Recursivity in Prosodic Phrasing: Evidence from Conamara Irish[*]

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1. Introduction

Prosodic phrasing above the word level bears at least some correspondence to syntactic constituent structure (Selkirk 1978 *et seq*.). It follows that an understanding of the correspondence relation between prosody and syntax, and the nature of mismatches, should give some insight into syntactic structure itself.

In this paper, I present new data from a phrase-level phonological pattern of rises (L-H) in Conamara Irish (CI),[1] a language that shows VSO word order in finite clauses. This pattern is interesting because it targets some, but not all, phonological phrases (φ). The data suggest that independently-motivated syntactic representations and prosodic phrasing, as evidenced from rise distribution, systematically correspond in a direct way. This is predicted from a theory of prosodic structure that allows recursivity (Ito & Mester 2006, 2010, *to appear*, Selkirk 2009, *to appear*; counter the Strict Layer Hypothesis, Selkirk 1978, 1984; Nespor & Vogel 1986): rises in CI target the leftmost word in every non-minimal (recursive) φ.

The analysis explores the predictions of Match Theory (Selkirk 2009, *to appear*), a correspondence-based approach to the syntax-prosody interface (as opposed to edge-based or alignment approaches; e.g. Selkirk 1984, 1995; Truckenbrodt 1995, 1999). As

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[1] Conamara Irish refers to the dialect of Irish (Celtic) spoken in the Conamara region of County Galway, Ireland. The speakers who participated in this study are from the towns of Ros Muc (one speaker, now living in Boston, MA) and Carraroe/An Cheathrú Rua (three speakers). This dialect has many features in common with other dialects of Irish, and there is in addition some variation among speakers within this dialect. I assume that the patterns discussed here are features of the Conamara dialect.

an indirect reference theory of the interface, Match Theory assumes that prosodic structure mediates between syntax and the application of domain-sensitive phonological processes. This predicts that purely prosodic well-formedness constraints can intervene to create mismatches between syntactic and prosodic structure. I show that this prediction is supported by the CI data with evidence from a preliminary examination of the interaction between the size of syntactic constituents (one word vs. two words) and the presence of rises. The data illustrate that the distribution of rises is in part determined by the satisfaction of constraints on the relative strength of left-edge prosodic constituents ('Strong Start', Selkirk *to appear*) and on prosodic binarity (Inkelas & Zec 1990).

2. Rises in Conamara Irish

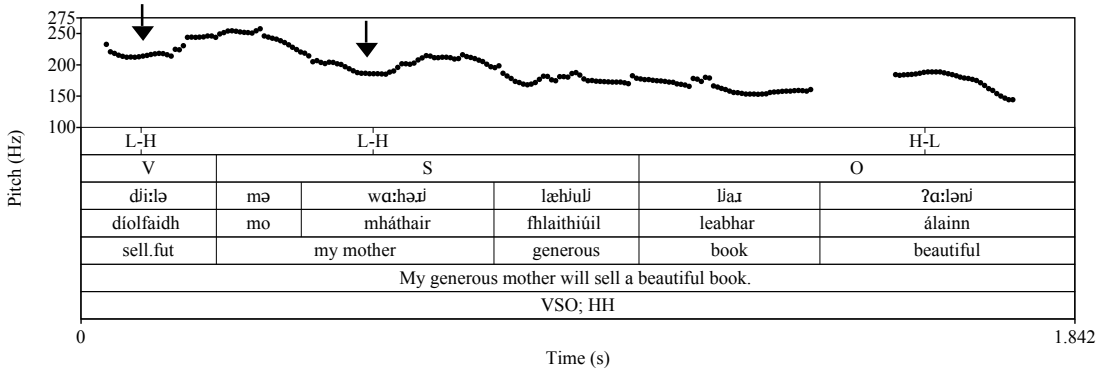
Basic word order in CI, like other varieties of Irish, is VSOX in finite clauses, where X is an adjunct or indirect object; adjectives follow the noun:

(1) a. Chonaic Seán Máire inné.
saw Seán Máire yesterday
'Seán saw Máire yesterday.'

b. Tabharfaidh mo mháthair fhlaithiúil leabhar álainn don leabharlann nua
give.FUT my mother generous book beautiful to.the library new
'My generous mother will give a beautiful book to the new library.'

Speakers of CI show a pattern of rises, where rises align with the left edge of some, but not all, lexical words.[2] For example, in an all-new VSO sentence, a rise falls on the verb (*díolfaidh* 'sell.fut') and the leftmost lexical word of the subject (*máthair* 'mother'):

(2) Pitch track for VSO sentence



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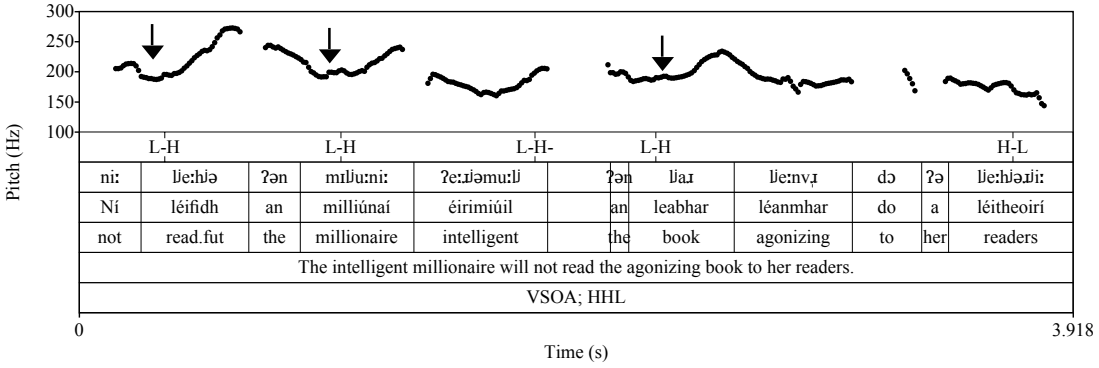
[2] All data cited in this paper are based on original fieldwork. Consultants were asked to read sets of sentences in which the target sentence was preceded and followed by context sentences. None of the words were contrastively focussed.

Additional data indicate that the rises do not simply mark the left-edge of certain syntactic constituents. For example, if an X element is added to form a VSOX sentence, a rise now falls on the leftmost word of the object (*leabhar* 'book') as well as on the verb and the subject as in (2):

(3) Pitch track for VSOX sentence[3]



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Lexical stress is generally initial in CI.[4] At present, the data do not distinguish between an analysis where the rises are boundary tones marking the left edge of a prosodic constituent (L-H%) and an analysis where the rises are pitch accents that align with the stressed syllable of the leftmost word in a prosodic constituent (L*+H). For the purposes of this paper, I will refer to them as rises (L-H) and remain agnostic with respect to whether they are boundary tones or pitch accents, as this will not affect the current proposal. Future research will help determine which analysis is correct.

3. Match Theory and Prosodic Recursion

Prosodic Hierarchy Theory (Selkirk 1978 *et seq.*) asserts the existence of a finite set of universally available prosodic levels that exist in a hierarchical relationship:

(4) Prosodic Hierarchy
- ι Intonational Phrase
- φ Phonological Phrase
- ω Prosodic Word

These levels define prosodic constituency, and form the basis for prosodic domains within which domain-sensitive phonological processes may apply.

[3] This example also shows a pause between S and O, as well as a rise on the rightmost edge of the subject. Lengthy pauses are also common in natural speech (Bennett 2008) and a rise often appears before pauses, suggesting that it is a boundary tone and not the same L-H rise that marks the left edge of recursive φs. In my data, pauses and pre-pausal rises are generally found only in VSOX sentences, where OX is at least three words.

[4] Note that in Irish orthography, acute accents as in *m<u>á</u>thair* indicate the presence of a long vowel and not the location of stress.

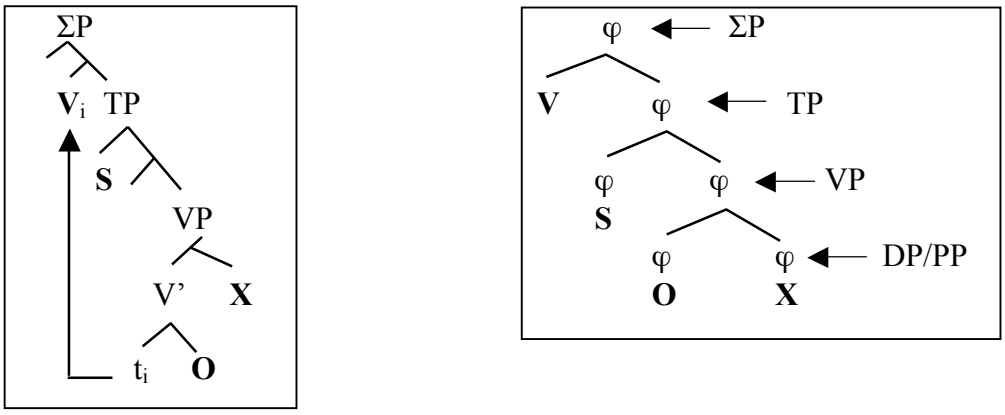
Match Theory (Selkirk 2009, *to appear*) is a correspondence-based approach to the syntax-prosody interface where syntactic constituents correspond to prosodic constituents (as opposed to edge-based or alignment-based approaches e.g. Selkirk 1984, 1995; Truckenbrodt 1995, 1999):

(5) **Match Theory**

(a) **Match Clause**: Syntactic clause → Intonational phrase (ι)
(b) **Match Phrase:** Syntactic phrase (XP) → Phonological Phrase (φ)
(c) **Match Word:** Syntactic word → Prosodic Word (ω)

These constraints, when fully satisfied, create a prosodic constituent structure that is recursive and closely mirrors syntactic structure. For example, if we take the constraint Match Phrase on its simplest terms, this constraint predicts that a syntactic phrase of any type (DP, VP, TP, etc.) should correspond to a φ. For an Irish VSOX sentence, Match Phrase predicts that the abstract syntactic structure in (6)a (based on McCloskey 2001, 2009) should correspond to the recursive prosodic structure in (6)b, provided that each of S, O, and X are XPs (DPs or PPs): [5]

(6) a. Syntactic Representation b. Recursive Prosodic Representation



Recursion-based prosodic subcategories theory (Ito and Mester 2006, 2010, *to appear*) distinguishes between the *maximal* and *minimal* projections of recursive prosodic structures, such that phonological constraints can specifically target these projections (where π is a prosodic category):

(7) π_{Max}: π not dominated by π
π_{Min}: π not dominating π

[5] This syntactic structure and the syntax-to-prosody mapping is simplified in several respects. For example, I ignore the presence of phrasal projections if they do not contain any phonologically overt material or if they dominate the same set of elements as a lower phrase, as in a structure like $_{XP}[_{YP}[_{ZP}[lex]]]$. I also assume that functional projections headed by weak functional elements (such as P or D) do not project their own φ because they are not prosodically heavy enough.

I extend this theory by proposing that in prosodic structures with multiple levels of recursivity, phonological constraints may also distinguish *non-minimal* prosodic constituents from minimal prosodic constituents:

(8) $\pi_{\text{Non-min}}$: π dominating π

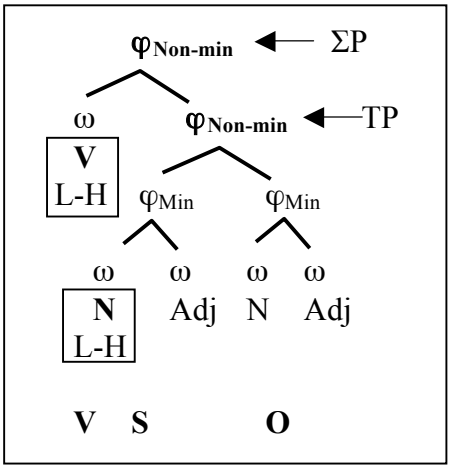
The distribution of rises in CI provide evidence for the non-minimal phrase as a prosodic constituent:

(9) Distribution of rises in CI
A rise falls on the leftmost ω in a non-minimal φ.

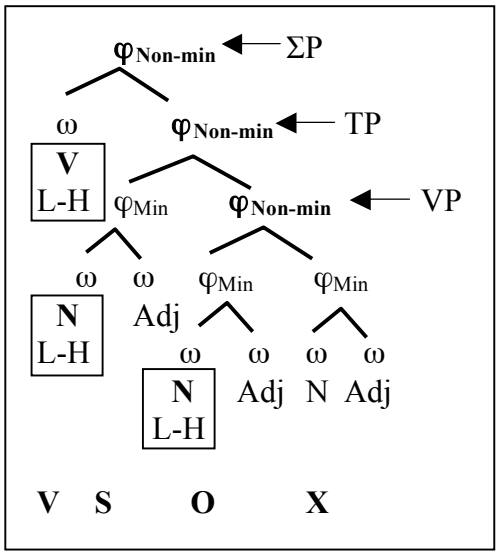
The contrast between the VSO and VSOX sentences above falls out from this account. In (10)a, the VSO sentence contains two $\varphi_{\text{Non-min}}$, and two rises, while in (10)b, the VSOX sentence contains an extra $\varphi_{\text{Non-min}}$ and a corresponding third rise:

(10) Proposed prosodic representations for VSO and VSOX sentences

a. VSO sentence: L-H on V and S



b. VSOX sentence: L-H on V, S, and O



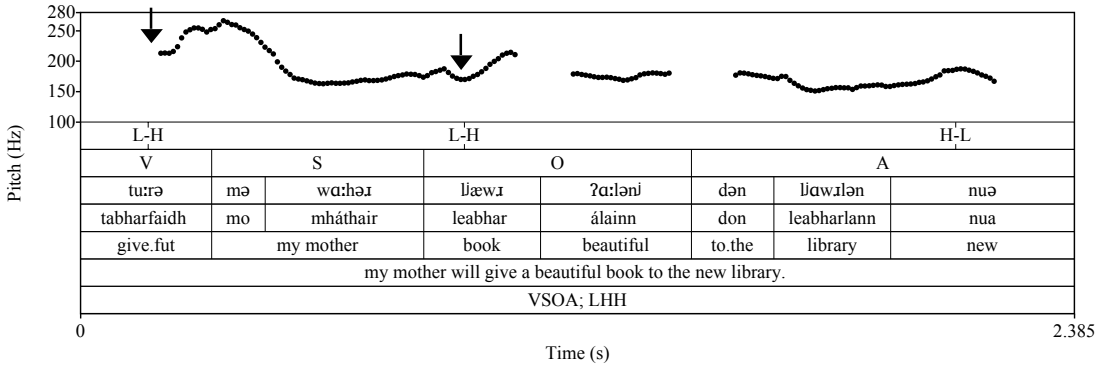
4. Interaction with Phonological Constraints

4.1. Light Subjects

Match Theory (Selkirk 2009, *to appear*), as an indirect reference theory of the interface, assumes that a level of prosodic constituency mediates between syntactic structure and domain-sensitive phonological processes such as the distribution of rises in CI. Accordingly, Match Theory predicts that prosodic well-formedness constraints may intervene to create a mismatch between syntactic structure and prosodic constituency.

Additional data indicate that rises disappear when the weight of S or O is reduced from two ω (N+Adj) to one (N only). For example, in a VSOX sentence where the subject contains a single lexical word (*máthair* 'mother' vs. *máthair fhlaithiúil* 'generous mother'), the rise on the subject is not present. In contrast with the VSOX sentence in (3) above with a binary S, rises fall on the verb and the object but not the subject:

(11) Pitch track for VSOX sentence with a one-word subject: no rise on subject



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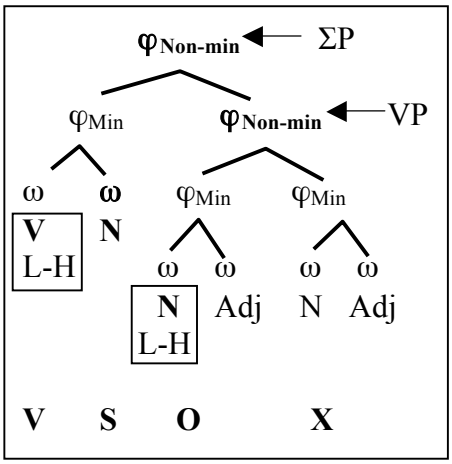
The absence of the rise suggests that the prosodic representation of (11) contains only two levels of recursive $\varphi_{\text{Non-min}}$, rather than three as in the VSOX sentence in (3).

I propose to group the subject with the verb to form a binary φ. This results in a prosodic structure that contains only two levels of recursivity, as in (12)a. This structure assumes the existence of a prosodic constituent between V and S that is not justified by the syntactic representation of this sentence in (6)a. However, this mismatch between syntactic and prosodic structure is supported by the distribution of rises: a representation as in (12)b that fully satisfies Match Phrase incorrectly predicts that the subject should be marked with a rise, as it is the leftmost ω in the $\varphi_{\text{Non-min}}$ that corresponds to the TP:

(12) Alternative prosodic representations for (11) (VSOX sentence with single-ω subject)

a. Proposed prosodic representation



b. Match Phrase representation (incorrect)

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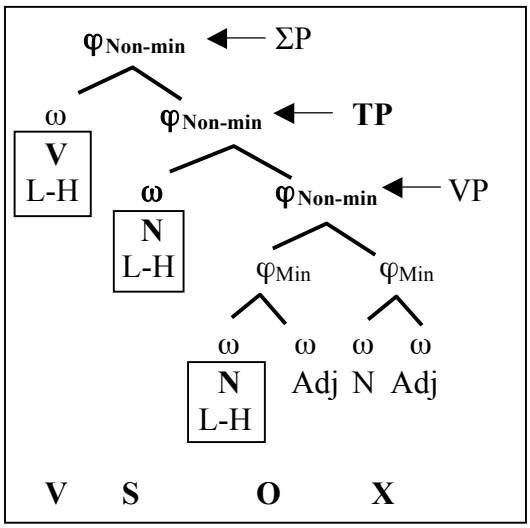


The contrast between the two structures exemplifies a mismatch between syntactic and prosodic structure: the proposed prosodic structure in (12)a shows less recursive structure as compared to (12)b. Because the theory predicts that purely phonological constraints on prosodic structure may intervene to create mismatches, this suggests that the structure in (12)a better satisfies prosodic well-formedness constraints than (12)b.

Strong Start is a purely prosodic constraint discussed in Selkirk (*to appear*:37) that calls for the left edges of prosodic constituents to begin with relatively "strong" prosodic constituents. More specifically, this constraint militates against prosodic structures where the leftmost daughter (the initial prosodic constituent) is of a category that is lower in the prosodic hierarchy than the constituent that is its sister. This can be captured using Optimality Theory (Prince & Smolensky 1993/2004), where Strong Start is assumed to be a violable constraint:

(13) STRONGSTART: assign one violation mark for every prosodic constituent whose leftmost daughter constituent is lower in the prosodic hierarchy than a sister constituent immediately to its right: *(π_n π_{n+1} … (after Selkirk *to appear*)

As discussed in Selkirk (*to appear*), this constraint is responsible for a variety of left-edge strengthening effects including the 'initial-dactyl effect' in English (Hayes 1995) and the promotion or displacement of pronouns in prosodic phrase-initial position (second-position clitic phenomena, as in Werle 2009). This constraint also appears to be active in another part of the prosodic phonology of Irish, where weak object pronouns are displaced when they appear at the left edge of φ in the process referred to as pronoun postposing (Elfner *to appear*).

More specifically, the structure in (12)b would incur two violations of this constraint, one for each of ω at the left edge of a $\varphi_{\text{Non-min}}$, while the structure in (12)a would not violate this constraint. Thus, the structure in (12)a is preferred to (12)b because STRONGSTART outranks MATCHPHRASE (defined as an OT constraint in (14)), as illustrated in the following OT tableau:[6]

(14) MATCHPHRASE: assign one violation mark for every syntactic XP that does not correspond to a φ.

(15) Elimination of a layer of recursive prosodic structure in a VSOX sentence with single-ω S

$_{\Sigma P}$[V $_{TP}$[N $_{vP}$[$_{DP}$[N Adj] $_{DP}$[N Adj]]]]	STRSTART	MATCHPHRASE
a. ☞ { (**V** N) { (**N** Adj) (N Adj)}} (=(12)a)		*
b. {**V** {**N** { (**N** Adj) (N Adj)}}} (=(12)b)	*!*	

STRONGSTART interacts with a constraint on prosodic binarity that is violated by prosodic constituents that do not dominate exactly two elements:

(16) BINφ: assign one violation mark for every φ that does not immediately dominate exactly two prosodic elements.

For instance, if V and the single-ω S in (12)b were promoted to independent φs, this structure would violate BINφ and would not improve on either STRONGSTART or MATCHPHRASE, because the verb is not itself a phrase in the syntax and therefore not predicted to correspond to a φ:[7]

(17) BINφ blocks the creation of single-ω φs

$_{\Sigma P}$[V $_{TP}$[N $_{vP}$[$_{DP}$[N Adj] $_{DP}$[N Adj]]]]	STRSTART	BINφ	MATCHPHRASE
a. ☞ { (**V** N) { (**N** Adj) (N Adj)}} (=(12)a)			*
b. {(**V**) {(**N**) { (**N** Adj) (N Adj)}}}		*!*	

Similarly, parsing only the N as a φ in (12)b would improve satisfaction of MATCHPHRASE, but the verb would continue to violate STRONGSTART. Because STRONGSTART is ranked higher than MATCHPHRASE, the representation in (12)a continues to be chosen as optimal:

[6] The input to the tableau is the output of the syntax, and the candidates represent possible prosodic parsings. Curly brackets {} indicate φNon-min and parentheses indicate φMin, and bold face indicates the presence of a rise.

[7] Note that this constraint will also block the creation of single-ω φs, as well as the creation of redundant layers of $\varphi_{\text{Non-min}}$ (as might be expected from a syntactic XP of the form $_{XP}$[$_{YP}$[$_{ZP}$[lex]]]). Interestingly, single-ω and two-ω utterances appear to lack rises, indicating that they do not contain a recursive φ. However, I am not yet aware of a diagnostic for the presence or absence of φ_{Min}.

(18) STRONGSTART blocks the parsing of S as a single-ω φ

ΣP[V TP[N vP[DP[N Adj] DP[N Adj]]]]	STRSTART	BINφ	MATCHPHRASE
a. ☞ { (**V** N) { (**N** Adj) (N Adj)}} (=(12)a)			*
b. {**V** {(**N**) { (**N** Adj) (N Adj)}}}	*!	*!	

The absence of the rise on a non-branching S in VSOX sentences as in (11) can therefore be attributed to the interaction between the prosodic well-formedness constraints STRONGSTART and BINφ, and the syntax-prosody correspondence constraint MATCHPHRASE.

In a framework like OT, this interaction is captured by constraint ranking and the evaluation of different possible prosodic representations that satisfy the constraints in different ways. In this particular case, the optimal prosodic representation was one that resulted in a mismatch between syntax and prosody. However, other languages may have different constraint rankings that would result in a more direct correspondence between the two grammatical systems. Match Theory predicts that syntax and prosody will correspond directly except when higher-ranked prosodic constraints are better satisfied by violating a Match constraint.

5. Possessive Objects

In this section, I expand the analysis to include VSO sentences where the object is a possessive construction. As in a VSO or VSOX sentence, the number of the elements included in the possessive construction may be varied: the possessive may be simple (*hata an fhir* 'the man's hat') or more complex (*hata gorm an fhir mhóir* 'the big man's blue hat'). I show that the analysis developed above using MATCHPHRASE and its interaction with BINφ and STRONGSTART, when applied to VSO sentences with complex and simple possessive objects, correctly predict the presence of rises as supported by pitch tracks of these sentences.

In Irish genitive constructions, the possessed object is followed by the possessor in the genitive case:[8]

(19) a. fear an tí
man the.GEN house.GEN
'the man of the house'

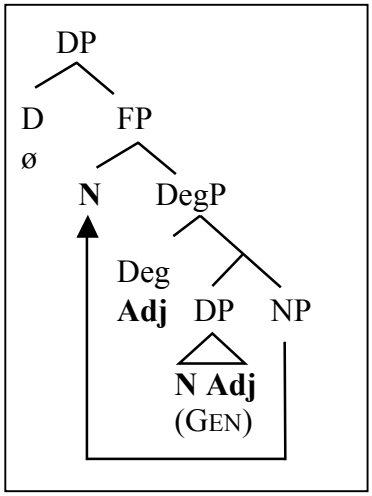
b. hata gorm an fhir mhóir
hat blue the.GEN man.GEN big.GEN
'the blue hat of the big man/the big man's blue hat'

[8] A determiner precedes the genitive possessor, but not the possessed object (see e.g. McCloskey 2006). Irish has a definite determiner *an* 'the', as well as possessive pronouns (e.g. *mo* 'my', *do* 'your.sg'), but no overt indefinite determiner.

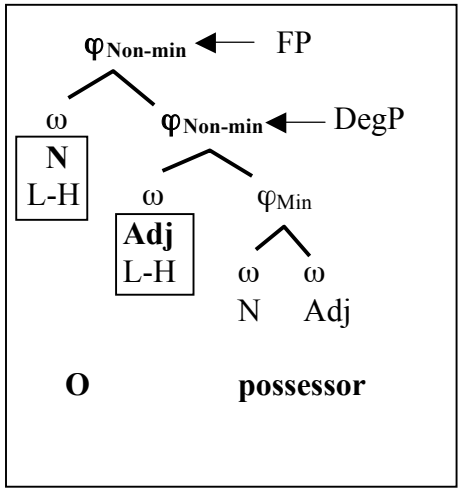
The syntactic structure of a binary possessive construction as in (19)b is shown in (20)a (based on McCloskey 2006). Blind application of Match Phrase predicts the recursive prosodic structure in (20)b, where the N and the Adj in the possessor are phrased into separate $\varphi_{\text{Non-min}}$:

(20) The structure of Irish possessives

a. Syntactic structure



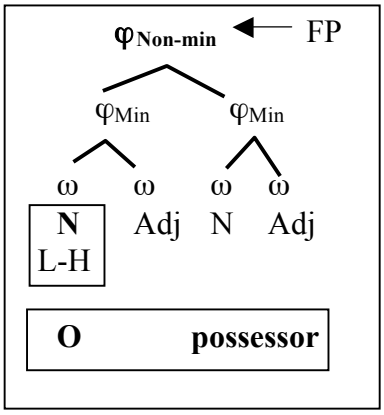
b. Predicted prosodic structure (Match Phrase)



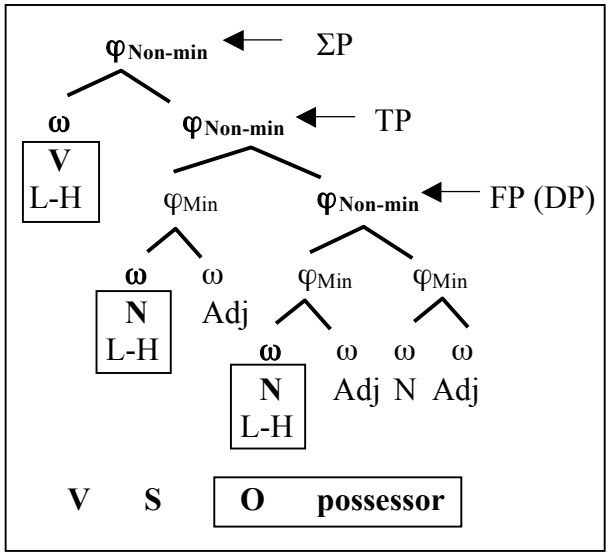
However, given the observed interaction with the prosodic constraint STRONGSTART, we predict that the prosodic structure in (20)b will be dispreferred to a structure as in (21)a, which phrases the N and Adj into a single φ, thus avoiding any violation of STRONGSTART. The structure in (21)b shows that when the binary possessive object is embedded as the object in a VSO sentence, we predict rises on V, S, and O:

(21) Prosodic representation of possessive and possessive object in a VSO sentence

a. Prosodic representation: Possessive

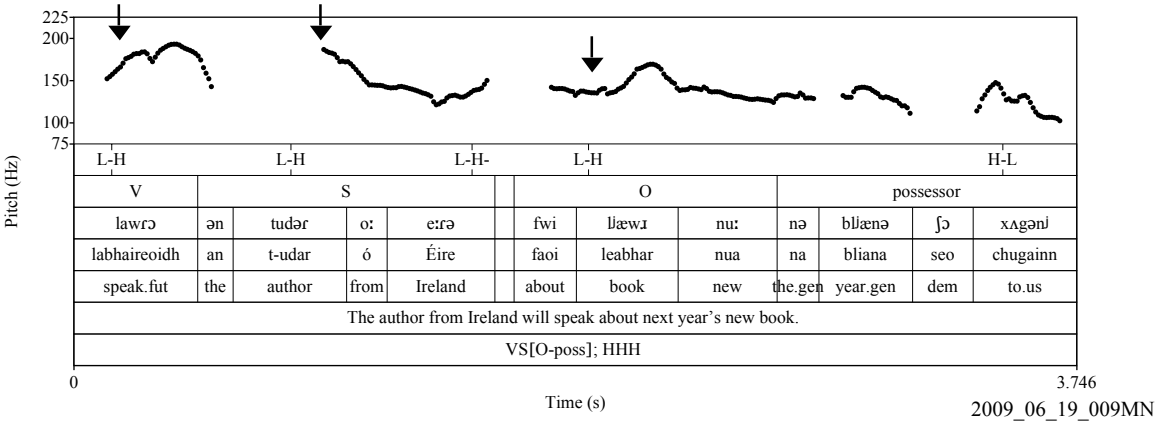


b. VSO with binary possessive object



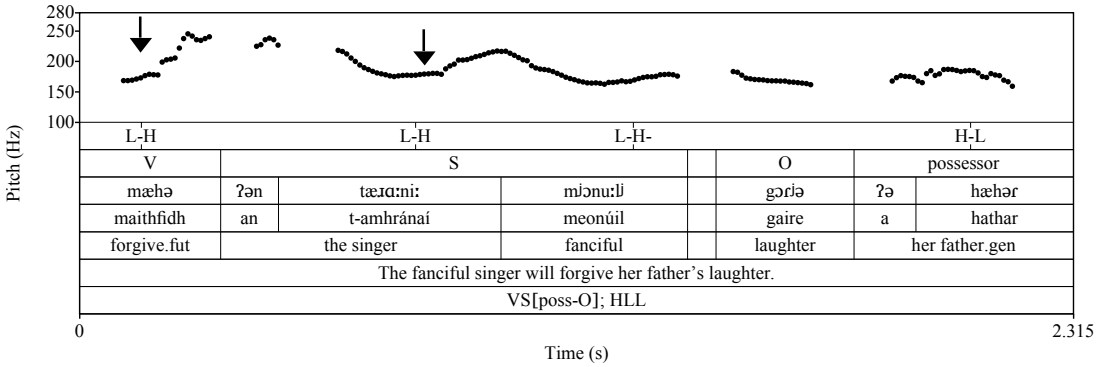
This prediction is borne out: in a VSO sentence with a binary possessive object, rises fall on each of V, S, and O:

(22) Pitch track for VSO sentence with binary possessive object



This pattern is identical to that of a fully binary VSOX sentences as in (3). This pattern can be compared to the pitch track for a VSO sentence with a simple possessive object. This behaves like a regular VSO sentence with a heavy (binary) object, with two rises on V and S, but no rise on O (compare with (2)):

(23) Pitch track for a VSO sentence with a simple possessive object (two nouns)



As before, the distribution of rises can be shown to target non-minimal φs. The degree of recursivity in prosodic structure is predictable from the interaction between Match Phrase, which is sensitive to syntactic constituency, and the prosodic constraints STRONGSTART and BINφ.

6. Conclusion

The distribution of rises in CI, as analysed above, can be summarized as follows:

(24) Rise distribution in CI
A rise associates with the leftmost ω in a non-minimal φ.

The present analysis differs from other possible approaches to φ building in several respects. First of all, prosodic structure can be recursive, which runs counter the assumptions of the Strict Layer Hypothesis. Secondly, recursive prosodic structure is preferred by a violable constraint MATCHPHRASE within Match Theory, as opposed to edge-based approaches within OT. Finally, recursive prosodic structure, while related to syntactic structure via MATCHPHRASE, can deviate from syntactic structure when MATCHPHRASE is outranked by phonological constraints such as STRONGSTART and BINφ, a pattern that cannot be straightforwardly captured using Direct Reference theories (recently, Wagner 2005, Pak 2008). This analysis correctly accounts for a number of patterns related to the distribution of rises in CI that would be puzzling under alternative accounts that adhere to Strict Layering by banning recursive prosodic structure, or that attempt to account for the distributions of rises without assuming a level of prosodic structure that mediates between the syntactic and the phonetic components.

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