

The Use of Prosody for Disambiguation in English-French Interlanguage

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In current second language processing research, a central question deals with whether L2 processing is essentially native-like, that is, whether it is driven by the same principles and mechanisms as L1 processing, or whether L2 processing is fundamentally different from native-language processing. On the one hand is a body of research that supports the claim that learners demonstrate native-like syntactic reflexes when parsing sentences, though some processing strategies may differ (Juffs and Harrington 1995; Juffs 2005; Frenck-Mestre and Pynte 1997; Frenck-Mestre 2002; Fernández 1999). On the other hand are those researchers who find evidence against such a claim and suggest rather that learners “over-rely” on lexical, semantic, pragmatic, and contextual information (Clahsen and Felser 2006; Felser and Roberts, to appear; Papadapoulou and Clahsen 2003). The present study is intended to add to the discussion by examining prosody as another factor in L2 processing.

1. Prosody and L1 interpretation

The role of prosody in processing has gone largely overlooked in L2 research. Yet a body of research has shown prosody to be an important factor in L1 sentence processing (Marselen-Wilson, et al. 1992; Kjelgaard and Speer 1999; Beach, Katz and Skowronski 1996; Katz, et al. 1996; Pynte and Prieur 1996). In fact, prosody has been observed to influence the rapidity of the parse even at the word level (Christophe et al 2003; Christophe et al. 2004).

1.1 Prosody and lexical disambiguation

Christophe et al. (2004) studied the influence of prosodic boundaries in the perception of sentence-internal words by adult speakers of French. Participants were asked to press a button immediately upon hearing the target word (here the word *chat* ‘cat’) in a given sentence.

- (1) a. [Le livre][racontait l’histoire][d’un chat grincheux][qui avait mordu][un facteur]
‘The book told the story of a grumpy cat who had bitten a postman.’
- b. [Le livre][racontait l’histoire][d’un chat drogué][qui dormait tout le temps]
‘The book told the story of a doped cat that slept all day long.’
- c. [D’après ma sœur][le gros chat][grimpait aux arbres]
‘According to my sister, the big cat climbed the trees.’
- d. [D’après ma sœur][le gros chat][dressait l’oreille]
‘According to my sister, the big cat pricked up its ears.’

Sixteen experimental sets like the one exemplified here were developed such that two sentences, (1a) and (1c) have a local lexical ambiguity, since *chat grincheux* and *chat grimpait* contain adjoining syllables that can themselves make up the word *chagrin*, whereas (1b) and (1d) have no such ambiguity, since no French word begins with the sequence **chad*... . An additional cue as to the position of the word boundary is provided in (1c) and (1d), where the target word is realized at the end of a major prosodic unit. Results indicated first that in a comparison between sentences in which the target word was realized in the middle of a prosodic unit (1a,b), reaction times were significantly faster

when the phonological sequence was unambiguous (1b). In contrast, in a comparison of results from sentences in which the target word was realized at a prosodic boundary (1c,d), there was no significant difference in reaction times between the ambiguous and non-ambiguous condition, indicating that listeners did not entertain the possibility that the target word was only the first syllable in a longer word when this would require crossing a major prosodic boundary. In addition, words were identified significantly faster overall when directly followed by a prosodic boundary, suggesting that the impositino of these prosodic boundaries facilitated retrieval of the target items.

1.2 Prosody and PP ambiguities

Pynte and Prieur (1996) examined the effects of both lexical and prosodic information on syntactic disambiguation. They considered L1 French interpretations of sentences like those in (2) and (3), where the interpretation of the PP as modifying the noun or the verb depended on its lexical content. Experimental items consisted of 16 sentences containing montransitive verbs (verbs which only anticipate one argument) as in (2), and 16 sentences containing ditransitive verbs (verbs which anticipate two arguments) as in (3). Each sentence was realized with the four different prosodies represented her. The slashes indicate major prosodic boundaries.

- (2) a. L'étudiant choisit / un appartement avec soin (avec balcon).
 b. L'étudiant choisit / un appartement / avec soin (avec balcon).
 c. L'étudiant / choisit un appartement avec soin (avec balcon).
 d. L'étudiant / choisit un appartement / avec soin (avec balcon).
 'The student chooses an apartment with care (with a balcony).'
- (3) a. Les espions informent / les gardes du complot (du palais).
 b. Les espions informent / les gardes / du complot (du palais).
 c. Les espions / informent les gardes du complot (du palais).
 d. Les espions / informent les gardes / du complot (du palais).
 'The spies inform the guards of the plot (of the palace).'

Participants in this study were presented with the task sentences aurally and a target word was presented on a computer screen at the same time as the final word of the utterance. For experimental sentences, the target word was always identical to this final word. Participants were to press a key when they heard the target word and reaction times were measured. Results showed that for ditransitive verbs, the prosody imposed on the sentence had no significant effect on the reaction times for VP-attachment sentences. Similarly, the prosody had no significant effect on the reaction times of sentences containing montransitive verbs in the NP-attachment condition. That is, when the expectation established by the lexical content of the verb was met by the semantically felicitous attachment, prosody had no discernable influence on the parse. Conversely, when there was a mismatch, prosody did come into play. For ditransitive verbs, NP-attachment was facilitated by the prosodies which imposed not major prosodic boundary between the NP and the PP (3a,c), and for montransitive verbs, VP-attachment was facilitated by the prosodies in which a major prosodic boundary intervened between the NP and the PP (2b,d).

1.3 Prosody and RC ambiguities

Fodor (1998, 2002) argues that prosody also intervenes in relative clause (RC) attachment resolution. This claim seeks to account for the cross-linguistic variation that has been observed concerning RC attachment preferences without requiring language-specific elements in the parser. The basic problem is that for sentences as in (4), some languages (such as Brazilian Portuguese, English, Egyptian Arabic, Norwegian, Romanian, and Swedish) have been described to prefer the RC "who was on the balcony" to attach to the second NP, "the actress" (low- or NP2-attachment), whereas other

languages (such as Afrikaans, Croatian, Dutch, French, German, Greek, Italian, and Russian) prefer RC attachment to the second NP, “the son” (high- or NP1-attachment).

(4) He saw the son of the actress who was on the balcony

The preference for high attachment appears to defy the well-attested principle of Minimal Attachment (Frazier 1979) which basically dictates that incoming elements of an utterance be incorporated into the closest node, and therefore the fact that some languages are actually described to prefer high attachment appears to require the admission of some language-specific parsing strategies.

Fodor maintains, however, that observed RC-attachment preferences are influenced by a language’s default prosody: those languages whose default prosody places a major prosodic boundary directly before the RC, as does French, will prefer attachment to NP1, whereas speakers of languages whose default prosody imposes no such boundary, like English, generally prefer attachment to NP2, that being the closest constituent.

2. Influence of prosody in L2 perception

If Fodor’s (1998, 2002) proposed influence of prosody on interpretation is in fact a primary cause of the observed cross-linguistic differences in RC attachment preferences, this could have serious implications on L2 processing studies that use RC disambiguation as the target structure. Dekydtspotter et al. (in press) examined the possibility that prosody can also influence the L2 interpretation of ambiguous RCs, postulating that if in fact learners do make use of prosodic information in the parse, the non-targetlike nature of L2 prosody may be a factor in their non-native-like behavior. They investigated two potential factors in RC ambiguity resolution by American learners of French: 1) constituent length (which has been observed to influence RC attachment, potentially for prosodic reasons, in silent reading) and 2) the position of a major prosodic boundary. Sentences like the one in (5) were used to create aural stimuli and each experimental sentence was realized with two distinct prosodies, one in which a major prosodic boundary directly preceded the RC (5a), and one in which a major prosodic boundary directly preceded the NP2 and no such boundary intervened between the NP2 and the RC (5b).

- (5) a. Nous aimons le secrétaire du psychologue / qui se promène (au centre ville).
 b. Nous aimons le secrétaire / du psychologue qui se promène (au centre ville).
 ‘We love the secretary of the psychologist who takes a walk (downtown).’

Students in the second and fourth semesters of their college French curriculum were asked to listen to each sentence and then answer a question in order to indicate their interpretation of that sentence. Results showed that for a subset of intermediate learners, the prosody in (5a), which is described to be the default prosody in French, enhanced NP1-attachment; the other prosody inhibited, however, this interpretation. The other intermediate learners and the early learners showed no significant asymmetries at all.

Thus there is evidence that at least some L2 speakers can capitalize on prosodic information to guide their final interpretation of RCs.

3. The present study

The fact that only a subgroup of learners in Dekydtspotter et al.’s (in press) study showed evidence for prosodic effects can be logically accounted for in one of two ways: either 1) certain learners attend to and know what to do with prosodic information while other learners do not (perhaps due to different learning strategies or different learning experiences) or 2) all learners are able to attend to prosodic information and use it appropriately, but other factors inhibit the successful use of prosodic cues due to the limits of cognitive resources. In other words, on this second view, learners who fail to use prosodic information consistently do so not because they lack competence with prosodic cues, but

rather because due to the complexity of the parse, which requires the incorporation of many kinds of information, they are unable to integrate the prosodic aspects of the utterance efficiently and thus they time out in the parse before they are able to include the prosodic information in their calculation.

If L2 processing is essentially native-like, all L2 learners, like native speakers, must make use of prosodic information to the extent possible within the limits of cognitive resources, thus requiring that even very early learners react to prosodic information at some level. This study intends to investigate this possibility by pursuing the following questions:

1) Can all learners, even early learners, successfully use prosody in order to arrive at an interpretation for some structures?

2) Does the type of ambiguous structure affect learners' successful use of prosody?

Successful use of prosody will be defined as consistent and statistically significant interpretive asymmetries based on differences in prosodic contour.

3.1 Participants

There were a total of 41 participants, 17 from the 2nd-semester French course (beginners), 14 from the 4th-semester French course (early intermediates) and 10 from a French course generally taken in the 6th semester of language study (mid- to late-intermediates).

3.2 Lexical ambiguity tasks

3.2.1 Materials

First I will look at the lexical ambiguity task, and then I will consider the structural ambiguity task. The purpose of the lexical ambiguity task was primarily to illicit the use of prosody for interpretation within simple sentences.

For the lexical ambiguity task, four sets of base sentence pairs like the one in (6) and (7) were recorded by a female native speaker of French.

- (6) a. [Marie a regardé le chat tôt ce matin.]
 b. [Marie a regardé le chat] [tôt ce matin.]
 'Marie looked at the cat early this morning.'
- (7) a. [Marie a regardé le château ce matin.]
 b. [Marie a regardé le château] [ce matin.]
 'Marie looked at the castle this morning'

All pairs consisted of two sentences which differed only in whether two identical syllables in the middle of the sentence were to be interpreted as a monosyllabic noun followed by a monosyllabic adverb (6), or as a disyllabic noun (7). Each base sentence was read twice by the native speaker: the first time, she was instructed to place a major prosodic boundary directly following the target word (6b, 7b), and the second time she was to produce no major prosodic boundaries within the sentence (6a, 7a). The speaker marked the major prosodic boundaries with boundary tones, pausing and pre-pausal lengthening, consistent with Jun and Fugeron's (2002) description of French prosodic boundaries.

Each sentence corresponded with a task item in a booklet for which two images were provided, one illustrating the sentence with the monosyllabic word and the other illustrating the sentence with the disyllabic word (in this case, one of a girl looking at a cat and the other of a girl looking at a castle). Whether the monosyllabic word image appeared as the first or second choice was randomized so as to control for a potential tendency to accept the first suggested interpretation. Participants were instructed to listen to the sentence and then circle the picture that best illustrated the sentence they heard. A question mark was also provided as a "cannot decide" option.

3.2.2 Lexical ambiguity results

The expectation was that if learners used prosody to help them resolve lexical ambiguity, they would show high accuracy for those items in which a prosodic boundary was realized directly following the target word, but that for those items in which there was no intermediate boundary, they would perform at chance.

Figure 1 gives the results just for those sentences in which the speaker intended a 1-syllable-word interpretation (“cat” sentences), and Figure 2 gives the results for the 2-syllable-word sentences (“château” sentences).

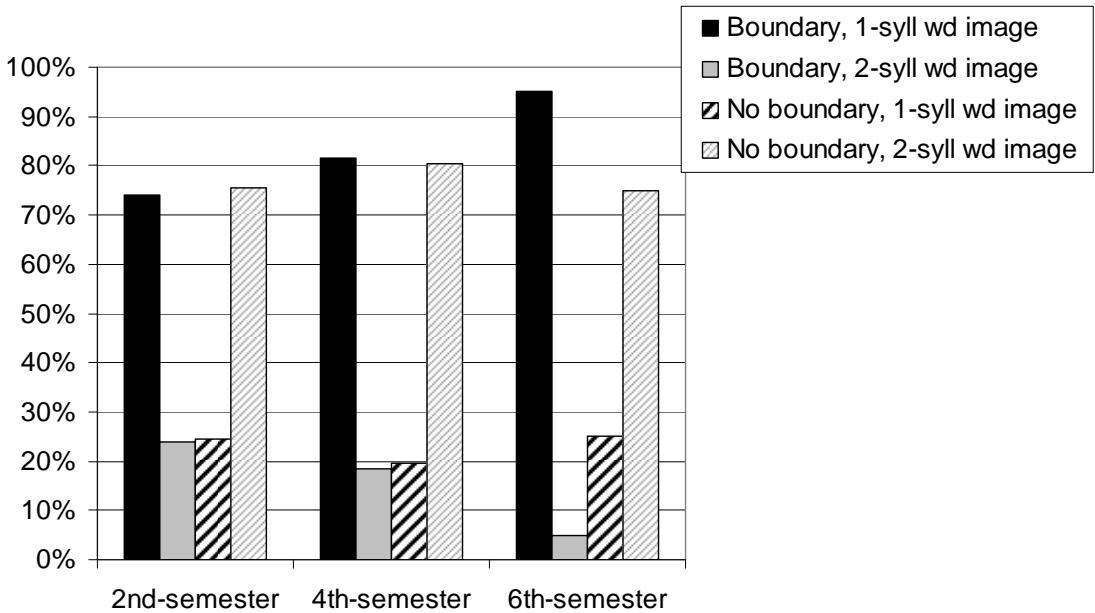


Figure 1: Responses to 1-syllable word sentences with and without a major prosodic boundary

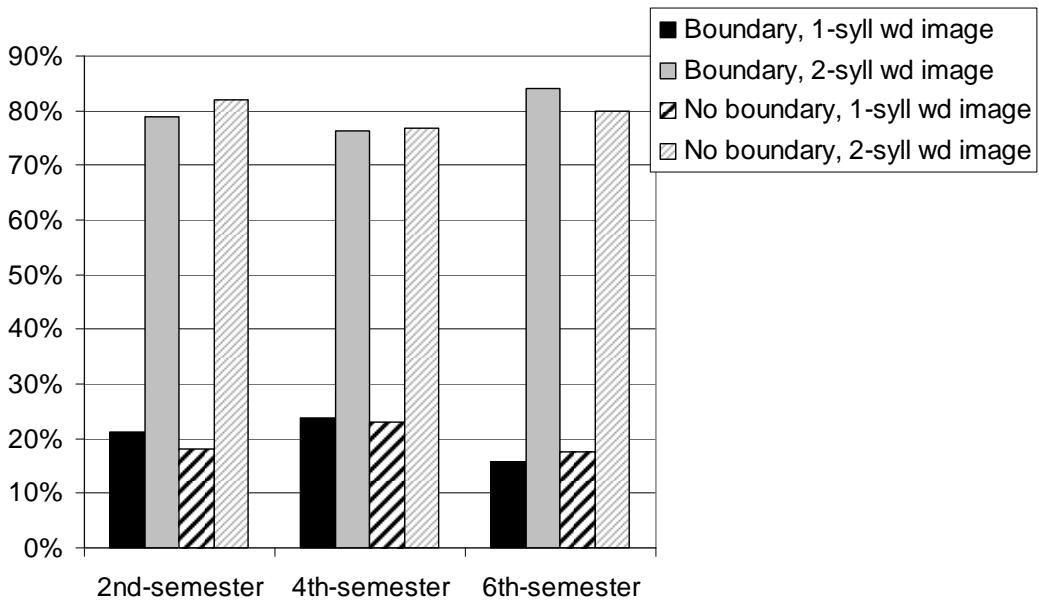


Figure 2: Responses to 2-syllable word sentences with and without a major prosodic boundary

Looking first at the 1-syllable word sentences in Figure 1, a repeated measures ANOVA run on these data with Prosody and Interpretation as within-subjects factors and Group as a between-subjects factor revealed no main effects, but there was a significant interaction between Prosody and Interpretation, $F(1,38) = 174.6, p. < .001$. What is particularly striking in this data is that while learners were highly accurate on sentences containing a boundary, they were highly inaccurate on sentences containing no boundary, actually preferring the incorrect interpretation.

The 2-syllable word sentences in Figure 2 show a very different pattern. An ANOVA using the same factors revealed a main effect for Interpretation, $F(1,38) = 132.17, p. < .001$, and no interactions. The 2-syllable word interpretation was preferred for both conditions.

Thus we find that all three learner groups behaved in a very similar manner and that they were highly accurate when the target word directly preceded a major prosodic boundary. However, when there was no prosodic boundary, learners greatly preferred the 2-syllable word interpretation.

3.3 Structural ambiguities

3.3.1 Materials

Let us turn now to the structural ambiguity task. For this task, there were two different ambiguity types tested: PP attachment, as in (8), and RC attachment, as in (9). In (8), the PP ‘in the museum’ could either modify the act of describing, VP-attachment, or it could modify the NP ‘the guard’, NP-attachment. In (9), it is either the banker who is writing, NP1-attachment, or the accountant is doing the writing, NP2-attachment.

- (8) a. Caroline a décrit / le gardien dans le musée.
 b. Caroline a décrit le gardien / dans le musée.
 ‘Caroline described the guard in the museum.’
- (9) a. Nous parlons au banquier / du comptable qui écrit.
 b. Nous parlons au banquier du comptable / qui écrit.
 ‘We talk to the banker of the accountant who is writing.’

There were six base sentences created for each structure type (12 base sentences total), and each base sentence was recorded twice by the native speaker with the two prosodies, for a total of 24 experimental items. A major prosodic boundary was imposed by the speaker in the positions indicated by slashes. 24 distractors were also included. There were three randomizations of the task.

Learners were instructed to listen to each sentence and then answer a multiple choice question as in (10) to indicate their interpretation of the sentence.

- (10) Qui est dans le musée? (a) le gardien (b) Caroline (c) cannot decide
 ‘Who is in the museum?’

Which answer appeared under answer (a) or answer (b) (whether, for example, *le gardien* or *Caroline* was the first choice as opposed to the second choice) was randomized throughout the task to control for a potential tendency to accept the first answer presented.

3.3.2 Expected response patterns

The prosodies imposed on the experimental sentences were chosen based on the prosodic contours used in Dekydtspotter et al.’s (in press) study (which followed from the claims of Fodor (1998, 2002) concerning RC attachment) and the observed NS behavior in Pynte and Prieur’s (1996) study. The prosodies for the two structure types were intended to be highly similar with the expectation that this would produce similar learner behavior across structures. If the learners behaved differently on the two structures, or showed greater success in using prosody for one structure than another, it cannot be due only to the prosodic contour.

If learners do use the prosody imposed on the sentence to inform their final interpretation, it is expected that a major prosodic boundary directly preceding the ambiguous constituent would favor high attachment of this constituent (that is, NP-attachment for PP ambiguities and NP1-attachment for RC ambiguities), and a prosodic boundary directly before the NP preceding the ambiguous constituent, thus grouping the ambiguous constituent with this NP would favor low attachment (that is, VP-attachment or NP2 attachment).

If learners also have a strong syntactic reflex, then they may exhibit a general preference to attach low due to Minimal Attachment (Frazier 1979) which basically requires that incoming material be incorporated in the nearest node when possible. In this case, a prosodic boundary intervening between the NP and the ambiguous constituent may merely inhibit this low-attachment preference rather than actually producing a high-attachment preference.

3.3.3 Results for PP ambiguities

We will first consider PP ambiguity results. Figure 3 shows that overall learners greatly preferred NP-attachment.

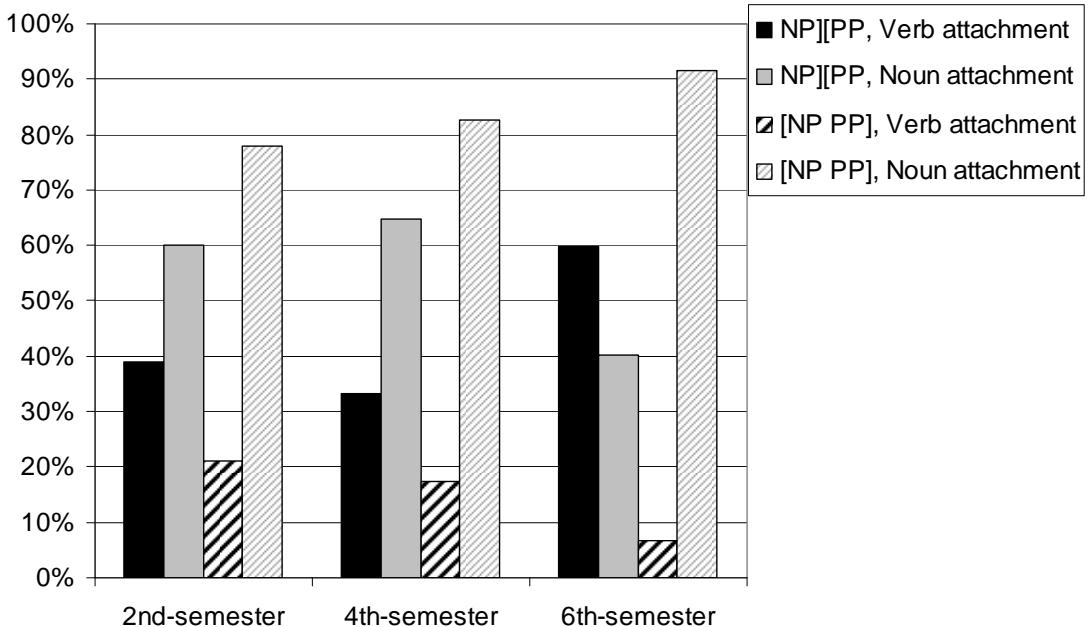


Figure 3: Responses to PP sentences for the two prosodic contours

A repeated measures ANOVA was run on the PP attachment data using Prosody and Attachment as within-subjects factors and Group as a between subjects factors. Results showed a main effect for Attachment, $F(1,38) = 44.249, p. < .001$. There was also a significant interaction of Attachment and Prosody, $F(1,38) = 43.312, p. < .001$, and a three-way interaction of Attachment x Prosody x Group, $F(2,38) = 6.083, p. = .005$

Post-hoc paired-samples t-tests were run to verify the nature of the Attachment x Prosody interaction. These revealed that although NP-attachment seems to be preferred over VP-attachment on the whole, the attachment asymmetry is only significant for the [NP PP] prosody. The NP] [PP prosody inhibited Noun attachment to the point that there is no statistically favored interpretation associated with this prosody ([NP PP] : $t(40) = 11.962, p. < .001$; NP] [PP : $t(40) = 1.613, p. = .12$).

In addition, the 6th-semester learners begin to show a reversal in the response pattern, with VP-attachment being higher than NP-attachment, with the NP] [PP prosody, but this asymmetry does not reach significance.

3.3.4 RC ambiguity results

Let us now turn to the RC ambiguity results. Figure 4 shows the results for the three groups.

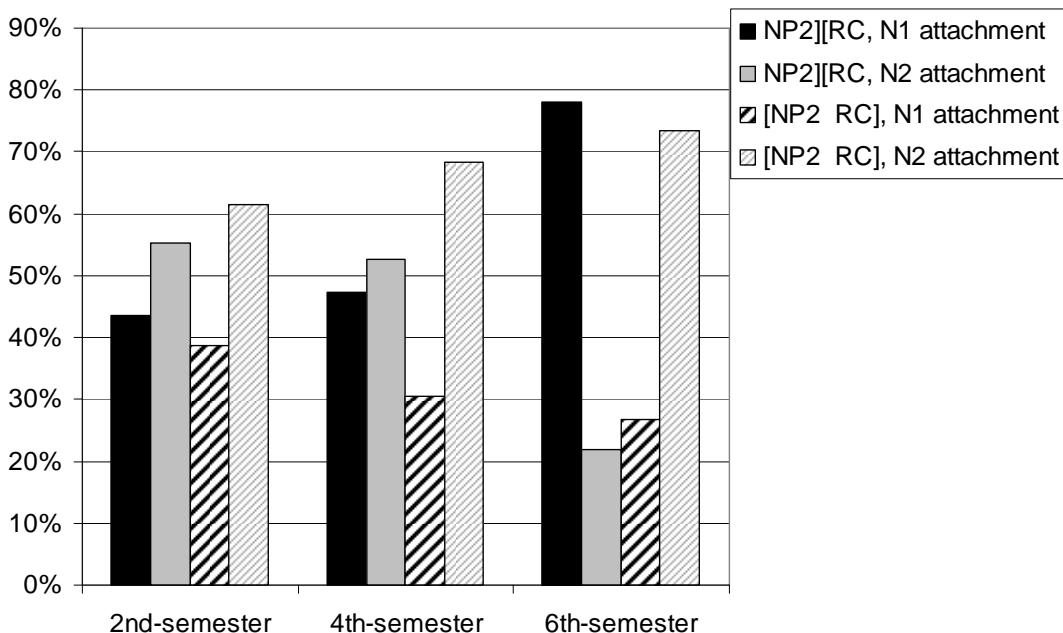


Figure 4: Responses to RC sentences for the two prosodic contours

A repeated measures ANOVA on these data using Attachment and Prosody as within-subjects factors and Group as a between-subjects factor showed no main effects, but there was a significant interaction again between Prosody and Attachment, $F(1,38) = 20.674, p < .001$, as well as a three-way interaction of Prosody x Attachment x Group, $F(2,38) = 6.050, p = .005$.

Post-hoc paired-samples t-tests showed that the apparent preference for NP2 attachment among the 2nd-semester learners was not significant ([NP2 RC] : $t(16) = 1.562, p = .138$), but it was significant among 4th-semester learners for the [NP2 RC] prosody ($t(13) = 2.761, p = .013$). As for the 6th-semester learner group, both prosodies resulted in significant asymmetries (NP2][RC: $t(9) = 5.569, p < .001$; [NP2 RC]: $t(9) = 2.550, p = .031$)

3.3.5 Summary of Structural task

To summarize the structural ambiguity task, among the lower level learners, successful use of prosody depended on structure type, and for a given structure, namely the RCs, success varied between proficiency groups. Behavior patterns indicated that although the prosody which contradicted low (NP or NP2) attachment was not able to consistently illicit the opposite interpretation (VP- or NP1-attachment) among lower-level learners, it did inhibit the otherwise-favored low-attachment interpretation. In addition, it is interesting to note that low-attachment was inhibited to a greater extent on RC ambiguities as compared to PP ambiguities.

4. Discussion

In response to my original questions, the data from these experiments indicate that all learner groups were able to use prosody successfully at least on certain ambiguity types, and that the type of ambiguity influenced the extent to which they were successful. One possibility is that for some reason, the lower level learners have access to prosodic information in order to deal with lexical ambiguities and PP structures whereas this information is not available to them with RC structures, but this would

be hard to explain. Another possibility is that it is due to the greater computational burden associated with RCs with respect to the other structures—with sentences containing RCs, embedded clauses must be constructed and these sentences simply contain more words that have to be accessed by the learners. When faced with this greater computational burden, within the limits of cognitive resources, the learners are not able to efficiently incorporate all of the information that is available to them, and they time out in their computation before they are able to successfully apply the prosodic information.

The word-boundary task results might also be explained on the grounds of computational complexity. The fact that learners preferred the two-syllable-word interpretation in the absence of a prosodic boundary may be because this is simply the easier interpretation to compute: they are only required to retrieve one word from their lexicon, rather than two, and to create a place in the syntactic structure for one word, rather than for two. Alternatively, the two-syllable word may be more quickly retrieved from the lexicon if this is the more frequent interpretation of this string of syllables in the input.

It is also interesting to note the particular patterns of learner behavior on the two syntactic structures. First of all, the lower-level learners showed a general preference for low-attachment, though this was only significant with a given prosody for PP attachment. This is evidence for a general “attach low” strategy due to structure minimization in the parse. In addition, although the low-attachment preference was apparent in both structure types, the appropriate prosody imposed on RC-ambiguity sentences was apparently more successful in inhibiting low attachment than was the similar prosody for PP-ambiguity sentences. Finally, the 6th-semester learners seemed to show an overall preference for low-attachment with PP ambiguities, but actually a general preference for high-attachment with RC ambiguities. These behaviors would be hard to explain if there were not some syntactic component at work in the learners’ parsing of the sentences.

5. Conclusions

In conclusion, these results give strong indication that L2 learners, and arguably all L2 learners, can attend to and use prosodic information for interpretation. It will be important, therefore, to incorporate prosody as a factor in future L2 processing studies. Of particular interest will be on-line tasks and the effect of prosody on reaction times at different proficiency levels. The examination of prosody and processing in the L2 may help to deepen our understanding of the way prosody is used in language as a whole.

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