td>W</td><td>e</td></tr>
</table>

- Considering the ω–φ sister sequences that are and are not tolerated, we can observe that the tolerable pair occurs ι-medially.
  - In the first loser, ω_1–φ_2 is not tolerated.
  - In the second winner, ω_2–φ_5 is tolerated.

  - MATCH(OhP,φ) does not distinguish the winners and losers here. Both winners match all OhP's.

- This suggests a solution to the second puzzle through a refinement to STRONGSTART.

(14) $\text{STRONGSTART}_{\text{Init}}$
Violated by an ι-initial ω that is sister to a φ.

- If this constraint replaces STRONGSTART in the above (13), it resolves the paradox.

4 Putting it all together

- By combining MATCH(OhP,φ) and $\text{STRONGSTART}_{\text{Init}}$, we can capture the phrasing of all the transitive sentences seen here.

- We define an explicit OT system in the sense of Alber et al. (2016), with GEN in §4.1 and CON in §4.2.

4.1 Gen

4.1.1 Inputs

(15) *Inputs*
An input is a tree $[_{\text{OhP}}$ V $[_{\text{ShP}}$ DP (DP)], where each DP is of the form (a), (b), or (c):

a. N
b. $[_{\text{OhP}}$ N A]
c. $[_{\text{OhP}}$ N $[_{\text{ShP}}$ A A]]

- This GEN defines a number of trees for which we lack data; these, and their predicted phrasing in our system, can be seen in the Appendix D.

(16) *Input trees*

a. *V-SS* (cf. (25))
$[_{\text{OhP}}$ V $[_{\text{OhP}}$ N A]]

b. *V-S-O* (cf. (26))
$[_{\text{OhP}}$ V $[_{\text{ShP}}$ N N]]

c. *V-SS-O* (cf. (27))
$[_{\text{OhP}}$ V $[_{\text{ShP}}$ $[_{\text{OhP}}$ N A] N]]

d. *V-S-OO* (cf. (28))
$[_{\text{OhP}}$ V $[_{\text{ShP}}$ N $[_{\text{OhP}}$ N A]]]

e. *V-SS-OO* (cf. (29))
$[_{\text{OhP}}$ V $[_{\text{ShP}}$ $[_{\text{OhP}}$ N A] $[_{\text{OhP}}$ N A]]]

f. *V-SSS-OO* (cf. (30))
$[_{\text{OhP}}$ V $[_{\text{ShP}}$ $[_{\text{OhP}}$ N $[_{\text{ShP}}$ A A]] $[_{\text{OhP}}$ N A]]]

g. *V-SS-OOO* (cf. (31))
$[_{\text{OhP}}$ V $[_{\text{ShP}}$ $[_{\text{OhP}}$ N A] $[_{\text{OhP}}$ N $[_{\text{ShP}}$ A A]]]]

4.1.2 Outputs

(17) *Outputs*
For an input *sTree*, an output *pTree* is a prosodic tree such that
a. Every maximal syntactic word X^0 in the input is mapped to an output phonological word ω.
b. The linear order of words is preserved.
c. The root node is of category ι.
d. All non-terminal non-root nodes are of category φ.
e. Every node of category φ immediately dominates at least two other nodes.

- These were calculated with SPOT (Bellik et al. (2020)). Note that for an input tree with 6 terminals (V-SS-OOO), this function yields 229 prosodic output trees, and an input with 7 terminals (V-SSS-OOO) yields 1,068 outputs, so automation is crucial.

4.2 Con

(18) Con
a. *Syntax–prosody mapping constraints*
i. Match(XP,φ) (Selkirk 2011; Elfner 2012, 2015)
Violated by an input XP that does not have a matching φ in the output.
ii. Match($XP_{\text{OvertlyHeaded}}$,$\varphi$) (Van Handel 2019)
Violated by an input OhP (overtly headed XP) that does not have a matching φ in the output.
b. *Markedness constraints*
i. BinMax(φ,branches) (Elfner 2012, 2015)
Violated by a φ that immediately dominates more than two nodes.
ii. $\text{StrongStart}_{\text{Init}}$ (new proposal)
Violated by an ι-initial ω that is sister to a φ.

- The definitions of the Match constraints in (18a) and (18c) use the term "matching". This is defined as follows:

(19) *Definition of matching* (Selkirk 2011; Elfner 2012, our wording)
Two constituents α and β are matching iff the terminal string of α is identical to the terminal string of β.

4.3 Results

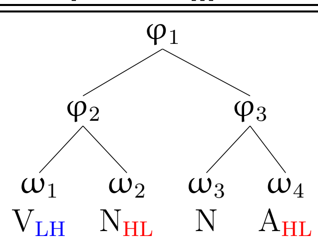
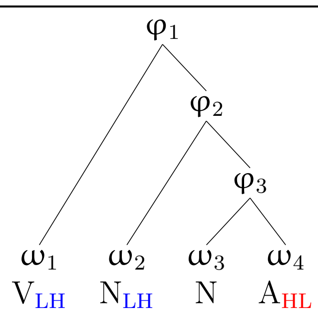
- We created violation tableaux for this system using SPOT (Bellik et al. (2020)), and calculated rankings and a typology using OTWorkplace (Prince et al. (2020)).
- The typology contains three languages, one of which (L2) is compatible with all the transitive inputs for Irish.

4.3.1 The prosodic grammar of Irish

We will examine the ERCs in L2 for the three sentences: V-S-OO, V-SS-O, and V-SS-OO.

- In the tableau for V-S-OO in (20)[7], the rebracketed winner (a)
  - violates MATCH(XP,φ), because ShP (the TP) has no matching φ,
  - but satisfies STRONGSTART$_{Init}$.
- The isomorphic loser (b)
  - satisfies MATCH(XP,φ), since the $OhP_{max} \rightarrow \varphi_1$, $ShP \rightarrow \varphi_2$, and $OhP_{Min} \rightarrow \varphi_3$
  - but violates STRONGSTART$_{Init}$ because ω_1 is sister to φ_2.

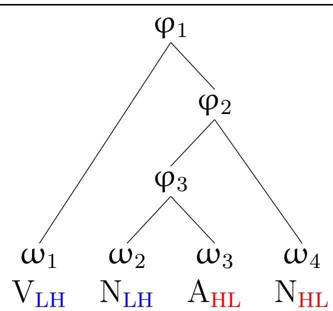
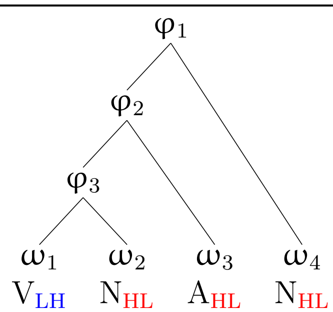
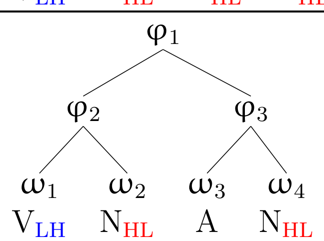
(20) *Tableau for Irish V-S-OO (2/2 optima; 10/10 HBs in (34))*

$[_{OhP}$ V $[_{ShP}$ N $[_{OhP}$ N A]]]	MATCH (OhP,φ)	ST ST$_{Init}$	MATCH (XP,φ)	BIN MAX
a. → 	0	0	1	0
b. 	e_0	W_1	L_0	e_0

- Combined with the ERC in (20), that in (21) for V-SS-O shows: MATCH(OhP,φ) ≫ STRONGSTART$_{Init}$.

- The isomorphic winning candidate (a)
  - fully satisfies Match(XP,φ), and by entailment Match(OhP,φ),
  - but violates StrongStart$_{\text{Init}}$ since ω_1 is sister to φ_2.
- The losing candidates (b) and (c) tie on all constraints.
  - Each violates Match(XP,φ) twice: neither the ShP (the TP) nor the smaller OhP (the subject) is matched.
  - Each violates Match(OhP,φ) once, for the OhP subject.
  - Neither violates StrongStart$_{\text{Init}}$.

(21) *Tableau for Irish V-SS-O (3/3 optima; 9/9 HBs in (33))*

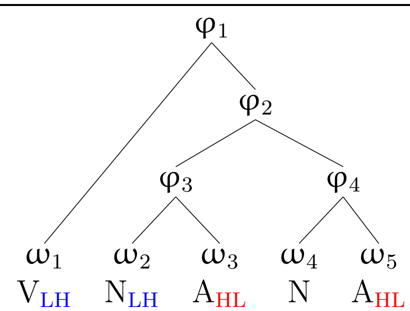
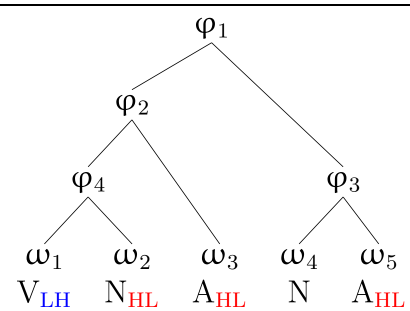
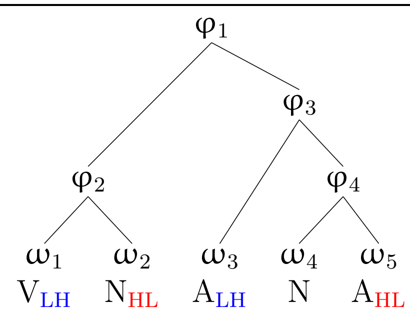
[$_{\text{OhP}}$ V [$_{\text{ShP}}$ [$_{\text{OhP}}$ N A] N]]	Match (OhP,φ)	St St$_{\text{Init}}$	Match (XP,φ)	Bin Max
a. → 	0	1	0	0
b. 	W$_1$	L$_0$	W$_2$	e$_0$
c. 	W$_1$	L$_0$	W$_2$	e$_0$

- The V-SS-OO case in (22) is similar to the V-SS-O case in (21), providing the same ERC.
  - What these have in common is that it is impossible to phrase the verb with the word to its left, avoiding a StrongStart$_{\text{Init}}$ violation, without violating Match(OhP,φ).

– This is because a multi-word subject is an OhP.

– This is also the case for V-SSS-OO and V-SS-OOO, which also have fully matching phonological phrasings (tableaux not shown here).

(22) *Tableau for Irish V-SS-OO (3/3 optima; 48/48 HBs in supplementary material)*[8]

[$_{\text{OhP}}$ V [$_{\text{ShP}}$ [$_{\text{OhP}}$ N A] [$_{\text{OhP}}$ N A]]]	MATCH (OhP,φ)	ST ST$_{\text{Init}}$	MATCH (XP,φ)	BIN MAX
a. → 	0	1	0	0
b. 	W_1	L_0	W_2	e_0
c. 	W_1	L_0	W_2	e_0

4.3.2 Factorial Typology

- The typology in (23) was calculated using OTWorkplace (Prince et al. 2020). Coloring in cells indicate a phrasing reported by Elfner.[9]

- It contains three languages. The typology obviously expands when even more constraints and syntactic inputs are included, but exploring this simple system allows us to focus on the main issues.

  – No prosody is isomorphic to syntax in L1: Always respect STRONGSTART$_{\text{Init}}$

    * Rebracket everything.

  – All prosody is isomorphic to syntax in L3: Always respects MATCH(XP,φ)

    * No rebracketing

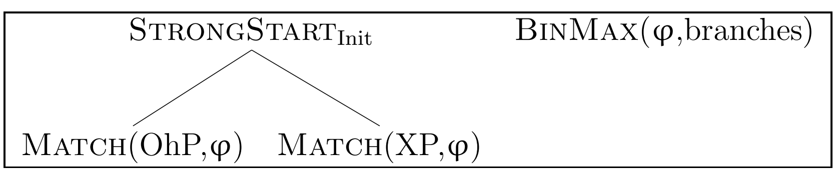
- Rebracket only silently headed XPs in L2: Always respect MATCH(OhP,φ)
  - Some rebracketing–as in Irish (as seen above)

(23) *Factorial Typology*

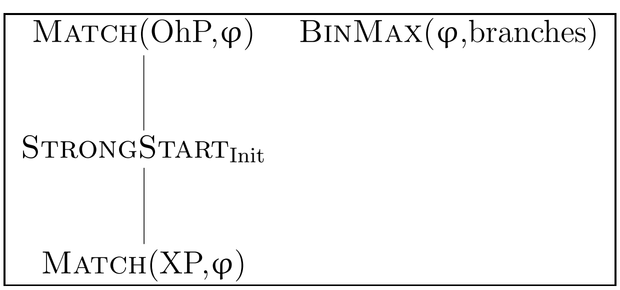
	Input	L1	L2	L3
a.	[$_{OhP}$ V [$_{OhP}$ N A]]	((V N) A)	(V (N A))	(V (N A))
b.	[$_{OhP}$ V [$_{ShP}$ N N]]	((V N) N)	((V N) N)	(V (N N))
c.	[$_{OhP}$ V [$_{ShP}$ [$_{OhP}$ N A] N]]	(((V N) A) N) ((V N) (A N))	(V ((N A) N))	(V ((N A) N))
d.	[$_{OhP}$ V [$_{ShP}$ N [$_{OhP}$ N A]]]	((V N) (N A))	((V N) (N A))	(V (N (N A)))
e.	[$_{OhP}$ V [$_{ShP}$ [$_{OhP}$ N A] [$_{OhP}$ N A]]]	(((V N) A) (N A)) ((V N) (A (N A)))	(V ((N A) (N A)))	(V ((N A) (N A)))
f.	[$_{OhP}$ V [$_{ShP}$ [$_{OhP}$ N [$_{ShP}$ A A]] [$_{OhP}$ N A]]]	(((V N) (A A)) (N A)) ((V N) ((A A) (N A)))	(V ((N (A A)) (N A)))	(V ((N (A A)) (N A)))
g.	[$_{OhP}$ V [$_{ShP}$ [$_{OhP}$ N A] [$_{OhP}$ N [$_{ShP}$ A A]]]]	(((V N) A) (N (A A))) ((V N) (A (N (A A))))	(V ((N A) (N (A A))))	(V ((N A) (N (A A))))

- MATCH(OhP,φ) is a special case of MATCH(XP,φ), and both are antagonized to STRONGSTART$_{Init}$.
- This is why ranking STRONGSTART$_{Init}$ between MATCH(OhP,φ) and MATCH(XP,φ) produces the intermediate matching/mismatching pattern seen in Irish.

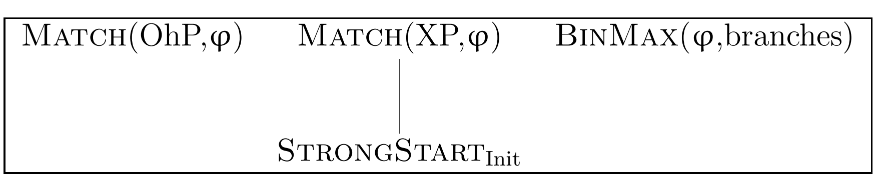
(24) a. *Grammar of L1*



b. *Grammar of L2 (Irish-like)*



c. *Grammar of L3*



5 Conclusion

- Theoretical results:
  - MT needs a constraint MATCH(OhP,φ), demanding matching of overtly headed XP's.
  - MT needs a version of STRONGSTART that only applies sentence-initially, or alternatively, only to the maximal φ.
- Methodological point: If the full set of candidates is not taken into account, errors will creep in. Using SPOT and OTWorkplace brought our attention to candidates that pose problems for previous formulations of STRONGSTART (Puzzle 2), enabling the refined definition presented here.
- Remaining questions:
  - Bennett et al. (2016) need STRONGSTART to apply sentence-medially to induce clitic movement. Can we square this with our $\text{STRONGSTART}_{\text{Init}}$?
    - Possible crucial difference: ω–φ weak start vs. σ–φ weak start?
  - Is STRONGSTART better formalized as STRONGSTARTINIT, as here, or as STRONG-START-MAXIMAL? The present data do not distinguish between these two formulations. We would need a language in which maximal φ's are not always coextensive with ι's.
  - Can MATCH(OhP,φ) handle some data previously explained using the Lexical Category Condition (Truckenbrodt 1999)?
  - What about the intransitive sentence $[_{\text{OhP}}$ V $[_{\text{OhP}}$ N A]] → ((V N) A), where rebracketing apparently applies to an overtly-headed XP.

Notes

[1]We use '+' to indicate head-adjunction. V+v+T+Σ is an abbreviation for a complex head $[_\Sigma\ [_T\ [_v\ V\ v]\ T]\ \Sigma]$, and N+F abbreviates $[_F$ N F].

[2]As will become apparent in §2.2, it does not matter for our purposes whether APs are adjoined to N or hosted within specifiers of dedicated functional projections above NP, as in cartographic syntax (Cinque 2010).

[3]We follow Elfner (2012, 2015) and Bennett et al. (2016) in simplifying the system by excluding unary φs from the set of phonological output candidates. Thus, no unary-branching XP is matched in any candidate, meaning that every candidate incurs an equal number of MATCH violations for unary XPs (for all constraints in the MATCH family used in this chapter). Within the theory of Bare Phrase Structure (Chomsky 1995a) and the broader Minimalist Program (Chomsky 1995b), a head X can be simultaneously maximal (phrasal) and minimal (non-phrasal), much like the [+min, +max] φ in (5) Unary-branching XPs in the X′-theoretic sense are recast as bare heads that do not project. We use X′-theoretic notation here for notational convenience, though the choice between X′-theoretic unary XPs and bare X(P)s has no significance for our theory of syntax–prosody mapping. See Kalivoda (2018) for further discussion of this issue. No other constraints in this chapter refer to unary XPs, so they can be safely omitted from input representations for the sake of simplicity. This is a harmless simplification in OT, since a constraint C partitions the candidate set (cset) the same as a constraint C+n, where n is constant within a given cset. The same is not true in Harmonic

Grammar, since weighted violation counts for all constraints in Con are summed to determine a candidate's harmony score. Thus, in HG, assigning MATCH(XP,φ) violations only for multi-word XPs, as opposed to for all XPs, affects a candidate's harmony score.

[4]We also abbreviate complex heads by representing only their leftmost (most deeply embedded) adjunct, and omit traces.

[5]The head of AP does not move, but every AP in an input admitted by GEN is unary-branching, hence invisible anyway.

[6]The distinction between OhPs and ShPs is reminiscent of a part of Truckenbrodt's (1995, 1999) Lexical Category Condition. However, we do not adopt the LCC, since our definition of XP-visibility differs in three crucial ways. (i) We follow Elfner (2012, 2015) in treating functional XPs like TP and ΣP as visible for mapping. (ii) ShPs are not invisible to all of the constraints we propose in §4.2, but are ignored by only one particular constraint. (iii) The distinction OhP/ShP is different from the distinction LexP/FuncP; a LexP might be silently headed, and a FuncP might be overtly headed. This third point is a major one. Although we do not present evidence for this from Irish in this talk, we suspect that it is indeed desirable for overtly headed functional projections like PPs, DPs, CPs, and TPs to be visible to MATCH in the same way as overtly headed lexical projections.

[7]Our tableaux here contain only non-harmonically-bounded candidates. Candidates found to be harmonically bounded using OTWorkplace were considered, but are not informative about ranking information. They are, however, included in Appendix C.

[8]SPOT and OTWorkplace files available upon request.

[9]There is optionality in the phrasing of [V [N N]].

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Appendix A: Irish Data

(25) *V-SS* (Elfner 2012, p. 62)

imeoidh$^{\mathrm{LH}}$	múinteoirí$^{\mathrm{HL}}$	banúla$^{\mathrm{HL}}$
leave.FUT	teachers	ladylike

'Ladylike teachers will leave.'

(26) *V-S-O* (Elfner 2012, pp. 170–171)

a. *Option 1*

cheannaigh$^{\mathrm{LH}}$	múinteoirí	málaí$^{\mathrm{HL}}$
bought	teachers	bags

'Teachers bought bags.'

b. *Option 2*

cheannaigh$^{\mathrm{LH}}$	múinteoirí$^{\mathrm{HL}}$	málaí$^{\mathrm{HL}}$
bought	teachers	bags

'Teachers bought bags.'

(27) *V-SS-O* (Elfner 2012, p. 62)

díofaidh$^{\mathrm{LH}}$	rúnaí$^{\mathrm{LH}}$	dathúil$^{\mathrm{HL}}$	blathanna$^{\mathrm{HL}}$
sell.FUT	secretary	handsome	flowers

'A handsome secretary will sell flowers.'

(28) *V-S-OO* (Elfner 2015, p. 1198)

cheannaigh$^{\mathrm{LH}}$	múinteoirí$^{\mathrm{HL}}$	málaí	bána$^{\mathrm{HL}}$
bought	teachers	bags	white

‘Teachers bought white bags.’

(29) *V-SS-OO* (Elfner 2015, p. 1174)

díolfaidh$^{\text{LH}}$ leabharlannaí$^{\text{LH}}$ dathúil$^{\text{HL}}$ blathanna áille$^{\text{HL}}$
sell.FUT librarian handsome flowers beautiful

‘A handsome librarian will sell beautiful flowers.’

(30) *V-SSS-OO* (Elfner 2015, p. 1195)

cheannaigh$^{\text{LH}}$ múinteoirí$^{\text{LH}}$ banúla dathúla$^{\text{HL}}$ blathanna áille$^{\text{HL}}$
bought teachers ladylike handsome bags white

‘Handsome ladylike teachers bought white bags.’

(31) *V-SS-OOO* (Elfner 2015, p. 1195)

díolfaidh$^{\text{LH}}$ rúnaí$^{\text{LH}}$ dathúil$^{\text{HL}}$ blathanna$^{\text{LH}}$ bána áille$^{\text{HL}}$
sell.FUT secretary handsome flowers white beautiful

‘A handsome secretary will sell beautiful flowers.’

Appendix B: Unsimplified input representations

Syntactic input trees prior to simplifications described above.

(32) a. *V-SS* (cf. (25))
$[_{\Sigma P}$ V $[_{TP}$ $[_{DP_i}$ D $[_{FP}$ N+F $[_{NP}$ $[_{AP}$ A] $[_{NP}$ t_N]]]] $[_{T'}$ t_T $[_{vP}$ t_i $[_{v'}$ t_v $[_{VP}$ t_V]]]]]]

b. *V-S-O* (cf. (26))
$[_{\Sigma P}$ V $[_{TP}$ $[_{DP_i}$ D $[_{FP}$ N+F $[_{NP}$ t_N]]] $[_{T'}$ t_T $[_{vP}$ t_i $[_{v'}$ t_v $[_{VP}$ t_V $[_{DP_j}$ D $[_{FP}$ N+F $[_{NP}$ t_N]]]]]]]]]

c. *V-SS-O* (cf. (27))
$[_{\Sigma P}$ V $[_{TP}$ $[_{DP_i}$ D $[_{FP}$ N+F $[_{NP}$ $[_{AP}$ A] $[_{NP}$ t_N]]]] $[_{T'}$ t_T $[_{vP}$ t_i $[_{v'}$ t_v $[_{VP}$ t_V $[_{DP_j}$ D $[_{FP}$ N+F $[_{NP}$ t_N]]]]]]]]]

d. *V-S-OO* (cf. (28))
$[_{\Sigma P}$ V $[_{TP}$ $[_{DP_i}$ D $[_{FP}$ N+F $[_{NP}$ t_N]]] $[_{T'}$ t_T $[_{vP}$ t_i $[_{v'}$ t_v $[_{VP}$ t_V $[_{DP_j}$ D $[_{FP}$ N+F $[_{NP}$ $[_{AP}$ A] $[_{NP}$ t_N]]]]]]]]]]

e. *V-SS-OO* (cf. (29))
$[_{\Sigma P}$ V $[_{TP}$ $[_{DP_i}$ D $[_{FP}$ N+F $[_{NP}$ $[_{AP}$ A] $[_{NP}$ t_N]]]] $[_{T'}$ t_T $[_{vP}$ t_i $[_{v'}$ t_v $[_{VP}$ t_V $[_{DP_j}$ D $[_{FP}$ N+F $[_{NP}$ $[_{AP}$ A] $[_{NP}$ t_N]]]]]]]]]]

f. *V-SSS-OO* (cf. (30))
$[_{\Sigma P}$ V $[_{TP}$ $[_{DP_i}$ D $[_{FP}$ N+F $[_{NP}$ $[_{AP}$ A] $[_{NP}$ $[_{AP}$ A] $[_{NP}$ t_N]]]]] $[_{T'}$ t_T $[_{vP}$ t_i $[_{v'}$ t_v $[_{VP}$ t_V $[_{DP_j}$ D $[_{FP}$ N+F $[_{NP}$ $[_{AP}$ A] $[_{NP}$ t_N]]]]]]]]]]

g. *V-SS-OOO* (cf. (31))
$[_{\Sigma P}$ V $[_{TP}$ $[_{DPi}$ D $[_{FP}$ N+F $[_{NP}$ $[_{AP}$ A] $[_{NP}$ t_N]]]] $[_{T'}$ t_T $[_{vP}$ t_i $[_{v'}$ t_v $[_{VP}$ t_V $[_{DPj}$ D $[_{FP}$ N+F $[_{NP}$ $[_{AP}$ A] $[_{NP}$ $[_{AP}$ A] $[_{NP}$ t_N]]]]]]]]]]

Appendix C: Tableaux with harmonic bounds

(33) *Full tableau for Irish V-SS-O (3/3 optima, 9/9 HBs; cf. (21))*

$[_{OhP}$ V $[_{ShP}$ $[_{OhP}$ N A] N]]			MATCH (OhP,φ)	ST ST_{Init}	MATCH (XP,φ)	BIN MAX
a.	→	$(V_{LH}\ ((N_{LH}\ A_{HL})\ N_{HL}))$	0	1	0	0
b.		$(((V_{LH}\ N_{HL})\ A_{HL})\ N_{HL})$	W_1	L_0	W_2	e_0
c.		$((V_{LH}\ N_{HL})\ (A\ N_{HL}))$	W_1	L_0	W_2	e_0
d.	HB	$(V\ N\ A\ N_{HL})$	W_1	L_0	W_2	W_1
e.	HB	$((V_{LH}\ N\ A_{HL})\ N_{HL})$	W_1	L_0	W_2	W_1
f.	HB	$((V_{LH}\ (N\ A_{HL}))\ N_{HL})$	e_0	e_1	W_1	e_0
g.	HB	$((V_{LH}\ N_{HL})\ A\ N_{HL})$	W_1	L_0	W_2	W_1
h.	HB	$(V_{LH}\ N\ (A\ N_{HL}))$	W_1	e_1	W_2	W_1
i.	HB	$(V_{LH}\ (N\ A\ N_{HL}))$	W_1	e_1	W_1	W_1
j.	HB	$(V_{LH}\ (N_{LH}\ (A\ N_{HL})))$	W_1	e_1	W_1	e_0
k.	HB	$(V_{LH}\ (N\ A_{HL})\ N_{HL})$	e_0	e_1	W_1	W_1
l.	HB	$(V\ N_{HL})\ (A\ N_{HL})$	W_2	L_0	W_3	e_0

(34) *Tableau for Irish V-S-OO (2/2 optima, 10/10 HBs; cf. (20))*

$[_{OhP}$ V $[_{ShP}$ N $[_{OhP}$ N A]]]			MATCH (OhP,φ)	ST ST_{Init}	MATCH (XP,φ)	BIN MAX
a.	→	$((V_{LH}\ N_{HL})\ (N\ A_{HL}))$	0	0	1	0
b.		$(V_{LH}\ (N_{LH}\ (N\ A_{HL})))$	e_0	W_1	L_0	e_0
c.	HB	$(V\ N\ N\ A_{HL})$	W_1	e_0	W_2	W_1
d.	HB	$((V_{LH}\ N\ N_{HL})\ A_{HL})$	W_1	e_0	W_2	W_1
e.	HB	$(((V_{LH}\ N_{HL})\ N_{HL})\ A_{HL})$	W_1	e_0	W_2	e_0
f.	HB	$((V_{LH}\ (N\ N_{HL}))\ A_{HL})$	W_1	W_1	W_2	e_0
g.	HB	$((V_{LH}\ N_{HL})\ N\ A_{HL})$	W_1	e_0	W_2	W_1
h.	HB	$(V_{LH}\ N\ (N\ A_{HL}))$	e_0	W_1	e_1	W_1
i.	HB	$(V_{LH}\ (N\ N\ A_{HL}))$	W_1	W_1	e_1	W_1
j.	HB	$(V_{LH}\ ((N_{LH}\ N_{HL})\ A_{HL}))$	W_1	W_1	e_1	e_0
k.	HB	$(V_{LH}\ (N\ N_{HL})\ A_{HL})$	W_1	W_1	W_2	W_1
l.	HB	$(V\ N_{HL})\ (N\ A_{HL})$	W_1	e_0	W_2	e_0

Appendix D: Inputs in our system for which we lack Irish data

(35) a. *V-S (no example)*

i. *Complex*

$[_{\Sigma P}$ V $[_{TP}$ $[_{DPi}$ D $[_{FP}$ N+F $[_{NP}$ $t_N]]]$ $[_{T'}$ t_T $[_{vP}$ t_i $[_{v'}$ t_v $[_{VP}$ $t_V]]]]]]$

ii. *Simplified*

$[_{OhP}$ V N$]$

iii. *Predicted phrasing (in L2 of our system)*

(V N_{HL})

b. *V-SSS (no example)*

i. *Complex*

$[_{\Sigma P}$ V $[_{TP}$ $[_{DPi}$ D $[_{FP}$ N+F $[_{NP}$ $[_{AP}$ A$]$ $[_{NP}$ $[_{AP}$ A$]$ $[_{NP}$ $t_N]]]]]$ $[_{T'}$ t_T $[_{vP}$ t_i $[_{v'}$ t_v $[_{VP}$ $t_V]]]]]]$

ii. *Simplified*

$[_{OhP}$ V $[_{OhP}$ N $[_{ShP}$ A A$]]]$

iii. *Predicted phrasing (in L2 of our system)*

(V_{LH} (N_{LH} (A A_{HL})))

c. *V-SSS-O (no example)*

i. *Complex*

$[_{\Sigma P}$ V $[_{TP}$ $[_{DPi}$ D $[_{FP}$ N+F $[_{NP}$ $[_{AP}$ A$]$ $[_{NP}$ $[_{AP}$ A$]$ $[_{NP}$ $t_N]]]]]$ $[_{T'}$ t_T $[_{vP}$ t_i $[_{v'}$ t_v $[_{VP}$ t_V $[_{DPj}$ D $[_{FP}$ N+F $[_{NP}$ $t_N]]]]]]]]]$

ii. *Simplified*

$[_{OhP}$ V $[_{ShP}$ $[_{OhP}$ N $[_{ShP}$ A A$]]$ N$]]$

iii. *Predicted phrasing (in L2 of our system)*

(V_{LH} ((N_{LH} (A A_{HL})) N_{HL}))

d. *V-S-OOO (no example)*

i. *Complex*

$[_{\Sigma P}$ V $[_{TP}$ $[_{DPi}$ D $[_{FP}$ N+F $[_{NP}$ $t_N]]]$ $[_{T'}$ t_T $[_{vP}$ t_i $[_{v'}$ t_v $[_{VP}$ t_V $[_{DPj}$ D $[_{FP}$ N+F $[_{NP}$ $[_{AP}$ A$]$ $[_{NP}$ $[_{AP}$ A$]$ $[_{NP}$ $t_N]]]]]]]]]]]$

ii. *Simplified*

$[_{OhP}$ V $[_{ShP}$ N $[_{OhP}$ N $[_{ShP}$ A A$]]]]$

iii. *Predicted phrasing (in L2 of our system)*

((V_{LH} N_{HL}) (N_{LH} (A A_{HL})))

e. *V-SSS-OOO (no example)*

i. *Complex*

$[_{\Sigma P}$ V $[_{TP}$ $[_{DPi}$ D $[_{FP}$ N+F $[_{NP}$ $[_{AP}$ A$]$ $[_{NP}$ $[_{AP}$ A$]$ $[_{NP}$ $t_N]]]]]$ $[_{T'}$ t_T $[_{vP}$ t_i $[_{v'}$ t_v $[_{VP}$ t_V $[_{DPj}$ D $[_{FP}$ N+F $[_{NP}$ $[_{AP}$ A$]$ $[_{NP}$ $[_{AP}$ A$]$ $[_{NP}$ $t_N]]]]]]]]]]]$

ii. *Simplified*
$[_{\text{OhP}}$ V $[_{\text{ShP}}$ $[_{\text{OhP}}$ N $[_{\text{ShP}}$ A A]] $[_{\text{OhP}}$ N $[_{\text{ShP}}$ A A]]]]

iii. *Predicted phrasing (in L2 of our system)*
$(\text{V}_{\text{LH}}\ ((\text{N}_{\text{LH}}\ (\text{A}\ \text{A}_{\text{HL}}))\ (\text{N}_{\text{LH}}\ (\text{A}\ \text{A}_{\text{HL}}))))$