Prosodic Spell-Out

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In many syntactic theories, the information that a syntax provides doesn't include how those structures are mapped onto strings. No syntactic theory that I am aware of determines the prosodic units that sentences have. I will adopt the view consonant with these two assumptions: syntactic representations need to be interpreted in order to get a representation that provides the melody it is associated with. The segmental and prosodic information that is associated with words makes a contribution to that melody by having that information concatenated into a contiguous string of words. The pitch, amplitude, and speed of that string is influenced by the prosodic structure read off the syntactic representation. I'll adopt the view in Kusmer (2020a,b) that the system which assigns words their linear position is also the system that assigns the resulting string its prosodic structure. In section one, I'll sketch how his system works, and illustrate its utility at capturing the dependence that word order has on prosody. Section two sketches the machinery I will adopt for modeling English prosody that is necessary for the solution in section three of the problem for Kusmer's system that ends section one.

1. Prosodic Linearization

Kusmer (2020a) argues that the best method of expressing how word order can be influenced by prosody is to build that influence directly into the procedure that linearizes the words in a syntactic representation—what I shall call the "linearization" of a phrase marker. Since Kayne (1994), linearizations are standardly expressed in terms of a set of precedence relations between the words of a phrase marker. Thus, for instance, the linearization of (1) (=$\mathscr{L}$(1)) is (2), which corresponds to the string *this sentence will illustrate a linearization*.

*The debt this paper owes to Leland Kusmer is, I hope, plain. Not as obvious, but just as important, are the many ways that Alessa Farinella has coached and improved my thinking about prosody.

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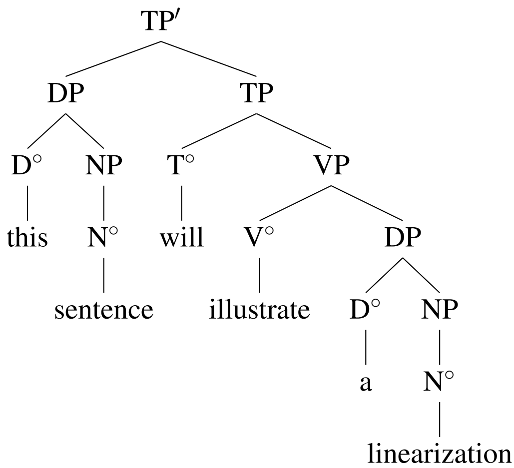
STRICT CYCLING, Universität Leipzig 2024

(1)



(2)

this < sentence	sentence < will	will < illustrate
this < will	sentence < illustrate	will < a
this < illustrate	sentence < a	will < linearization
this < a	sentence < linearization	
this < linearization		illustrate < a
	a < linearization	illustrate < linearization

Kusmer's system involves a series of constraints that read off of a syntactic representation certain pieces of information and rank strings according to their compatibility to that information. The two central constraints in Kusmer's system are (3) and (4). (Understand x to be the word dominated by X°, and y to be the word dominated by Y°.)

(3) ANTISYMMETRY
Assign one violation for each pair of nodes X° and Y° in *P* where:

a. X° asymmetrically c-commands Y°, and
b. $y < x \in \mathscr{L}(P)$.

(Kusmer 2020a: roughly (9): 10)

(4) HEADFINALITY
Assign one violation for each branching node XP in *P* dominating a pair of nodes X° and Y° such that:

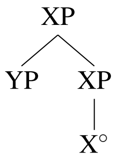
a. Y° is dominated by the in-law of XP,
b. X° is not dominated by the in-law of XP, and
c. $x < y \in \mathscr{L}(P)$.

The notion "in-law" is defined in (5).

(5) Let α and β be daughters of γ. If γ is an X-bar Projection of α, then β is the in-law of γ.

Schematically, YP is an in-law in:

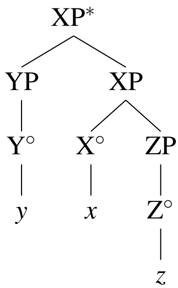
(6)



HeadFinality favors putting the terminals in a X° and its projections after the terminals in its sisters. It favors linearizations in which the terminals dominated by that Specifier precede the terminals in the Specifier's sister.

Consider how these constraints apply to (7).

(7)



The tableau in (8) indicates how HeadFinality applies, picking the set of precedence relations that corresponds to the string *yzx*.

(8)

(7)			HEADFINALITY
a.		*yxz*	∗XP
b.		*xyz*	∗XP,∗XP*
c.		*xzy*	∗XP,∗XP*
d.	☞	*yzx*	
e.		*zyx*	∗XP*
f.		*zxy*	∗XP*

HEADFINALITY favors languages that are head final and Specifier first. By contrast, Kusmer's ANTISYMMETRY favors head initial languages, as can be seen by considering how it applies to (7); see (9).

(9)

(7)			ANTISYMMETRY
a.	☞	*yxz*	
b.	☞	*xyz*	
c.	☞	*xzy*	
d.		*yzx*	$*z < x$
e.		*zyx*	$*z < x$
f.		*zxy*	$*z < x$

When HEADFINALITY outranks ANTISYMMETRY, the language will put Specifiers first and heads last, as (10) demonstrates.

(10)

(7)			HEADFINALITY	ANTISYMMETRY
a.		*yxz*	*!XP	
b.		*xyz*	*!XP, *XP*	
c.		*xzy*	*!XP, *XP*	
d.	☞	*yzx*		$*z < x$
e.		*zyx*	*!XP*	$*z < x$
f.		*zxy*	*!XP*	$*z < x$

When ANTISYMMETRY outranks HEADFINALITY, the language will again put Specifiers first but it will put heads first too, as (11) shows.

(11)

(7)			ANTISYMMETRY	HEADFINALITY
a.	☞	*yxz*		*XP
b.		*xzy*		*XP, *!XP*
c.		*xyz*		*XP, *!XP*
d.		*yzx*	$*!z < x$	
e.		*zyx*	$*!z < x$	*XP*
f.		*zxy*	$*!z < x$	*XP*

These two constraints, then, carve out the major word orders found cross-linguistically, once the effects of movement have been removed. Kusmer (2020a) shows how this system can be enriched with a set of related constraints to characterize languages that have different orderings for different kinds of phrases, while still constraining this variation so that trends like the Final-Over-Final Condition are captured.[1]

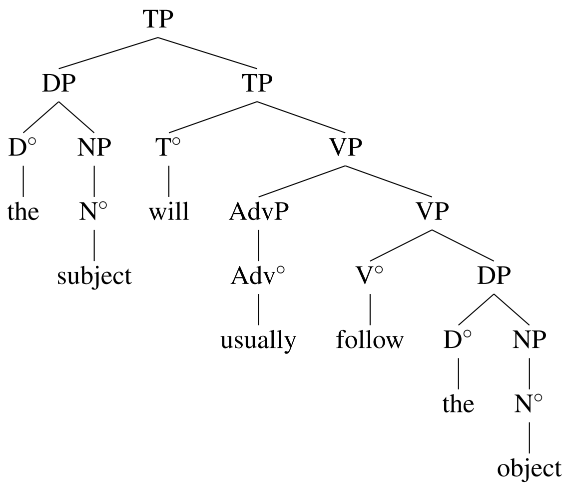
Kusmer's argument that the procedure which linearizes a syntactic representation should be part of the same procedure that gives the string its prosody comes from examples in which the linear order of words is determined by prosodic conditions, rather than syntactic ones. For example, in Celtic languages, there is a well-studied case where object pronouns that are prosodically weak are not spoken in the position that strong object pronouns or other nominals are spoken. (See Chung & McCloskey (1987), Adger (2007), Duffield (1995), and Bennett et al. (2016).) In the Conamara dialect of Irish, for instance, Elfner (2012) shows that weak pronouns are not pronounced in the canonical position for direct objects, but instead find a position at the right edge of some prosodic phrase to be pronounced. This has the effect of causing these pronouns to be optionally linearized in a variety of positions that follow the canonical object position. Elfner (2012) argues that this effect derives from a feature of Conamara Irish prosody that disfavors putting prosodically weak terms at the beginning of a prosodic phrases. Because the canonical object position is at the beginning of a prosodic phrase in Irish, prosodically weak pronouns in this position create this disfavored prosody. A similar pattern emerges for the prosodically weak pro-forms that some prepositional phrases can have in Conamara Irish. They too are not pronounced at the beginning of certain prosodic phrases, but instead get linearized at the end of some prosodic phrase. Interestingly, not all terms that are prosodically weak in the same way as these pro-forms are susceptible to this effect in Conamara Irish. Weak determiners, for instance, are linearized at the beginning of the phrases they head, even when this makes them the first thing in a prosodic phrase. Kusmer argues that this is because the constraint that determines where heads are relative to their complements (i.e., ANTISYMMETRY) outranks the constraint that disfavors prosodic phrases that start with prosodically weak terms. Because it is a different constraint that determines where object pronouns (which are phrases) and prepositional phrases are linearized, it can be

[1] See Sheehan et al. (2017) for the Final-over-Final Condition.

ranked lower than the constraint that disfavors prosodic phrases that start with a prosodically weak term. The point is that the conditions which determine how the strings are prosodified can affect, and be affected by, the conditions that determine what those strings are. There is one system that both linearizes and prosodifies a syntactic representation.

English is a language that most closely approximates the word orders allowed by (11), where ANTISYMMETRY outranks HEADFINALITY. That ordering of constraints, for instance, correctly produces the string associated with (12).

(12)



High Ranking ANTISYMMETRY requires $\mathscr{L}$(12) include the ordered pairs in (13).

(13)	the < subject	will < usually	follow < the follow < object	the < object

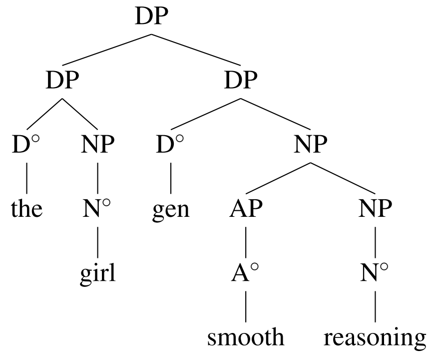
HEADFINALITY is satisfied when $\mathscr{L}$(12) contains the ordered pairs in (14).

(14)	the < will	subject < will	usually < follow
	the < usually	subject < usually	usually < the
	the < follow	subject < follow	usually < object
	the < the	subject < the	
	the < object	subject < object	

The union of these two sets gives us a linearization that conforms to the correct string: *the subject will usually follow the object*.

The same correct outcome arises in DPs, as (15) illustrates.

(15)



ANTISYMMETRY requires $\mathscr{L}$(15) to include the ordered pair "the < girl". HEADFINALITY will require it to include the ordered pairs in (16).

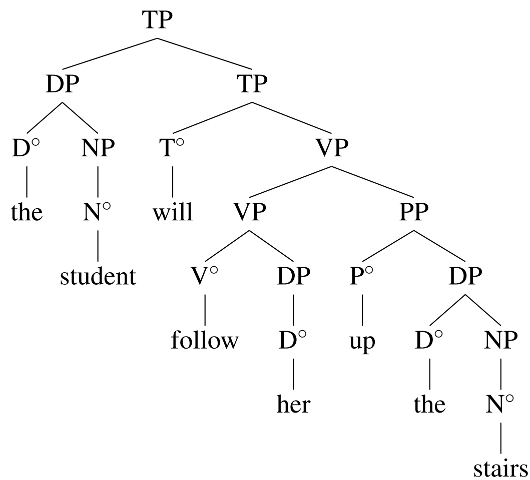
(16)

the < smooth	girl < smooth	smooth < reasoning
the < reasoning	girl < reasoning	

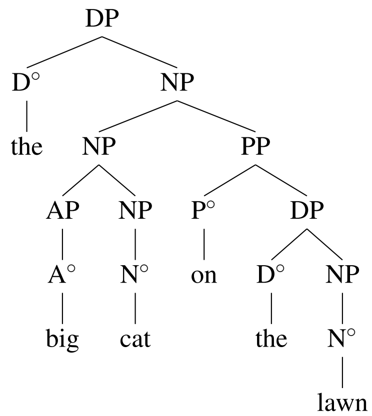
The union of these two sets produces an ordering that is consistent with the correct string: *the girl's smooth reasoning*.

This system fails in cases such as (17) and (18) where "adjuncts" get linearized to the right of the words in the phrase that they are a sister to.

(17)



(18)



High-ranked ANTISYMMETRY requires $\mathscr{L}$ to contain the ordered pairs shown below.

(19) $\mathscr{L}(17) \supseteq$

the < student	will < follow	up < the	the < stairs
	will < her	up < stairs	
	will < up		
	will < the		
	will < stairs		

(20) $\mathscr{L}(18) \supseteq$

the < big	on < the	the < lawn
the < cat	on < lawn	
the < on		
the < the		
the < lawn		

HEADFINALITY is responsible for determining the rest of the ordered pairs in $\mathscr{L}(17)$ and $\mathscr{L}(18)$. HEADFINALITY is satisfied if (21) and (22) is holds.

(21) $\mathscr{L}(17) \supseteq$

the < will	student < will	up < follow	up < her
the < follow	student < follow	the < follow	the < her
the < her	student < her	stairs < follow	stairs < her
the < up	student < up		
the < the	student < the		
the < stairs	student < stairs		

(22) $\mathscr{L}(18) \supseteq$

big < cat	on < big	the < big	lawn < big
	on < cat	the < cat	lawn < cat

This produces the incorrect strings in (23).

(23) a. $\mathscr{L}$(17) = *the student will up the stairs follow her*
b. $\mathscr{L}$(18) = *the on the lawn big cat*

I want to sketch a prosody-based solution to this famous problem.

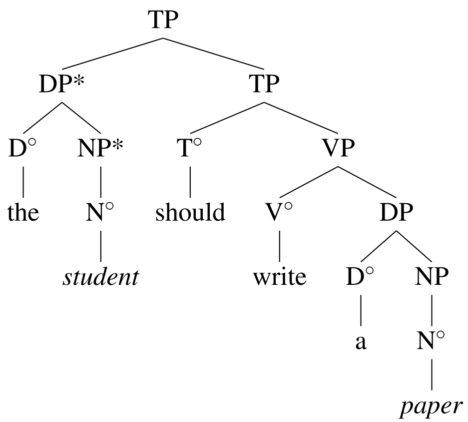
2. Prosodic Phrases and Stress

The solution leans on how English relates syntactic phrases to stress. Truckenbrodt (2006) suggests that English has a requirement that every syntactic phrase contain a word with greater stress than the others in that phrase. He calls that "phrasal stress." A preliminary formulation of this requirement is in (24).

(24) STRESSXP
Assign one violation for each XP that doesn't contain a word with phrasal stress.

Consider how this constraint evaluates (25).

(25)



The default prosody for this sentence puts phrasal stress on *student* and *paper*. This prevents STRESSXP from assigning any violations to this sentence, as every XP contains a stressed word. Phrasal stress on *student* allows DP* and NP* to satisfy STRESSXP, and phrasal stress on *paper* allows every other phrase in (25) to as well.

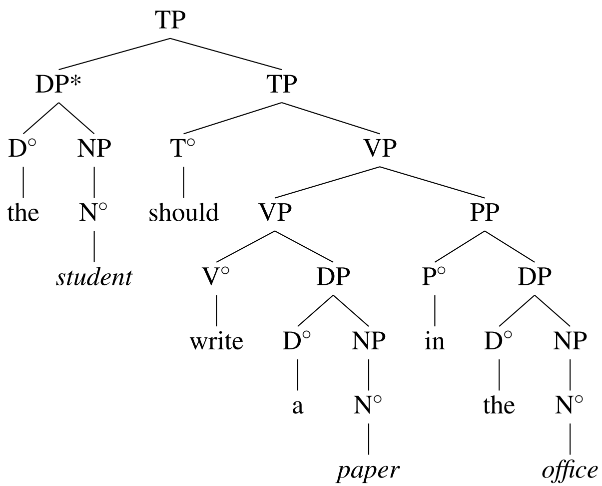
STRESSXP is not sufficient, however, because it is equally well satisfied if there is phrasal stress on any of the other words in (25), and this should be prevented. I suggest, then, that we also penalize stress with (26).

(26) NOSTRESS
Assign one violation for every word with phrasal stress that a sentence contains.

If STRESSXP outranks NOSTRESS, the result is that *student* and *paper* will have to be phrasal stressed in (25), but no other word can be. This is exactly what is desired.

Another illustration of how this system works is in (27).

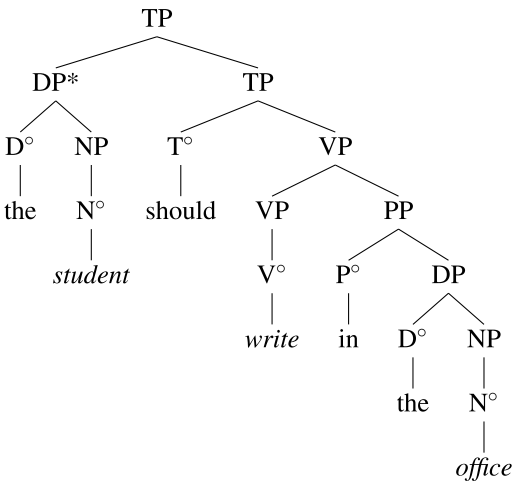
(27)



This has the same pattern of phrasal stress assignment, except that the additional presence of PP introduces phrases that cannot satisfy STRESSXP without introducing more phrasal stresses. The fewest numbers of additional phrasal stresses required to satisfy STRESSXP is one: placed on *office*.

It is instructive to compare (27) with (28), where the optional object is missing.

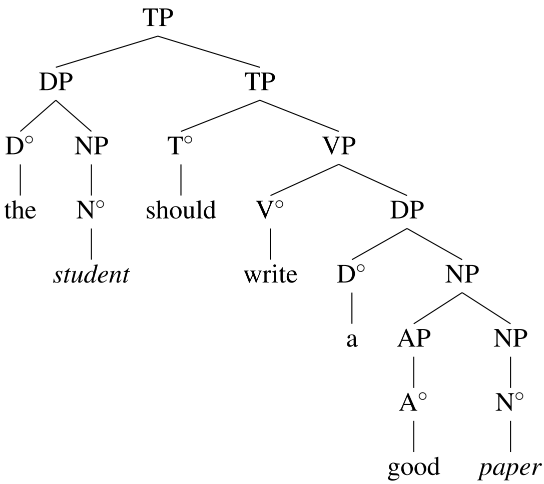
(28)



Because the object is missing in (28), phrasal stress must fall on *write* in order to allow VP to satisfy STRESSXP. The differing patterns of phrasal stress on (25), (27), and (28) indicate that it is indeed the presence of XPs that controls where phrasal stress is placed, just as Truckenbrodt's STRESSXP says.

Something goes awry with this system in (29), however.

(29)



The addition of the AP in (29) does not require additional phrasal stresses. Indeed, putting phrasal stress on *good* is not allowed, suggesting that NOS-

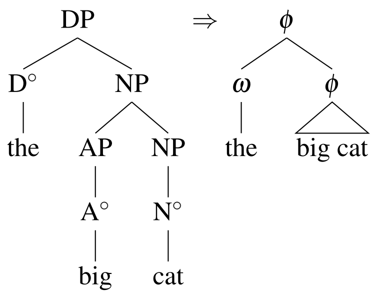
TRESS disallows it. There is something that causes STRESSXP to differentiate the PP adjunct in (27) from the AP adjunct in (29).

The difference between these examples that I will leverage is that the additional phrase in (29) contains just one word, whereas the one in (27) contains more than one word. The difference between strings of words that are minimal—contain just one word—and those that aren't—contain more than one word—is prosodically relevant. Individual words are mapped onto prosodic words, whereas strings of words that form syntactic units are mapped onto prosodic phrases. Let's follow Selkirk (2011) and express these as constraints.

(30) MATCH ϕ
Assign one violation for every d(XP) that doesn't make a prosodic phrase (ϕ). d(XP) is the set which contains all and only the words dominated by XP.

(31) MATCH ω
Assign one violation for every X° whose exponent doesn't make a prosodic word (ω).

The formulation of MATCH ϕ follows Elfner (2012). It has the useful feature of controlling linearization as well as prosodification, on the natural assumption that a string of words must be contiguous to be a prosodic phrase. To see this, consider how MATCH ϕ evaluates (32).

(32)


If $\mathscr{L}$(32) contains the ordered pairs in (33), it will violate MATCH ϕ, as there is no way of forming a prosodic phrase from it of just the words *big* and *cat*, i.e., d(NP).

(33) the < cat   big < the
big < cat

Instead, $\mathscr{L}$(32) must contain the ordered pairs in (34) if NP is to satisfy MATCH ϕ.

(34) the < cat   big < cat
the < big

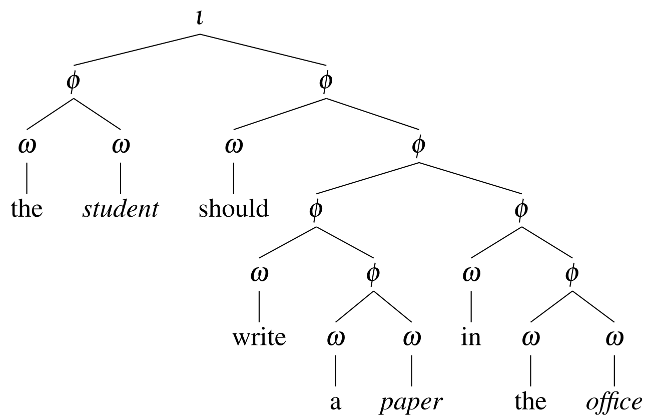
In what follows, I will silently rely on this feature of MATCH ϕ in determining linearizations.

The sensitivity that MATCH ϕ and MATCH ω have to single-word versus multi-word phrases can be used to control where phrasal stress goes. Let's see how.

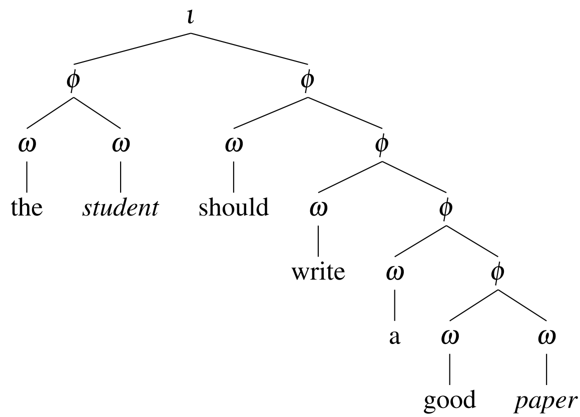
There is a tension between these two Match constraints that arises when a phrase consists of just one word. In these scenarios, the constraints require that the same string—the single word—be parsed as both a prosodic phrase and a prosodic word. These situations are resolved cross-linguistically in various ways. For our cases, let's consider first what happens when these scenarios are resolved by making single-word phrases prosodic words.

With these assumptions, the sentences in (27) and (29) get the prosodification indicated below.

(35)



(36)



(ι marks intonational phrases—yet a third kind of prosodic unit. Intonational phrases won't play a role in this paper.)

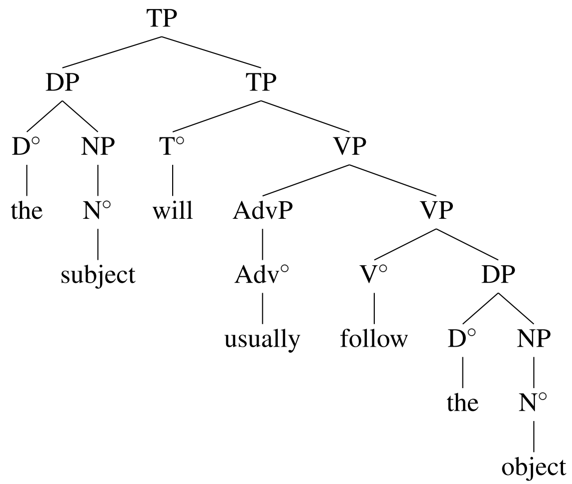
I suggest using these representations to determine where stress is placed. I'll translate Truckenbrodt's proposal about the relationship between XPs and phrasal stress as instead a relationship between prosodic phrases and phrasal stress.

(37) STRESS ϕ
Assign one violation for each ϕ that doesn't contain a word with phrasal stress.

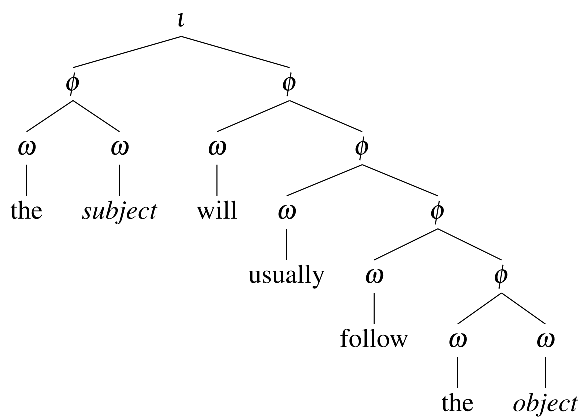
When combined with lower-ranked NOSTRESS, this (almost) produces the correct pattern of stress-placement for (27) and (29). The representations in (35) and (36) have no violations of STRESS ϕ, and minimize the violations of NOSTRESS.

These results have a parallel in situations involving adverbial modification of VPs. The example in (12), repeated here, will get the prosodic representation in (39).

(38)

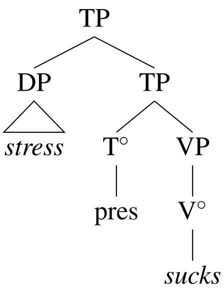


(39)

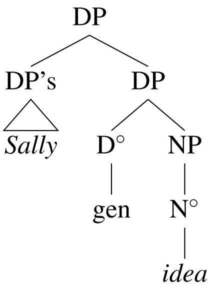


The proposal, then, is that the reason pre-verbal adverb phrases and pre-nominal adjective phrases are not subject to STRESS ϕ is because they are not parsed as prosodic phrases due to their single-word status. This is forced by letting the contest between MATCH ϕ and MATCH ω be won by MATCH ω. But interestingly, outside of this context, single-word phrases are normally subject to STRESS ϕ. Two examples are in (40).

(40) a.



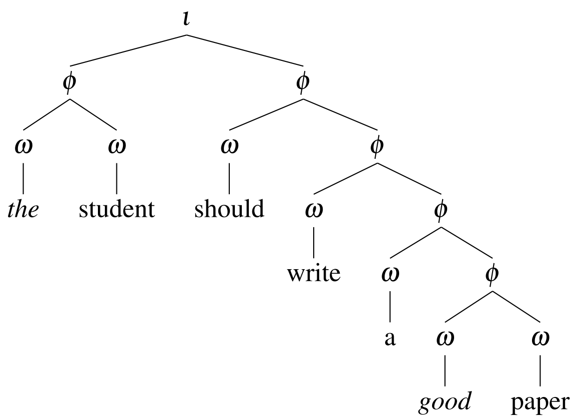
b.



Phrasal stress is required on both of the words in each of these examples, and that follows from STRESS ϕ only if all the single-word phrases in these examples are parsed as prosodic phrases.

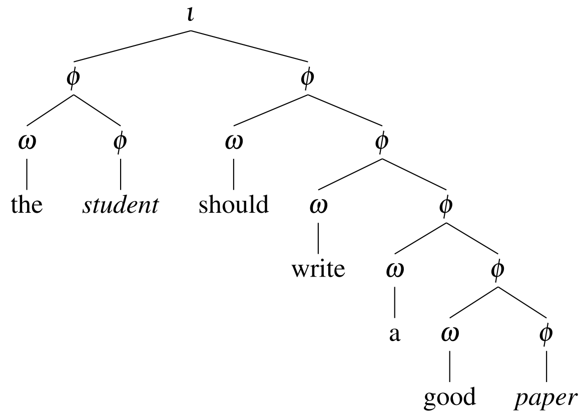
Furthermore, for STRESS ϕ to correctly put phrasal stress on *paper* and *student*, rather than *good* and *the*, in (29) requires that the NPs dominating these single words be parsed as prosodic phrases as well. Otherwise, STRESS ϕ could be satisfied by the prosodification in (36), as shown in (41).

(41)



The desired outcome follows from STRESS ϕ only if *paper* and *student* are parsed as prosodic phrases, as in (42), thereby making them subject to STRESS ϕ.

(42)

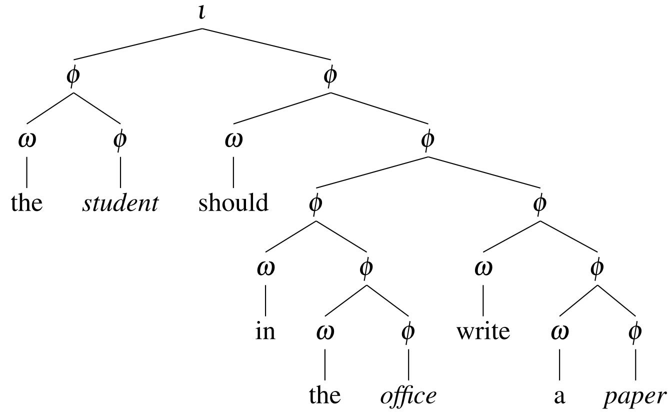


Our conclusion should be that in general MATCH ϕ wins in its contest with MATCH ω. There is something about the contexts in (27) and (12) that requires the single-word AdvP and AP to be parsed as prosodic words rather than prosodic phrases. Let's explore the idea that prosodic phrases in this position are disallowed in English, and that this is the reason HEADFINALITY is not obeyed here.

3. Prosodic Phrasing and Linear Order

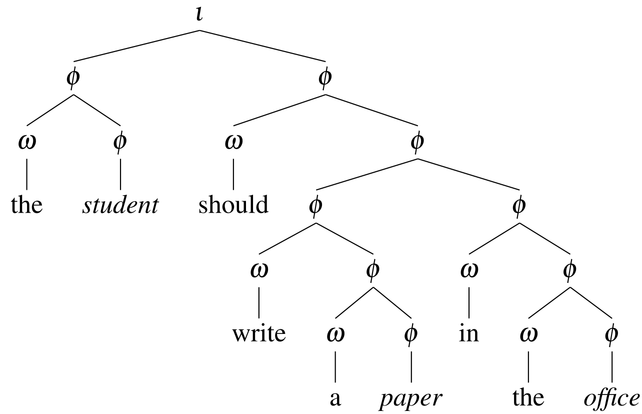
Consider the string that HEADFINALITY predicts for the prosodified representation in (35), repeated here.

(43) the *student* should in the *office* write a *paper*



From the standpoint of prosody, this is same as the desired linearization, shown in (44).

(44) the *student* should write the *paper* in the *office*

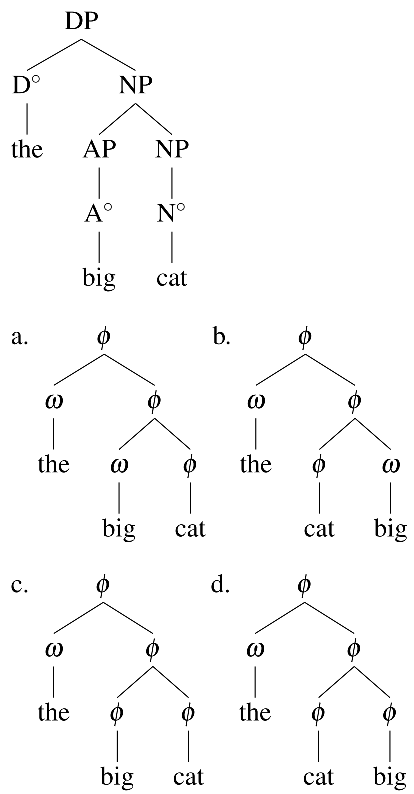


The information needed to distinguish these cases is syntactic. In particular, it resides in the notion of "in-law" that is used in Kusmer's HEADFINALITY. An in-law is a phrase whose mother node is not its projection. HEADFINALITY favors linearizations where the words in an in-law precede the words in the in-law's sister. That's opposite to what is desired in the case of English adjuncts; its utility is in correctly positioning Specifiers and adjunct phrases that get parsed as prosodic words. I propose adding to HEADFINALITY, ALIGN INLAW.

(45) ALIGN INLAW
Assign one violation for each word that separates the right edge of the prosodic phrase of an in-law from the right edge of the prosodic phrase immediately dominating it.

This constraint favors (44) over (43). There are three violations of ALIGN INLAW in (43) that are absent in (44)—namely, violations that are incurred by each of the words that separates the right edge of *in the office* from the right edge of *in the office write a paper*. Examples like (46), by contrast, incur no violations of ALIGN INLAW because the adjunct AP is not parsed as a prosodic phrase.

(46)



Because adjuncts in this position are unique in being parsed as prosodic words, we should make ALIGN INLAW responsible for interrupting the otherwise general trend that single-word phrases are parsed as prosodic phrases in

English. We'll first need a way of modulating the contest between MATCH ϕ and MATCH ω when they both evaluate the same single-word expression. This is typically done with a constraint that disfavors single-word prosodic phrases, sometimes called "Binarity."[2]

(47) BIN ϕ
Assign one violation for every prosodic phrase that contains less than two words.

English instantiates the ranking of these constraints in (48).

(48) ALIGN INLAW >> MATCH ϕ >> HEADFINALITY >> BIN ϕ

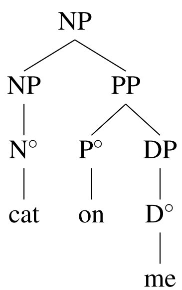
An illustration of how this system applies to (46) is given in the following tableau. (I only consider here outcomes that obey highest ranking ANTISYMMETRY, which requires that *the* precede *big* and *cat*.)

(49)

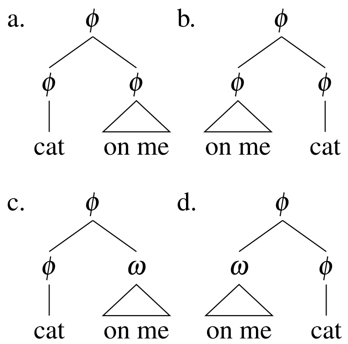
		(46)	ALIGN IL	MATCH ϕ	HEADFIN	BIN ϕ
a.	☞	the big cat		∗AP		∗NP
b.		the cat big		∗AP	∗!AP	∗NP
c.		the big cat	∗!AP			∗AP,∗NP
d.		the cat big		∗AP	∗!AP	∗AP, ∗NP

A situation that involves an adjunct that doesn't violate BIN ϕ is illustrated by (50), with the tableau in (51). (I don't consider the way the system evaluates the contents of the PP.)

(50)



[2]See, e.g., Inkelas & Zec (1990) Mester (1994), Selkirk (2000).

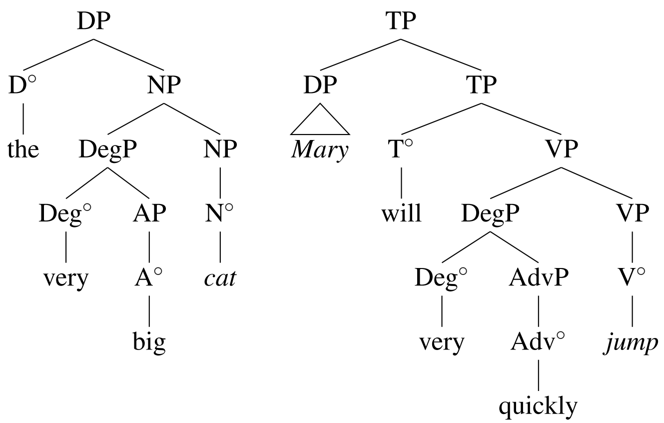


(51)

(50)			ALIGN IL	MATCH ϕ	HEADFIN	BIN ϕ
a.	☞	cat on me			∗PP	∗NP
b.		on me cat	∗!PP			∗NP
c.		cat on me		∗!PP	∗PP	∗NP
d.		on me cat		∗!PP		∗NP

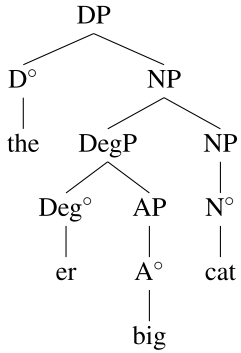
There are two problems for this proposal that I am aware of. One comes from letting the contest between MATCH ϕ and MATCH ω be determined by BIN ϕ alone. This predicts that it is only the difference between a one-word string and a multi-word string that determines whether an XP is susceptible to being parsed as a prosodic phrase or not. If prosodic phrases can be detected by whether or not they require a word with phrasal stress within them, then the Degree Phrases in (52) should be prosodic phrases.

(52)



As can be seen from where phrasal stress falls, these DegPs do not trigger Stress ϕ violations when they fail to contain phrasal stress. This, as well as their linear position, would follow if they do not constitute prosodic phrases. I do not know how to derive this effect. The syntax does seem to require that the two words that make up *very big* and *very quickly* constitute phrases, in the way indicated. I note that the case involving the adjective *big* includes examples in which the morpheme in the Deg° position and the adjective that follows are parsed as single words, as in (53).

(53) the bigger cat



Perhaps there is some sense in which DegPs can be classed as words—even when they seem to have two of them—and therefore escape violating Match ϕ when they are not prosodic phrases.

The second problem concerns the phrases in Specifier position. As we've seen, these are always parsed as prosodic phrases—even when they violate Bin ϕ—and this correlates with the fact that they obey HeadFinality even when they violate Align InLaw. In Kusmer's system, what makes a phrase in Specifier position special is that the words it contains are not c-commanded by the head. As a consequence, phrases in Specifier position are not subject to Antisymmetry's requirement that the phrase's contents follow the head. It is only phrases in complement position that Antisymmetry might apply to, as these are the only phrases whose content will be c-commanded by the head.

This way of distinguishing phrases in Specifier positions from phrases in complement positions makes the wrong cut when phrases in adjunct position are considered. We want these phrases to be subject to the conditions that govern complements—as we've just seen—but phrases in Specifier position to be freed from those conditions. The cross-linguistic specialness of phrases in Specifier position with respect to their linearization is well-known. They are phrase initial in-laws, even when that is at odds with the normal position of in-laws. This paper aims to suggest that they are also prosodically special. In English, this is seen by their stubborn insistence on being prosodic phrases, even in conditions where other in-laws demote to prosodic words. We should look for a characterization of the specialness of Specifiers that takes into account the prosodic nature of that specialness as well.

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