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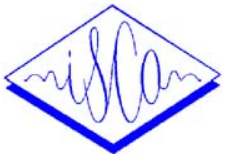

Speech Prosody 2002
Aix-en-Provence, France
April 11-13, 2002

Psycholinguistics Cannot Escape Prosody

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Abstract

Once, sentence processing research set aside prosody in order to focus on syntactic and semantic processing. Experimental sentences were mostly presented visually, often without prosodic markers such as commas. Now that we have made some progress by this 'divide and conquer' approach, and now that the technology for working on speech has improved, it may be time to integrate prosody into processing models. I argue here that we have no choice but to do so, because current evidence shows that even in silent reading, prosody is projected onto written sentences, and can influence the course of syntactic processing.

10.21437/SpeechProsody.2002-12

1. Why try to escape?

In its early years, sentence processing research mostly ignored speech and all that went with it, including prosody. This was partly for practical reasons: the technology for studying speech was still quite primitive. But it was theoretically motivated too: there was no shortage of questions to ask and answer about syntax and semantics, and it seemed they could be answered better if phonology was not allowed to intrude. Possible complaints about this methodological restriction were contemplated but were headed off. Lyn Frazier's dissertation (Frazier 1978) addressed the matter: "In many cases I will be relying on data which consists of responses to (or intuitions about) sentences which are presented in somewhat artificial circumstances, such as sentences presented in isolation, sentences presented visually, sentences which lack normal suprasegmental cues or punctuation, etc....Of course, typically contextual and suprasegmental information is available to hearers and may be expected to play an important role in the sentence comprehension process. The rationale for relying on data which does not take these factors into account is simply that it allows us to isolate the various lexical, semantic and syntactic routines which are available to the parser. Though there are potential dangers with this 'divide and conquer' approach..., the approach has been successfully applied in other sciences. And, in the case of language comprehension studies, the approach may be necessitated by the sheer complexity of the object of investigation" (p.23). Later, Frazier indicates that the ban is not forever, but just "until more is known about what suprasegmental information is available in the speech signal, and about how that information is interpreted and used by the parser" (p.113).

A point to be noted is that it is not only speech prosody that was set aside, but also the punctuation symbols, such as commas, which partially represent it in writing. Most controversially, experiments were run on sentences lacking a comma between a subordinate clause and a following main clause, such as *While Mary was mending the sock fell off her lap*. With a comma after *mending*, there would be no syntactic garden path left to be studied. Frazier could point to several types of syntactic ambiguity that are NOT resolved by prosody or punctuation, such as *The horse raced past the barn fell.* Recently, Hill & Murray (2000) have confirmed that disambiguation by commas is effective in only some syntactic constructions. And Lehiste (1973) and others have shown the same for disambiguation by prosody. But sentence processing research has by no means limited itself to cases where punctuation or prosody is unimportant.

2. Why we can't escape.

Times have changed. A mouse click now displays instant waveforms on a lap-top screen. The phonology of prosodic phrasing and intonation has seen huge advances. Principled notational systems for representing prosodic properties of sentences have been created. And the number of sentence processing studies that specifically include prosody has been rapidly accelerating. So we are making good on the promise of older work, that one day "suprasegmental information" would not be ignored. Psycholinguists working on sentence parsing now can and do manipulate the prosody of input sentences, and measure the prosodic properties of sentences that subjects produce. I will argue in this paper that we not only can and do, but must. It is not the case that while some people study prosody in sentence processing, others can continue to exclude it in order to study 'pure' syntactic/semantic processing. Even in reading, prosody is present. Even in silent reading, and even if prosody-marking punctuation is absent. Prosody is mentally projected by readers onto the written or printed word string. And - the crucial point - it is then treated as if it were part of the input, so it can affect syntactic ambiguity resolution in the same way as overt prosody in speech does.

I agree that this sounds far-fetched. If nothing else, it seems to be dismissable on logical grounds. Prosody in reading must be projected on the basis of the lexical string and the syntactic structure assigned to it, so how could that projected prosody influence the assignment of syntactic structure to the lexical string? The answer, in part, is that syntactic analysis and prosody assignment can be interleaved, with prosodic processing following along in the wake of low-level syntactic processing, and feeding later syntactic decisions. But the question also has a deeper point. If the prosody in reading is derived from the lexical/syntactic facts, it must be redundant, in a strict sense. Unlike the prosodic contour of a spoken sentence, it cannot in principle contribute any additional information. Though phonological encoding may be an efficient way to REPRESENT sentence structure (see Slowiaczek & Clifton, 1980), it cannot supply any facts to DISAMBIGUATE sentence structure. Thus, implicit (internal, silent) prosody may exist, but it couldn't in principle make any difference to sentence-level processing.

This refutation of the possibility of a causal role for internally generated prosody seems unassailable. But in face of the growing empirical evidence, some of which I will present

below, there has to be a way around it. Implicit prosody demonstrably does affect syntactic decisions. I will attempt to formulate a general characterization of the cases in which it does so. To anticipate: they are cases in which the prosody as well as the syntax is ambiguous. I mean by this not just cases where the prosody does not disambiguate the syntax, such as *The horse raced past the barn (fell)*, but cases where a specific prosodic feature, such as a major phrase boundary, could have had different sources - it might be due, say, to a constraint on prosodic phrase length or to a syntax/prosody alignment constraint. Such prosodic ambiguities must be resolved by perceivers, whether they are actually listening to speech or are mentally monitoring the implicit prosody of inner speech. And as usual, where there is ambiguity, mis-resolution may occur. A reader may create a boundary for one reason (e.g., optimal phrase length), but the boundary may be understood as present for another reason (e.g., alignment with syntax). Under the latter construal, the prosodic break can be relevant to syntactic structure assignment: it can bias the resolution of a syntactic ambiguity just as a prosodic break in a spoken sentence does. Note that on syntactic or semantic grounds alone the parser might have favored the alternative analysis. Thus, the analysis that is computed may - without logical contradiction - be causally affected by the prosody that is derived by the reader from a prosody-less word string.

This is all very abstract. Some real instances in the next sections will show that it has application to natural language. I will then try to assess how widespread the phenomenon is. This part of the project is new and still very speculative. But it has practical importance for psycholinguistics. Wherever silent reading is affected by mentally projected prosody, prosody cannot be escaped by presenting experimental materials visually. Wherever experimental materials are presented visually, there is a risk that processing outcomes will be affected by mentally projected prosody. Therefore, to avoid experimental artifacts, the interface principles by which prosodic contours are assigned to sentences need to be understood and applied even in silent reading experiments.

3. The Implicit Prosody Hypothesis

The sentence processing research group at the City University of New York has been collecting evidence, from several languages, bearing on the Implicit Prosody Hypothesis (IPH).

(1) **Implicit Prosody Hypothesis** (IPH): In silent reading, a default prosodic contour is projected onto the stimulus, and it may influence syntactic ambiguity resolution. Other things being equal, the parser favors the syntactic analysis associated with the most natural (default) prosodic contour for the construction.

We stumbled into this by accident. Cuetos & Mitchell (1988) reported a difference in ambiguity resolution preference between Spanish and English, challenging the hypothesis that the human sentence processing mechanism is innate and hence applies uniformly to all languages. Several promising explanations of the cross-language facts have been proposed, but one by one they have succumbed to contrary data from other languages, including Afrikaans, Romanian, Brazilian Portuguese, and Croatian (for discussion see Mitchell & Brysbaert 1998; Ehrlich et al. 1999; Lovric et al. 2000).

What eventually suggested the involvement of prosody, even though the data came from silent reading tasks, was a sensitivity of these non-universal phenomena to constituent length (Fodor 1998), reminiscent of the 'input chunking' effects of older parsing models designed to accommodate short term working memory limitations (e.g., Frazier & Fodor 1978). However, STM capacity ought to be much the same across languages, so it looks less plausible as an explanatory basis for structural biases as the differences between languages have emerged. On the other hand, prosodic phrasing varies with both syntactic structure and constituent length, and it is partly universal but also subject to language-specific rules. So prosodic phrasing offers the right sort of profile to account for a mostly universal pattern of length-sensitive syntactic processing tendencies with a few language-specific exceptions.[1]

I will illustrate here with the relative clause attachment ambiguity first noted by Cuetos & Mitchell and much studied since. For space reasons I will limit the discussion to a comparison of English and French, with data mostly from Quinn et al. (2000), but I would emphasize that the empirical strength of the IPH lies in the convergence of evidence from several constructions in several different languages. For some highly informative data on relative clause attachment in Croatian, see Lovric et al. (2000, 2001). For two other relevant constructions, in Japanese, see Hirose (1999, 2000). All this material is summarized in Fodor (2002).

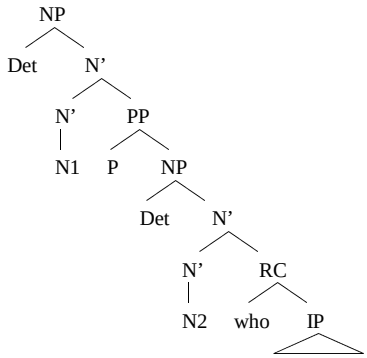
4. Empirical evidence

Syntactic processing exhibits a general locality tendency: it prefers to keep adjacent words close together in the hierarchical tree structure for the sentence. Some such locality principle is variously known in the literature as Late Closure, Right Association, Local Association, or Recency, and it applies to almost all constructions in all languages that have been studied. But Cuetos & Mitchell noticed that it has one exception. For attachment of a relative clause (RC) to a complex NP with two competing noun hosts, as in (2), local attachment is the preferred structure for English but not for Spanish. In English the tendency is for the RC to modify the closer (lower) noun: *actress* in (2a). In Spanish the RC is more often taken to modify the more distant (higher) noun: *criada* in (2b).

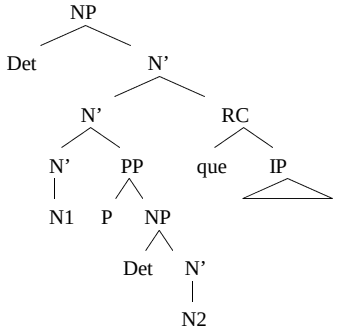
(2) a. Someone shot the servant of the actress
who was on the balcony. *60% local attachment*
b. Alguien disparó contra la criada de la actriz
que estaba en el balcón. *40% local attachment*

The percentages shown in (2) are only approximate, and the cross-linguistic differences are not large, but they are fairly stable across a number of experiments. See the tree diagrams in (3), where (3b) clearly shows the non-locality of the attachment site of the relative pronoun in the structure that is preferred in Spanish.

(3) a. *Local RC attachment (preferred in English)*



b. *Non-local RC attachment (preferred in Spanish)*



Research since that early discovery has found more languages of each persuasion, as shown in Table 1. As the question marks indicate, a few cases are unresolved; I have made my best guess as to which list they belong in. References are in Lovric et al. (2001).

LOCAL ATTACHMENT PREFERENCE

Brazilian Portuguese	Norwegian
Egyptian Arabic	Romanian
*English (American)?	Swedish
English (British)	

NON-LOCAL ATTACHMENT PREFERENCE

Afrikaans	**German
*Croatian	Italian?
Dutch	Russian
*French	*Spanish

* Greater tendency to local attachment for short RCs.
** Length effect in subject position only.

Table 1: Cross-language differences in preferred resolution of RC-attachment ambiguity in silent reading

The task is to account for this curious classification of languages. Note that Norwegian and Swedish contrast with Dutch and German, and Romanian contrasts with Spanish, so the typology is not a simple one, such as Germanic versus Romance. The one point on which languages do apparently agree is that for short RCs (one prosodic word) there is a stronger tendency toward low (local) attachment than there is for mid-to-long RCs (more than one prosodic word) This is so for all languages that have been tested so far, indicated by asterisks in Table 1. For ease of reference I have summarized the facts for English and French in Table 2.

	ENGLISH	FRENCH
LONG RC	mild low attachment	strong high attachment
SHORT RC	more low attachment	no attachment bias

Table 2: English and French attachment preferences

Given the resistance of these facts to other attempted explanations, let us consider how prosodic phrasing might account for them. Our experimental data support what prosodic theory predicts: that in all languages there is a lower probability of a prosodic break before a short RC such as *who cried*, than before a long one such as *who cried all through the night*. Although a prosodic boundary before a clause is common, an RC that consists of just one minor phrase cannot comfortably constitute a major phrase by itself (see the BinMin constraint of Selkirk 2000), so it will tend to group with preceding words. To the extent that the principles of the syntax-prosody interface prefer a congruent relationship (i.e., phrasal alignment; see discussion below), the absence of a pre-RC prosodic boundary for short RCs would tend to favor syntactic structure (3a), while the presence of a pre-RC boundary for long RCs would favor structure (3b). That the presence or absence of a prosodic break before the RC does affect RC-attachment tendencies has been confirmed for overt prosody in spoken sentences. Maynell (1999) showed for English that more high attachment responses are given by listeners when a pause and prepausal lengthening create a prosodic break after N2, before the RC. The IPH predicts that this will be so in silent reading also, and thus the effect of RC-length on RC attachment tendencies in silent reading is explained: RC-length affects prosodic phrasing, and prosodic phrasing affects RC-attachment.[2]

Note that this IPH explanation exemplifies the kind of mis-resolution of a prosodic ambiguity that was outlined in general terms in section 2. The absence of a prosodic break before a short RC is dictated by optimal phrase-length principles but apparently it is often construed (even by the same reader) as signaling local (low) attachment. The presence of a prosodic break before a long RC may be the consequence of a language-specific rule requiring a break (length permitting) at the left edge of a clause (perhaps specifically a relative clause), but it may then be interpreted as a mark of non-local (high) attachment.

Now consider the odd classification of languages in Table 1. An IPH explanation must look for some relevant cross-language differences in the syntax-prosody alignment principles for (long) RCs. I believe they exist, but at this point I go beyond any treatises I have been able to find in the phonological literature. What follows is therefore speculation. It is supported by our experimental data on English, French and Croatian, but a great deal more is needed. It may well be that this account must be revised as we learn more about interface principles, how they can differ across languages, and which if any are universal (see Jun 2002).

My proposal is that the languages which prefer non-local

RC-attachment are those whose interface constraints favor a prosodic break before an RC, a break which could be misconstrued as marking a structural discontinuity in the syntactic tree, as in (3b) above. (The constraint for RCs may be an instantiation of some more general constraint, but I will limit discussion to the specific case here.) Our evidence suggests that this is so for French and Croatian (modulo competition with optimal length constraints as noted above[3]), but not for English. Intuitive evidence suggests that English has no left-alignment requirements at all (except whatever is involved in bracketing appositive or parenthetical material, which I will not discuss here). In an Optimality Theory framework, it could be said that left-alignment constraints are universal but rank very low in English. An English sentence may or may not break prosodically at the left edge of a CP or an IP or a VP, and so forth, depending entirely on what is preferred on the basis of other factors such as length considerations (BinMin and BinMax) and other alignment constraints. Selkirk (2000) has proposed for English an $Align_R$ XP constraint, in order to permit a major phrase boundary after a complement within a VP, as in (4a). $Align_R$ XP is optional in the sense that it is equally ranked with the Wrap XP constraint of Truckenbrodt (1995) which prohibits splitting of the VP.

(4) a. (She loaned her rollerblades) (to Robin.)
b. (She loaned the book we bought) (to Robin.)

I have suggested (Fodor 2002) that the $Align_R$ XP constraint in English is an instance of a more general right-alignment phenomenon, which is sensitive to the number of right-edge syntactic brackets between adjacent words. In other words, it is a graded constraint which reflects the configurational relations in the syntactic tree: the pressure to insert a prosodic break (and perhaps the intensity of the acoustic realization of the break) is greater where the structural discontinuity in the tree is greater (i.e., more right brackets together). (See Cooper & Paccia-Cooper 1980 on boundary strength. See Frazier & Clifton 1998 on parsing difficulty at positions with multiple right-brackets.) In (4a) a break is highly optional because the discontinuity is slight. In (4b) a break is closer to obligatory because *bought* is quite low in the tree compared with the following *to*; there are a number of right brackets (VP, IP, CP, NP) between them. (Fighting against a break after *bought* is the shortness of *to Robin*.) Note that graded constraints such as this contribute to the congruence between syntactic and prosodic phrasing. Although prosodic structure is flat and cannot directly mirror the recursive hierarchical structure of syntax, the obligatoriness or strength of its breaks may indirectly and partially signal hierarchical information. Applying these points now to the structures in (3): $Align_R$ XP would increase the probability (or strength) of a pre-RC prosodic break in (3b), compared with (3a), since (3b) has more right brackets between N2 and the relative pronoun.

Now we can return to the cross-language comparison. A language like French, whose rules demand a break (phrase lengths permitting) at the left edge of an RC, will have a break there regardless of the position of the RC in the tree (if phrase-length restrictions are met). But a language like English, whose grammar calls for a break where multiple right edges coincide, will make a break before the RC only when the RC attaches high (or when length considerations demand it). Without any evidence at all, I conjecture that the graded (configuration-sensitive) $Align_R$ XP constraint is universal, and not in fact directional. Its effects will vary naturally with the branching direction of the syntax. In a left-branching language like Japanese, the major discontinuities occur where multiple LEFT brackets coincide in the word string, so a universal configurational constraint Align XP will be tantamount there to an $Align_L$ XP constraint. (Kubozono 1993 describes graded phenomena in Japanese which I believe reflect this concern for structural discontinuity, but I cannot discuss them here.) Universal status implies that the graded Align XP constraint is active also in French, though it will be less visible there than in English since its effect will sometimes coincide with that of the (non-graded) $Align_L$ RC constraint.[4]

To summarize: English and French both have reasons to break, in some cases, between a noun and an RC. But their reasons are different. In French, $Align_L$ RC and BinMin favor a break before a long RC but not a short one, regardless of RC-attachment height.[5] In English, the configurational Align XP and BinMin favor a break before a long RC but not a short one, if the long RC attaches high but not if it attaches low. (Even in (3b) the RC does not attach VERY high, so a high long RC might have less tendency to break in English than in French. Exact details of how the acoustic properties or probability of a break are scaled remain to be established.)

The acoustic data reported by Quinn et al. (2000) for American English and European French, and additional data for Canadian French discussed in Fodor (2002), show just this distribution of prosodic breaks for unambiguous sentences, as summarized in Table 3.

	ENGLISH	FRENCH
LONG RC	forced high: break	forced high: break
	forced low: no break	forced low: break
SHORT RC	forced high: no break	forced high: no break
	forced low: no break	forced low: no break

Table 3: Distribution of pre-RC prosodic breaks in unambiguous sentences.

Disambiguation of N1 or N2 attachment was by agreement marking on the RC verb. Subjects read the sentences to themselves to understand them, and then read them aloud for recording. To identify prosodic breaks we measured F0 at the mid-point of the vowel in the stressed syllable of N1, of N2, and of the RC verb (which was always the first prominence in the RC), looking for reset of F0 as an index of the start of a new phrase. For the Canadian French materials we also measured pauses and/or pre-pausal lengthening at the end of N1, and of N2. The F0 and duration data concurred on the distribution of breaks: before short RCs in neither language; before long RCs in French; and before high-attaching long RCs in English.

Given the IPH, these prosodic facts can account for the pattern of syntactic preferences in silent reading of ambiguous sentences, shown in Table 2. The short RCs were discussed earlier. So we need to consider now the situation of a reader faced with a long RC, with no lexical or syntactic disambiguation of its intended position in the tree. What prosody should the reader assign? For French it is clear: a break should be produced before the RC. The attachment preferences in Table 2 are thereby explained for French if (a)

silent readers are sensitive to the prosody they have projected onto the visual input, as the IPH maintains, and (b) where a prosodic break has more than one potential cause, perceivers tend to attribute it to configurational congruence with syntax rather than to a specific category-based constraint or a length constraint. Assumption (b) is important, and I return to it below. It played a role earlier in accounting for more low attachment of short than long RCs. And it is needed here to explain why French readers, whose grammar offers two sources for a break before a long RC (a bundle of right brackets, or a single left bracket labeled RC), are biased toward one of them: they tend more often than not to interpret a break as the result of the configurationally-sensitive $Align_R$ XP rather than the category-based constraint $Align_L$ RC.

In contrast to French, the prosodic principles of English do not dictate whether or not there should be a prosodic break before an ambiguously-attached long RC. Yet the attachment data for English long RCs are not neutral; they show a mild low attachment preference (approx. 60%). There are two explanatory possibilities here. One is a prosodic explanation: perhaps English leans toward no pre-RC break for ambiguous long RCs because that is easy and is acceptable; then the absence of a break is interpreted, by the general priority of configurational principles, as a sign of low attachment. However, there is an alternative possibility: since the English prosodic principles are neutral, that may leave room for a syntactic locality principle such as Late Closure to step in and resolve the ambiguity. Thus we cannot claim that English long RCs make the case for syntactic disambiguation by implicit prosody. What supports the IPH is the pattern of contrasts between long and short RCs, and between languages. This has found no stable explanation so far on any other grounds, but it is exactly what would be expected given independently demonstrable facts about prosodic phrasing.

5. The extent of the phenomenon

It is important to establish how pervasively implicit prosody influences syntactic ambiguity resolution in reading. There are also effects on reading times for unambiguous structures; see Pynte & Colonna (2000) and references there. To exaggerate somewhat: No sentence processing data derived from a reading task can be safely interpreted until the scope of implicit prosody is known. But if we can formulate a generalization about the range of constructions that are susceptible to implicit prosody influences, then we can safely ignore the problem in other cases. The constructions we have studied so far, in Japanese and Croatian as well as English and French, have all involved adjuncts. This was not planned, but it may nonetheless not be a coincidence. Construal theory (Frazier & Clifton 1996) distinguishes the processing of primary and non-primary relations. The latter, which include adjuncts, are processed more flexibly; they are open to many influences, not just syntactic attachment principles. So this might be the generalization we need, about the scope of IPH effects. But though this would be interesting, a reason for doubting it is that one of the Japanese constructions studied by Hirose (1999, 2000), which I have not had space to discuss here, does not involve an ambiguity concerning where the adjunct fits in the sentence (i.e., what it modifies), but a quite different sort of ambiguity to which Construal's primary/non-primary contrast does not apply.

While leaving the Construal hypothesis open as a candidate, I think the best route to circumscribing the phenomenon is to understand its cause. What we have observed so far is a tendency to interpret a prosodic break as a syntactic configuration marker where possible, even if the grammar of the language contains other principles that could have been its source. We don't know yet why there should be this interpretive bias, but I have speculated (in Fodor 2002) that a perceiver faced with a structural ambiguity is seeking some cue - any cue - to resolve it. Treating a prosodic boundary as due to a length constraint, or a fixed alignment constraint such as $Align_L$ RC, does not contribute to this goal. But treating it as configurational in origin, due to the graded Align XP constraint, does tip the balance toward one structural analysis rather than the other. I suggest, then, that a preference for configurational interpretations is one general principle that guides the resolution of prosodic ambiguities (comparable to principles like Minimal Attachment which guide the resolution of syntactic ambiguities). More work is needed to establish whether there are other such principles (e.g., a bias toward attributing a prosodic break to the presence of focus rather than to phrase alignment). When we know what they are, that will identify the cases of interest, in which prosodic phrasing that is not configurational in origin is invested with configurational import by perceivers.

I end with an assortment of examples where this might be so. None of these have been studied from this point of view, and some of them may prove irrelevant, but I think they are worth looking into.

(5) a. She put the candy in her mouth on the table.
b. Did she put the candy in her mouth on the table?
c. I met the niece of the king Spaniards hated.
d. I met the niece of the king Italians hated.
e. Sam knows which books students like to read most.
f. Sam knows what the students like to read most.
g. Chickens were eating the remaining green vegetables.
h. This is the book I was reading while waiting for Marvin.
i. He cleaned the rug for Jennifer Wilkinson.
j. He steam-cleaned the rug for Jill.

In (5b) the interrogative pitch rise on the last phrase (*on the table*) seems to separate it perceptually from the preceding phrase (*her mouth*) so that the silly interpretation in (5a) is avoided. The source of the contour is illocutionary force, but it may be interpreted as revealing phrase structure. In (5c) the hiatus caused by the stress clash between N2 and the start of the RC may simulate a structural break and encourage RC attachment to N1 (Spaniards hated the niece). Compare (5d) which is similar but without the stress clash (Italians hated the king). (5e) shows a rather clear break at the left of the syntactic IP (i.e., before *students*), while (5f), if it has a break at all, divides at the left of the syntactic CP (before *what*). Stress clash may again be implicated, but also *which books* is more focussed than *what*, and the prosodic phrasing may be taking advantage of the tendency to break after a focused item. These examples clearly illustrate the flexibility of English about left edges, as does the classic example (5g) where the break precedes not the VP but the object NP. (5h) illustrates again that constituent length can defeat structural configuration: the matrix clause and half of the relative clause are in one prosodic phrase, while the other half of the relative clause (the *while* phrase) is in the next one. (5i) and (5j) tend to divide differently due to their constituent lengths, creating a

different bias for attachment of the ambiguous *for*-PP (cleaned for, or the rug for). All of these various examples have the potential to show us how the prosodic phrasing system deals with competition and trade-offs between length, focus, illocution, edge alignments, and tree configuration (see Selkirk 2000), and how perceivers resolve ambiguities between them.

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[1] Non-phonological accounts have been given for constituent length effects on preferred word order but are not applicable to the attachment ambiguities we have studied. Pynte & Colonna (2000) offer a non-phonological account of the latter in terms of the timing of parsing decisions, but this may not cover comparable effects for left-branching languages.

[2] In French there were significantly more low attachments for short RCs than long ones, but not significantly more than 50%. We can only surmise that some short RCs were indeed phrased separately, either by treating them as non-restrictive, or by strengthening them with a focal accent. Because of such options, it is not to be expected that any of the syntax-phonology correlations we propose will hold absolutely.

[3] The length of the preceding material matters also. We find less tendency to phrase the RC separately following a single noun than following N1 *de* N2.

[4] The configurational Align XP, if it is operative in French, would reinforce the Align_{L} RC break for high-attaching RCs. In fact our data show no significant additive effect. Perhaps it will show up in measurements of the continuation rise. If not, either I am wrong about this constraint in French, or else alignment constraints are not additive but mutually exclusive.

[5] Conceivably, the difference between French and English is not Align_{L} RC but the strictness of BinMax, which limits the size of major phrases. But Lovric's data show this could not be so for Croatian.