

Prosody and the production of structurally ambiguous phrases

Amanda C. Edmonds
Jason Killam
Audrey Liljestr nd

Indiana University

Abstract

Our work builds on a previous study concerning the role of prosody in interpretation of relative clause (RC) attachment among adult learners of French (Dekydspotter, Donaldson, Edmonds, Liljestrang, & Petrush, under review). In particular, we further explore the hypothesis set forth by Fodor (2002) that the default prosody in French is at the root of the preference among native speakers to attach RCs to the first noun in a complex (genitive) noun phrase. We test this hypothesis with data from a French linguist who produced the stimuli for Dekydspotter et al. and add data from three naïve native speakers. The latter three speakers performed two tasks: one in which the fully ambiguous sentences were disambiguated by information provided in a context, the second in which sentences were produced as minimal pairs, with the intended interpretation indicated in parentheses. The data were analyzed for the use of both final lengthening and changes in fundamental frequency as markers of prosodic boundaries. It was found that all four speakers used final lengthening as predicted but that the results from fundamental frequency were less consistent. Additionally, we found a clear effect of task, with greater differentiation made between interpretations in the minimal pairs task

A large number of studies on the disambiguation of structurally ambiguous phrases in English have shown that prosodic means of marking boundaries constitute an efficacious disambiguation strategy, which is employed by speakers and interpretable by listeners (Beach, 1991; Beach, Katz, & Skowronski, 1996; Katz, Beach, Jenouri, & Verma, 1996; Kjelgaard & Speer, 1999; Lehiste, 1973; Lehiste, Olive, & Streeter, 1976; Marslen-Wilson, Tyler, Warren, Grenier, & Lee, 1992; Schafer, Carter, Clifton, & Frazier, 1996; Scott, 1982; Van Lancker & Canter, 1981; Van Lancker, Canter, & Terbeek, 1981). However, this generalization only seems to be valid when the two meanings of an ambiguous sentence differ only by the placement of a syntactic boundary (Lehiste, 1973; Lehiste et al., 1976). In such sentences, it has been shown that prosody (most often by means of final lengthening and boundary tone phenomena) can be used to express one of two meanings, and that this is done by highlighting the position of the syntactic break that differentiates the two interpretations. Although the use of prosody in structural disambiguation boasts of a rich literature, several gaps remain. First, the majority of the existing literature examines English. Additionally, several structural ambiguities have not yet been researched in terms of their prosodic disambiguation. These two gaps motivated the current project, in which the prosodic strategies for disambiguation of relative clause (RC) attachment to a complex noun phrase (NP) in the production of French are examined.

In what follows, we will begin by providing an overview of the experimental work that has been done in this area. Additionally, RCs and prosodic marking of boundaries in French will be reviewed. This discussion will set the stage for the current study, and the method and results sections will follow. As the four participants who took

part in this study show slightly different disambiguation strategies, the discussion section will be devoted to the identification of general trends.

Previous Studies: Perception

The purpose of Scott's (1982) study was to isolate the variable of duration in structural disambiguation. In particular, Scott examined ambiguous conjunctions of the type *Kate or Paul and Tom*, whose structure does not tell us whether we have a choice between *Kate* and *Paul and Tom* or if the choice is actually just between *Kate* and *Paul*. In a series of four experiments, Scott first regularized the fundamental frequency (F0) contour and then manipulated the duration of phrase final syllables, phrase final feet, or the pause following a phrase break. It was found that listeners' interpretations were significantly influenced by all three of these manipulations. This finding led Scott to conclude that duration on its own can serve to disambiguate structurally ambiguous sentences.

Pynte and Prieur (1996) constitute a second study in which duration was the prosodic phenomenon under investigation. Their ambitious psycholinguistic study, which focused on the ambiguous attachment of prepositional phrases, attempted to respond to two research questions: (a) What role do pauses play in the disambiguation of prepositional attachment? and (b) Does the thematic structure of the verb (mono- versus ditransitive) influence attachment preferences? This study represents one of the rather rare attempts at examining the interaction between prosody and structural ambiguity in French. The reaction times recorded from four psycholinguistic experiments showed a clear effect of both prosody and argument structure in initial attachment of ambiguous prepositions. The importance of these results for the current study concerns the finding

that prosody, operationalized as duration of pauses, significantly affected attachment preferences in French. Although these listeners were not asked to provide off-line interpretations of the sentences, this suggests that durational differences may be employed by French speakers to mark different attachments.

In addition to duration, there exist a large number of studies that have examined the effects of F0 on structural disambiguation. In a study that examined prosodic effects on minimal attachment (attachment of a phrase to the phrase marker currently under construction), Marslen-Wilson et al. (1992) showed that initial (minimal) attachment preferences (hypothesized to be universal) can be overridden by prosodic information. In particular, their cross-modal priming experiment demonstrated that manipulation of F0 can significantly influence attachment preferences in sentence fragments such as *The workers considered the last offer from the management*. A second study that focused on F0 and attachment preferences is presented in Schafer et al. (1996). Rather than targeting prosodic boundary phenomena, as is the case in most studies, Schafer et al. examined the effect of focus on attachment preferences. Specifically, sentences in which a RC could attach to either member of a complex NP were manipulated such that one of the nouns received a focal accent. With all other prosodic cues kept constant, a perceptual test showed that Anglophone listeners were significantly more likely to interpret the RC as modifying the focalized noun. Although the most widely acknowledged role of prosody in disambiguation concerns its ability to mark displaced syntactic boundaries, this study demonstrates that other disambiguation strategies that crucially involve prosody (at least in English) are available.

The final perceptual study that we will mention systematically manipulated both duration and F0. The purpose of Kjelgaard and Speer's (1999) study was not to prove that prosody plays a role in structural disambiguation (as this was assumed to be the case), but rather to examine how early in the parse of an ambiguous sentence prosody could be shown to resolve an ambiguity. To this end, the authors imposed three different prosodies—cooperating, baseline, and conflicting—on each temporarily ambiguous sentence in their study. These manipulations (of F0 and duration) were made to the ambiguous region, which in the following example sentence is *leaves his house*: *When Roger leaves his house is/it's dark*. In the cooperating prosody, the syntactic and prosodic breaks coincided, and prosodic boundary cues were expected to lead the listeners to the correct interpretation. The baseline prosody was shown independently to be an acceptable prosodic realization for both interpretations and, thus, was not expected to privilege either of the two possible attachments. Finally, in the conflicting prosodic condition, the syntactic and prosodic breaks did not align, and each was consistent with a different interpretation. The results from this study indicated a significant effect of prosodic contour on interpretation, and this effect was detectable as early as the ambiguous region.

Previous Studies: Perception and Production

In one of the first studies to examine the perception and production of structural ambiguities, Lehiste (1973) chose as his object of study 15 sentences identified in the literature as ambiguous. The resultant group of experimental items was rather diverse, and included (among others) attachment ambiguities (e.g., *The hostess greeted the girl with a smile*), adjectival ambiguities (e.g., *German teachers visited Greensboro*), and argument structure ambiguities (e.g., *The lamb is too hot to eat*). A group of four native

speakers (NS) of English (including two linguists and two non-linguists) read each of the 15 sentences twice (once for each interpretation). The recordings were then presented to a group of 30 listeners who were charged with assigning an interpretation to each sentence. For 10 of the 15 sentences, the listeners' interpretation matched the intended reading at a significant level. Lehiste then completed an acoustic analysis of the recordings and concluded that "the sentence pairs which were successfully disambiguated differed primarily with regard to timing...Intonation appears to have been less systematic" (p. 114). Thus, at least as concerns the speakers and listeners from this study, it appears that duration was manipulated more consistently than intonation, and that these manipulations were more interpretable than were clues from intonation.

In a subsequent study, Lehiste et al. (1976) further examined Lehiste's (1973) conclusion that duration differences were more salient clues to ambiguity resolution than intonational differences. For the second study, duration in 10 phrases from the 1973 experiment was manipulated, and F0 was regularized. From each of the original phrases, 10 manipulated phrases were created. Once again, the ambiguous sentences were presented to a group of 30 listeners who assigned interpretations to each of the items. This study confirms that duration on its own can successfully differentiate certain structural ambiguities. However, variability of success was a finding common to both of the studies. For instance, in neither of the experiments were the listeners able to discern the intended interpretation of *The shooting of the hunters was terrible*. Although this is an important asymmetry to highlight, for our purposes, it is sufficient to note that in both of Lehiste's experiments, prosodic disambiguation was shown to be effective for ambiguities of attachment (the type of ambiguity that is the focus of this project).

In two different studies, Van Lancker and colleagues examined the production and perception of the idiomatic and literal meanings of English idioms, such as *He's skating on thin ice*. In Van Lancker and Canter (1981), the authors recruited five NSs of English to complete two tasks. In the first task, the speakers read aloud short passages. In each passage, an idiom had been embedded, and its intended interpretation—idiomatic or literal—was made clear by the passage. Following this task, the speakers completed a minimal pairs task in which they read each experimental item while attempting to express one of its two meanings. An acoustic analysis of these recordings was published in Van Lancker et al. (1981). Although no significant differences distinguished idiomatic from literal readings on the passage task, three acoustic correlates characterized the production of literal (vs. idiomatic) readings on the minimal pairs task: overall slowness, more pauses, and more pitch excursions. Van Lancker and Canter also played these recordings to a group of listeners whose task was to identify them as idiomatic or literal. Unsurprisingly, the listeners could not distinguish the two meanings from the recordings taken from the first task; however, for the recordings made from the minimal pairs task, the listeners successfully classified 85% of the tokens. Although produced for what is arguably a highly artificial task, the validity of the contrasts made by the speakers in the minimal pairs task seems to be supported by the fact that naïve listeners were able to correctly interpret these contrasts. Nonetheless, the high level of correct classification does not necessarily indicate (contrary to the authors' interpretation) that the listeners are responding to an idiomatic-specific prosodic contour versus a literal interpretation-specific prosodic contour. Instead, the difference to which the listeners respond may have more to do with the contrast between a default contour (idiomatic reading) and a less

natural contour (literal reading). Without additional research, it is not clear what distinction is really at play.

Relative Clauses and Prosody in French

Although the variety of structural ambiguities that have been investigated with respect to the potential disambiguating role of prosody is large, the construction given in (1) has not yet received much attention.

- (1) *Jeanne invite le dentiste du docteur qui cuisine tous les jours*
“Jeanne invites the dentist of the doctor who cooks every day”

Given this sentence, it is not clear whether the RC (*qui cuisine tous les jours*) is intended to modify the dentist or the doctor. Currently, we know of no studies that have examined the production of this construction (in French or in English) in an attempt to determine what prosodic strategies NSs might employ. Nevertheless, the studies that examine this structure for other reasons are far from scarce, as this particular construction has inspired much research in the area of sentence processing. These studies report on crosslinguistic attachment preferences (whether speakers prefer to attach the RC to the first noun [N1] or to the second [N2]) and, taken as a whole, the results are characterized by contradiction. For example, although French has generally been shown to be a language that prefers high attachment (attachment to N1) in constructions such as (1) (e.g., Pynte & Colonna, 2000; Zagar, Pynte, & Rativeau, 1997), evidence in favor of an initial low attachment (attachment to N2) preference has also been found (Baccino, De Vincenzi, & Job, 2000). In the face of these results, Fodor (1998, 2002) suggested that some of the confusion may be due to the uncontrolled effects of prosody. Taking French as one example case, Fodor claimed that default French prosody treats RCs as separate prosodic constituents. As a result, a prosodic boundary precedes the RC, and this grouping biases high attachment.

Fodor's (1998, 2002) insight has particular importance for sentence processing, and especially for the controversy surrounding the existence of a universal parser (see Crocker, 1996). A large number of studies, in both first (L1) and second language (L2), have attempted to determine whether minimal attachment—a specific instantiation of the principle of incremental comprehension—exists crosslinguistically, and the structure in (1) has been the most common experimental item in these tests. Minimal attachment predicts that a universal parser will integrate incoming information into the phrase marker that is currently under construction, which predicts that languages will show a universal tendency to attach the ambiguous RC of (1) to N2 (low attachment). That said, the contradictory results that have come out of a large number of studies present a significant problem for proponents of a universal parser. Fodor's explanatory suggestion for these contradictions is founded on the assumption that minimal attachment is universal but that other factors (such as prosodic structure) can lead to subsequent revisions of the initial (low) attachment. In what was to our knowledge the first study to apply Fodor's claim to the study of L2 processing, Dekydtspotter, Donaldson, Edmonds, Liljestrang, and Petrush (under review) manipulated prosody (in the form of RC length and prosodic contour) in French sentences such as (1). These sentences were presented aurally to English-speaking learners who were enrolled in either their second or fourth semester of university French study. The results showed that a subset of fourth semester learners showed significant sensitivity to the manipulations of both length and contour. On the basis of these results, the authors argued that (a) early French learners were sensitive to the prosodic structure of their L2, despite the differences in prosody between their L1 and L2; (b) the interpretation of results from a subsequent online reading time experiment with the same

learners must take into consideration prosodic structure; and (c) the results from both experiments suggest that L2 learners demonstrate modular, deep (as opposed to shallow) processing in their L2, contrary to what has been argued by Clahsen and Felser (2006).

The stimuli used in the aural experiment reported on in Dekydtspotter et al. (under review) consisted of a set of 40 ambiguous sentences read by the first author (a NS of French), who consciously manipulated the placement of boundary high tones in an attempt to facilitate the interpretation of the RC with one of the two nouns. For high attachment, the high tone was placed on the final syllable of N2: [N1 du N2] [RC]. For low attachment, it was hypothesized that the prosodic strategy that would be adopted by NSs (and, thus, also interpretable by NSs) would be to group N2 and the RC into one prosodic constituent: [N1] [du N2 RC]. Thus, for interpretation of the RC with N2, the speaker attempted to place a high boundary tone on the final syllable of N1. Although grounded in descriptions of French boundary phenomena and based on Fodor's (1998, 2002) observations, there exist no studies in which production of the structure in question by naïve NSs of French has been examined. As a result, it is not yet clear that the disambiguation strategies employed in the creation of the Dekydtspotter et al. (under review) stimuli are in line with the strategies employed by naïve NSs of French. In the current study, we will report on a project for which we conducted an acoustic analysis of the stimulus set used in Dekydtspotter et al. These results will then be compared with data for a similar set of sentences collected from three naïve NSs of European French.

Prosodic Boundaries in French

For this project, we predict that NSs of French will signal which of two possible interpretations of an ambiguous sentence they intend by the placement of a prosodic

boundary that corresponds to the targeted syntactic structure. In line with the stimuli used in the Dekydtspotter et al. (under review) study, we expect that a prosodic boundary will be placed directly before the RC in sentences in which the relative should attach high, whereas the boundary will be placed before N2 when the RC modifies N2. These predictions both guide our hypotheses and acoustic analyses and lead us to briefly describe prosodic boundary marking in French.

In their discussion of the French prosodic system, Vaissière and Michaud (in press) provide a description of what we refer to as the default prosodic contour for prosodic constituents smaller than the utterance in French: “French is generally considered a ‘rising’ language with final lengthening” (p. 3). In other words, high tones (F0 rise) and final lengthening are used to mark the right edge of these prosodic constituents. This generalization underpins several analyses of French prosody. For example, Jun and Fougeron (2000, 2002) propose the existence of an Accentual Phrase (an intonational grouping larger than the prosodic word but smaller than an intonational phrase), which is characterized by the tonal schema Low-High_{initial}-Low-High_{final}. The final high tone is generally realized on the final full syllable of the accentual phrase, and its realization is generally accompanied by final lengthening. Thus, these two prosodic phenomena—F0 rise and final lengthening—tend to work together to mark the right edge of intermediate prosodic constituents.

Hypotheses

Given both the preceding literature and our assumptions concerning the use of boundary phenomena to disambiguate the construction under investigation, we tested three hypotheses. The first hypothesis concerns the potential difference between the

results on the basis of task (each participant completed two tasks). The second and third hypotheses are closely linked and concern the different prosodic means of disambiguating the experimental items. Hypothesis 2 concerns final lengthening, whereas hypothesis 3 targets F0 rise.

Hypothesis 1. In the first task, the intended interpretation is indicated by a context, whereas, in the second task, each phrase is disambiguated explicitly through the use of minimal pairs with the intended meaning provided in parentheses. Given the results reported in Van Lancker and Canter (1981), we expect that the participants will more clearly differentiate between the two interpretations on the more explicit task (task 2).

Hypothesis 2. To express that the RC modifies N1, we expect that the speaker will place a prosodic boundary before the RC. As a result, the final syllable of N2 will be lengthened in comparison to the final syllable of N1 in the same sentence. When the RC is interpreted with N2, it is assumed that the speaker will insert a boundary before N2. As such, the effects of final lengthening will be seen on the final syllable of N1.

Hypothesis 3. When the RC attaches to N1, we expect to see a greater F0 rise on the final syllable of N2 with respect to the rise noted for N1. On the other hand, to indicate an interpretation of the RC with N2, the presence of a prosodic boundary before N2 will result in a greater F0 rise on the final syllable of N1 than on N2.

The Current Study

Method

Participants. In addition to analyzing the 40 experimental sentences read by a linguist NS from northern France (M1) used in Dekydtspotter et al. (under review), three

additional NSs of European French were recruited and completed two tasks. Each of the speakers (including M1) is also a L2 speaker of English, and all three naïve NSs are graduate students at an American university. Two of the participants were women (F1, F2), and the third participant was a man (M2). Two of the speakers are from northern France (F2 and M2), whereas the third is from Biarritz (a town in southwestern France where Basque is traditionally spoken).

The major dialect line in France divides the country into the southern region, where Occitan and related dialects were historically spoken (*les langues d'oc*), and the northern region, where dialects more closely related to modern French are found (*les langues d'oïl*). Although we attempted to recruit only participants from one of the two regions, this proved difficult because of the small number of available subjects. Thus, even though none of our participants is from the region of France where Occitan is historically spoken, it is important to acknowledge that F2 is nonetheless from the southwest of France. Consequently, we might expect her speech to differ from her northern compatriots.

For the current study, each of the three participants completed a 45 minute session with one experimenter in a quiet room. Recordings were made using Audacity, at a sampling rate of 44,000Hz.

Experimental items. The same set of experimental items was used in both tasks, and each experimental item showed the same structure: subject + main verb + article N1 + article N2 + complementizer + subordinate verb + adjunct. Additionally, we controlled for the effects of length in two ways. First, the number of syllables in the critical regions—article N1, article N2, complementizer + subordinate verb—was kept constant

within each sentence; for any given sentence, these three regions were each made up of either 3 or 4 syllables. Second, we controlled for the effect of segmental material by counterbalancing the order of the nouns in the complex NPs. This resulted in pairs of sentences (see [2]), both of which were read by each participant.

(2) *Charles accuse le coiffeur du banquier qui revient du Japon*
“Charles accuses the hairdresser of the banker who returns from Japan”

Charles accuse le banquier du coiffeur qui revient du Japon
“Charles accuses the banker of the hairdresser who returns from Japan”

Additionally, all nouns that made up the complex NPs (with the exception of *grand-père* “grandfather”) designated professions, in an attempt to control for possible frequency effects. Altogether, we created a total of 20 experimental items for use in the two tasks. The two experimental tasks are included in the appendix.

Task 1. Each of the 20 experimental items was paired with two different contexts—one requiring high attachment, the other forcing low attachment. Within each context, a relationship that could be described using the genitive construction was established between two characters.¹ There was always a unique plausible referent in the context for the common noun not modified by the RC, whereas there were multiple plausible referents in the context that satisfied the denotation of the noun modified by the RC; thus, the modification by the RC allows for one of these referents to be uniquely identified.

Each context, followed by a contextualizing question and a logical response, was presented on its own page (see Figure 1). The context was first read silently. Following

¹ After completing this experiment, we realized that two of the contexts were faulty (numbers 3 and 4). In each of these two contexts, the relationship established could not be expressed with a genitive construction. As such, the data from these items were removed and the results from task 1 are based on data from a maximum of 38 items for each participant.

this reading, the participant was asked to read aloud the contextualizing question, which was intended to draw the participant's attention to the relation between the two characters. Immediately after the contextualizing question, the participant read aloud the response (experimental item). Once finished, the participant handed the paper back to the experimenter and responded to a comprehension question. This question always concerned the attachment of the RC. For the example in Figure 1, the comprehension question was *Qui attend tranquillement?* "Who waits calmly?" A correct response to the comprehension question allows us to be confident that the intended interpretation was understood by the participant. An incorrect response to a comprehension question resulted in the removal of that experimental item from the analysis.

Dans un restaurant, Paul a vu son dentiste Dr. Émail s'emporter contre son serveur. Malheureusement, Paul doit s'en aller sans voir la fin de la dispute, pour aller à un rendez-vous chez son avocat. Quand il y arrive, Paul s'étonne de voir que plusieurs dentistes fâchés attendent de voir l'avocat. En plus, Paul remarque que son dentiste est assis calmement dans la salle d'attente; il est clairement prêt à porter plainte contre le serveur malpoli. Paul décide qu'il vaudrait mieux téléphoner au jeune serveur irrespectueux pour le prévenir de la plainte imminente.

Qui est-ce que Paul appelle ?

Paul appelle le serveur du dentiste qui attend tranquillement.

English translation :

At a restaurant, Paul happened to see his dentist, Dr. Émail, who got into an angry fight with his waiter. Unfortunately, Paul had to leave without seeing the end of the fight, due to an appointment with his lawyer. Upon arriving at his appointment, Paul is shocked to see several angry dentists waiting to see the lawyer. Moreover, Paul notes that his dentist is seated calmly in the waiting room; he is clearly ready to press charges against the impolite waiter. Paul decides that it would be best to telephone the disrespectful young waiter in order to warn him of the imminent charges.

Who does Paul call?

Paul calls the waiter of the dentist who waits calmly.

Figure 1. *Experimental item from task 1.*

Task 2. The same 20 experimental items were read aloud by each participant in a minimal pairs task; each sentence was read twice, first with the RC modifying N1, then with the RC as a modifier of N2. After each sentence, the intended attachment was indicated in parentheses. The first four items from this task are given in (3).

(3)

- | | |
|---|---------------------------------------|
| 1. <i>Paul appelle le serveur du dentiste qui attend tranquillement</i> | <i>(c'est le serveur qui attend)</i> |
| “Paul calls the waiter of the dentist who waits calmly” | (it's the waiter who waits) |
| 2. <i>Paul appelle le serveur du dentiste qui attend tranquillement</i> | <i>(c'est le dentiste qui attend)</i> |
| “Paul calls the waiter of the dentist who waits calmly” | (it's the dentist who waits) |
| 3. <i>Jean appelle le dentiste du serveur qui attend tranquillement</i> | <i>(c'est le dentiste qui attend)</i> |
| “Jean calls the dentist of the waiter who waits calmly” | (it's the dentist who waits) |
| 4. <i>Jean appelle le dentiste du serveur qui attend tranquillement</i> | <i>(c'est le serveur qui attend)</i> |
| “Jean calls the dentist of the waiter who waits calmly” | (it's the waiter who waits) |

Acoustic analysis. In addition to the 40 sentences from M1 (Dekydspotter et al., under review), our acoustic analysis examined 94 sentences from task 1 (F1: 33 sentences; F2: 31 sentences; M2: 34 sentences) and 120 sentences from task 2 (40 sentences \times 3 speakers). For each sentence, we used Wavesurfer to take two measurements of duration and five measurements of F0. For the two measurements of duration, we determined the length of the final syllables of N1 and of N2. For each syllable, the measurement began at the beginning of voicing for the vowel (determined by the identification of periodic oscillations in the waveform). The measurement ended immediately before the burst of the following onset ([d] for N1, [k] for N2). As such, each measurement included the entire final vowel, the final coda (if there was one), and the following pause. This measurement provided a global measure of final lengthening, which other studies have found to occur on the final syllable, in the following pause, or both (Scott, 1982).

To determine F0 rise on N1 and N2, we took two measures for each syllable. First, we identified the F0 peak on the targeted syllable. Next, we identified the preceding valley (i.e., the lowest preceding point without the intervention of a high tone). The difference between these two measurements was calculated and is used in our analysis as F0 rise. Although the valley was generally located on the preceding syllable, several schemas were noted, including two schemas in which the first measure taken was not actually lower than the measure on the targeted syllable (e.g., when the F0 on the targeted syllable was lower than the F0 on the preceding syllable and when there was an F0 plateau leading up to the targeted syllable). We have illustrated the four most common variations and indicated where measurements were taken in Table 1. In this table, the first (left-most) arrow corresponds to the first measurement taken (usually the preceding valley). The second arrow indicates the F0 peak on the targeted syllable. As can be seen from the table, our coding schema allowed us to differentiate between rises, falls, and plateaus.

Description	Illustration
Rise onto the target syllable <ul style="list-style-type: none"> • Positive difference 	
Fall onto the target syllable <ul style="list-style-type: none"> • Negative difference 	

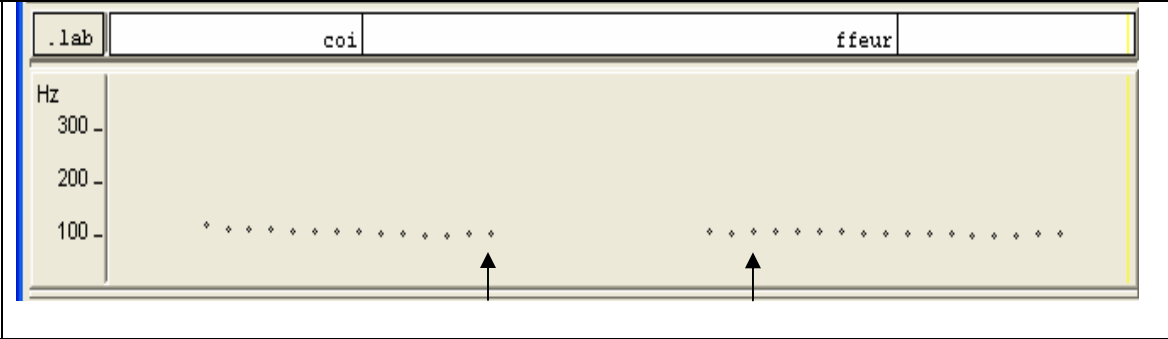
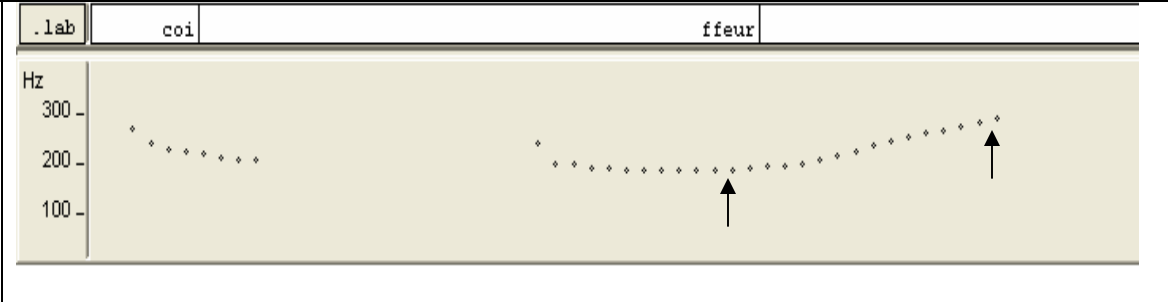
Plateau leading up to target syllable <ul style="list-style-type: none"> • Difference = 0 	
Rise within the target syllable <ul style="list-style-type: none"> • Positive difference 	

Table 1. Coding of four different F0 schemas.

Results

Before discussing the results, we would like to briefly highlight the organization adopted for this section, in addition to providing a general description of the statistical tests used. As for the organization, we have divided up the results according to the prosodic phenomenon: We will first discuss the findings for final lengthening, followed by those for F0 rise. Within this large division, the results will be divided by participant, beginning with the recorded stimulus set from Dekydtspotter et al. (under review) and then moving to the three speakers who completed the tasks for this study. As is the case in much of the research on prosody, different speakers opt for different patterns, which motivated the decision to present individuals separately. With regard to our statistical analysis, we carried out four paired comparison *t*-tests for each participant: two comparisons of lengthening (one for each task) and two comparisons of F0 rise (one for each task). Given that the speaker for the stimulus set from Dekydtspotter et al. only

completed one complete reading, only two *t*-tests were conducted on his data. The purpose of these statistical tests was to compare the use of final lengthening and F0 rise on one interpretation versus the other. As such, for each sentence, we recorded the difference between the value found for N1 and N2 (for duration and F0). The resultant differences indicate whether there was more lengthening or a greater F0 rise on N1 (positive difference) or whether more lengthening or greater F0 rise characterized N2 (negative difference). These differences were then separated according to interpretation, and the *t*-test assessed the significance of the distribution by interpretation of the difference scores for the targeted prosodic phenomenon on a given task.

Final Lengthening

Table 2 presents the mean length of the final syllables of N1 and N2 on the basis of interpretation (N1 or N2 attachment) on each of the two tasks. Examining first the asymmetry found in M1's data (the speaker from Dekydtspotter et al. who attempted to prosodically disambiguate the two interpretations), it is clear that his behavior supports the predictions made by hypothesis 2: When the RC attaches to N1, the final syllable of N2 is lengthened, whereas attachment of the RC to N2 results in a lengthening of N1. In general terms, a similar pattern is seen in the results from the three naïve participants on task 2. On task 1, however, the same pattern only seems to be evident in F1's data. In what follows, the data from each of the four speakers will be examined in turn.

Speaker	N1 attachment		N2 attachment	
	N1	N2	N1	N2
M1	151.7	337.95	320.2	181.25
M2				
Task 1	188.37	376.68	200.53	438.87
Task 2	255.3	494.4	386.15	208.05
F1				
Task 1	244.94	397.28	302.53	229.73
Task 2	226.2	491.7	350.8	221.05
F2				
Task 1	330.53	395.47	281.07	278.64
Task 2	456.95	424.15	383.65	181.55

Table 2. Mean length (in ms) of the final syllables of N1 and N2 by interpretation.

Final lengthening: M1. In the 40 stimuli sentences read aloud for Dekydtspotter et al. (under review), the length of the final syllables of N1 and N2 clearly differed depending on interpretation. Each point on the scatter plot in Figure 2 represents one sentence; the squares correspond to N2 attachment sentences, whereas the bars stand for N1 attachment sentences. Each sentence is plotted with respect to the length of N1 (x-axis) and N2 (y-axis). According to the graph, when the RC attached high, the length of N1 was relatively constant and short. The same pattern is noted for N2 when the RC attached low. Despite some apparent overlap between the two interpretations (see the lower left-hand corner of the figure), 19 of 20 high attachment items showed longer duration of N2 than N1, whereas 17 of 20 low attachment items demonstrated the expected final lengthening on N1. The statistical comparison of N1 and N2 differences according to interpretation was significant: $t(19) = -7.358, p < .001$.

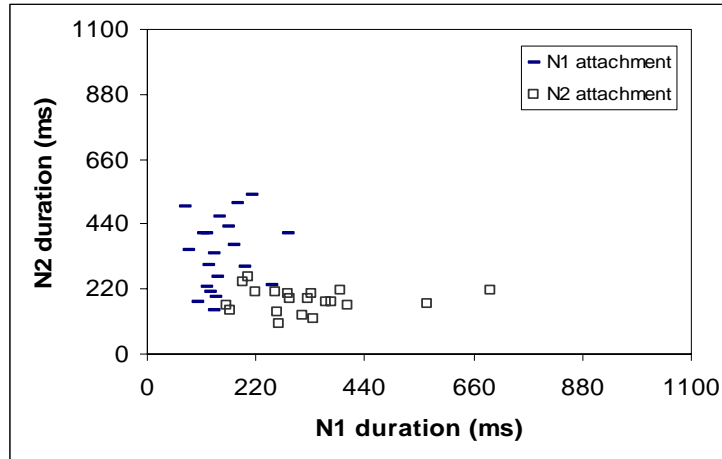
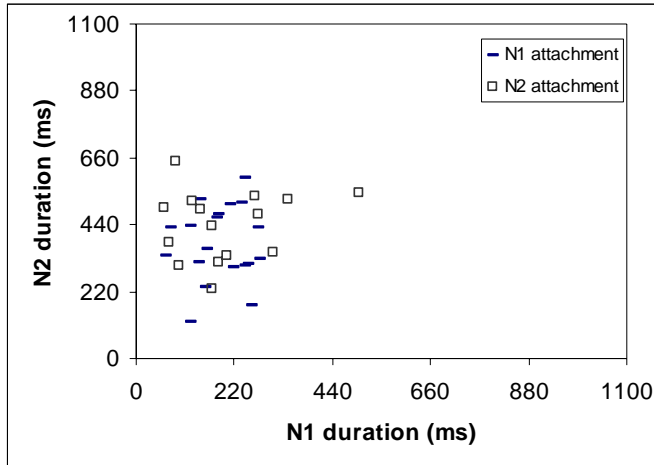
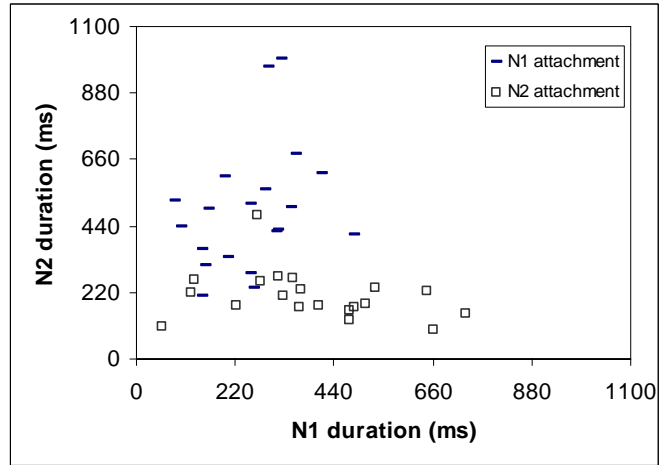


Figure 2. *M1: Duration differences by attachment*

Final lengthening: M2. On task 1, M2 made no distinguishable difference in final lengthening on the basis of interpretation, $t(14) = 1.25, p = .232$. Instead, on both interpretations, the final syllable of N2 tended to be longer than the final syllable of N1 (consistent with the default prosodic contour described by Fodor, 2002). This generalization is accurate for all but two items on task 1. On the other hand, the task 2 data look similar to the pattern noted for M1 in Figure 2 (see Figure 3). When the RC modifies N1, the duration of the final syllable of N2 tends to be longer than the duration noted for N1 (true of 18 of 20 items), whereas N2 attachment results in lengthening of the final syllable of N1 with respect to N2 (true of 16 of 20 items). This difference was found to be significant: $t(19) = -8.248, p < .001$.



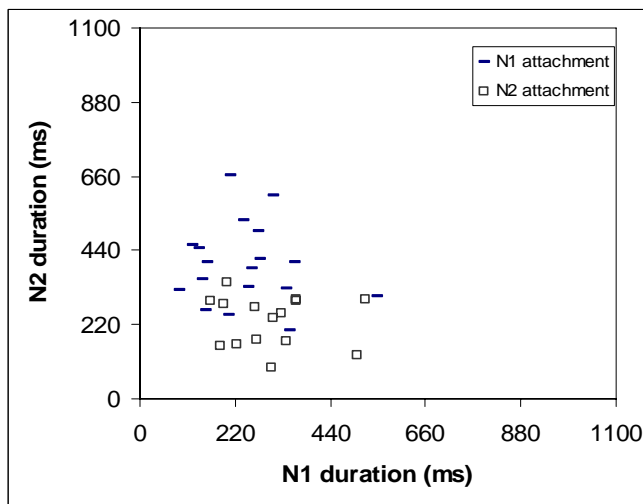
Task 1



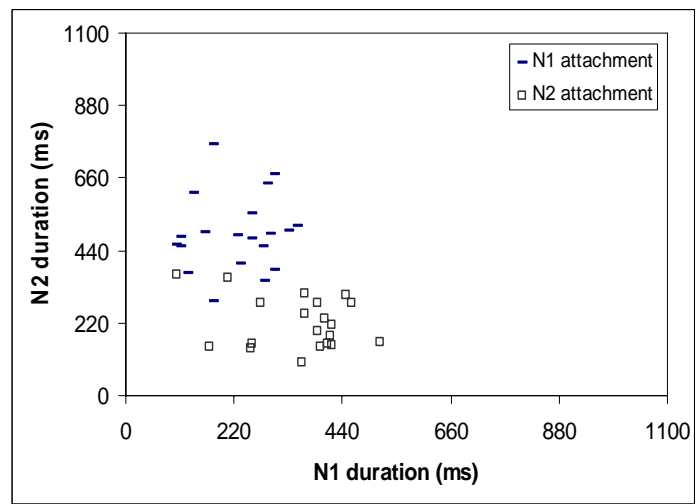
Task 2

Figure 3. *M2: Duration differences by attachment on tasks 1 and 2.*

Final lengthening: F1. Of the three naïve speakers, only F1 made a consistent final lengthening distinction in both tasks (see Figure 4). In both cases, the pattern matches hypothesis 2: N2 is lengthened when the RC attaches high, whereas N1 is lengthened when the RC attaches low. Although this tendency is seen on both tasks, the asymmetry is more distinct on task 2 (on which the generalization is true of 37 of 40 items) than on task 1 (true of 27 of 33 items). The results from the *t*-tests are significant for both tasks: task 1: $t(14) = -3.304, p < .01$; task 2: $t(19) = -10.966, p < .001$.



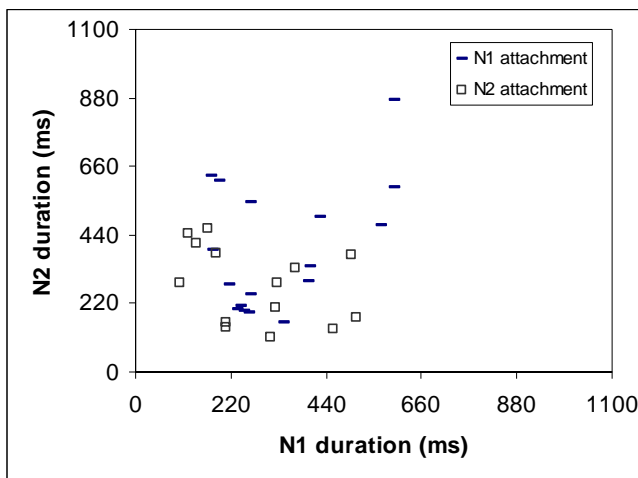
Task 1



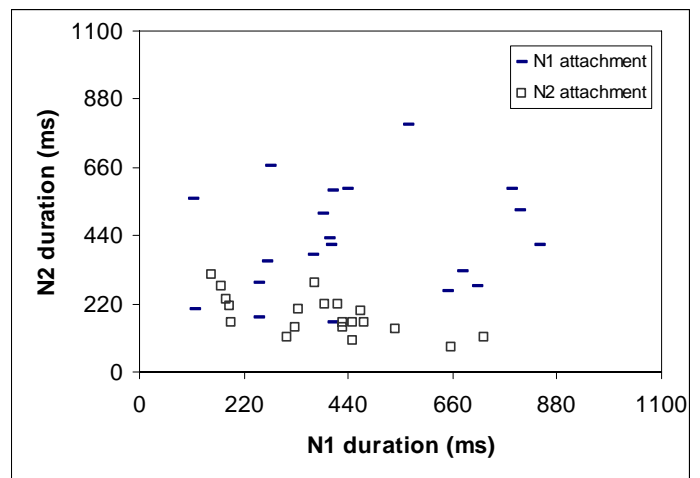
Task 2

Figure 4. *F1: Duration differences by attachment on tasks 1 and 2.*

Final lengthening: F2. F2's results from task 1 show no clear division on the basis of interpretation: $t(13) = -1.08, p = .3$. However, an examination of the scatter plot for task 2 (Figure 5) suggests that this speaker distinguished between the two readings on the more explicit task. As is clear from the scatter plot, the attachment of the RC to N2 resulted in a lengthening of the final syllable of N1 ($M = 383.65$ ms) in comparison to N2 ($M = 181.55$ ms). In contrast, the data points representing the interpretation of the RC with N1 are much more widely spread out and, on average, the durations recorded for the two target syllables on this interpretation were relatively elevated: N1 = 456.95 ms; N2 = 424.15 ms. Thus, this speaker's disambiguation strategy seems to involve clearly and consistently marking low attachment (presumably the dispreferred attachment in French) by a faster articulation of N2. If she is attempting to underscore the prosodic grouping of N2 with the following RC, this strategy is not surprising. The differences across the two interpretations were found to be significant: $t(19) = -2.410, p < .05$.



Task 1



Task 2

Figure 5. F2: Duration differences by attachment on tasks 1 and 2.

F0 rise

In Table 3, we have provided the average F0 rise on the final syllables of N1 and N2 according to the intended attachment. Contrary to the relatively clear patterns that could be discerned from the average length data presented in Table 2, the participants appear to show greater variability with respect to the differences in F0 rise. On the basis of these averages, two speakers—M1 and M2 (second task only)—appear to show tendencies in line with hypothesis 3. More specifically, greater F0 rise is seen on N2 when the RC modifies N1, whereas N1 receives the greater F0 rise when the RC modifies N2. Although F1 appears to adopt distinct F0 rise patterns on the basis of attachment, this speaker seems to opt for different strategies on the two tasks, and the patterns from task 2 do not appear to match our expectations. Finally, the average F0 rise data for F2 indicates that she regularly has an F0 rise on N2, regardless of task or interpretation. Each participant will be discussed in turn in the following sections.

Speaker	N1 attachment		N2 attachment	
	N1	N2	N1	N2
M1	27.07	134.17	153.00	12.47
M2				
Task 1	31.58	51.27	36.69	51.24
Task 2	36.99	43.93	58.58	33.77
F1				
Task 1	70.29	92.45	68.14	62.08
Task 2	104.78	57.57	59.34	73.57
F2				
Task 1	37.28	83.48	54.74	80.9
Task 2	3.85	81.77	59.89	95.62

Table 3. Average F0 rise on the final syllables of N1 and N2 by interpretation

F0 rise: M1. As shown in Figure 6, the two interpretations for this speaker show distinct F0 rise asymmetries. Moreover, these asymmetries are in line with the predictions expressed in hypothesis 3: We find greater F0 rise on N2 when the RC attaches to N1

(true in 18 of 20 cases) as well as greater F0 rise on N1 when the RC attaches to N2 (true of all 20 items). The differences between F0 rise on N1 and N2 by interpretation were found to be significant, $t(18) = -9.533, p < .001$.

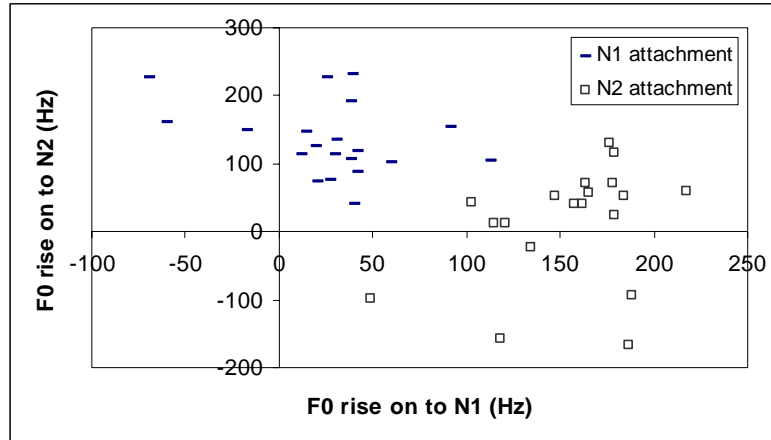
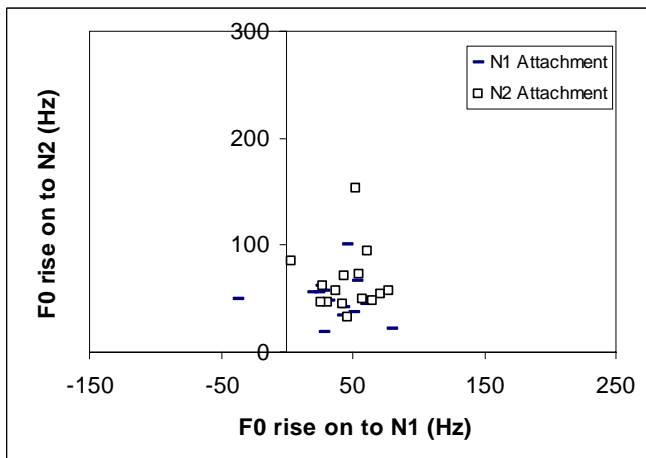
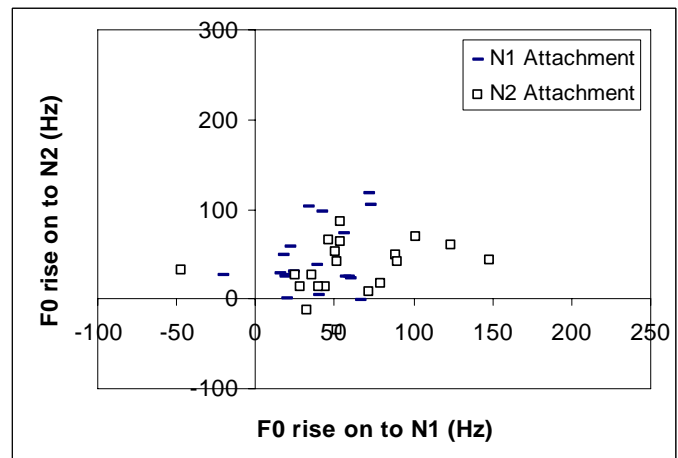


Figure 6. M1: F0 rise differences by attachment

F0 rise: M2. On task 1, we see no clear difference in F0 rise on the basis of interpretation, $t(14) = .756, p = .462$. On task 2, on the other hand, the predicted asymmetry is found in the data. When the RC attaches to N1, 13 of 20 items show greater F0 rise on N2, whereas when the RC attaches to N2, 14 of 20 items show greater F0 rise on N1. The difference in F0 rise on N1 and N2 by interpretation is found to be significant, $t(19) = -2.427, p < .05$.



Task 1



Task 2

Figure 7. M2: F0 rise differences by attachment on tasks 1 and 2

F0 rise: F1. On task 1, we found no clear difference in F0 rise on the basis of interpretation, $t(17) = -1.386, p = .184$. On task 2, however, both the average F0 rises (Table 3) and the graph (Figure 8) indicate that this speaker opts for relatively distinct patterns of F0 rise according to interpretation of the RC. However, unlike M1 and M2, the asymmetry seen in F1's data goes precisely in the opposite direction of the prediction of hypothesis 3. When the RC is interpreted with N1, the greater F0 rise is seen on N1 (true for 15 of 20 items); when the RC attaches to N2, the greater F0 rise is seen on N2 (true for 13 of 20 items). This difference on the basis of interpretation is significant, $t(19) = 3.402, p < .01$. What is both interesting and puzzling about this speaker is the fact that the F0 rise data appear to go against both the prediction offered in hypothesis 3 and her own final lengthening data (which did match the predictions for hypothesis 2). This contradiction will be given additional attention in the discussion section.

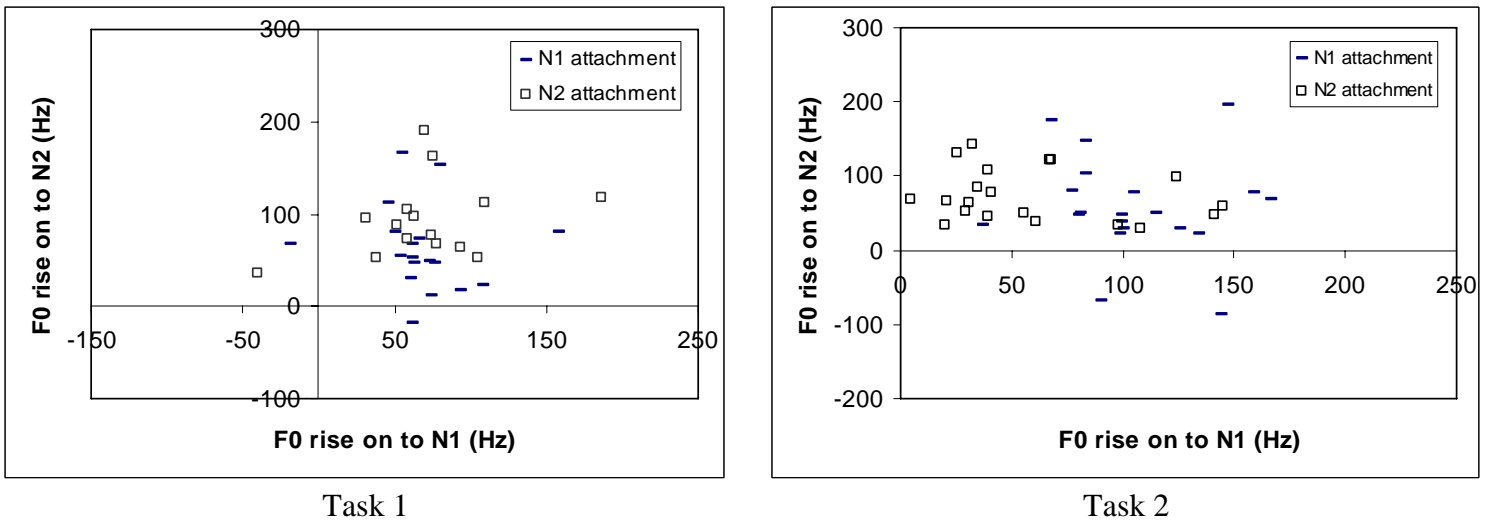


Figure 8. F1: F0 rise differences by attachment on tasks 1 and 2

F0 rise: F2. The results from the two tasks are similar for F2: There is no discernable differentiation between interpretations by means of different F0 rises on

either task 1, $t(12) = .283, p = .782$, or on task 2, $t(19) = -1.53, p = .143$. Regardless of task and interpretation, this speaker tends to have a more significant F0 rise on the final syllable of N2 than on the final syllable of N1.

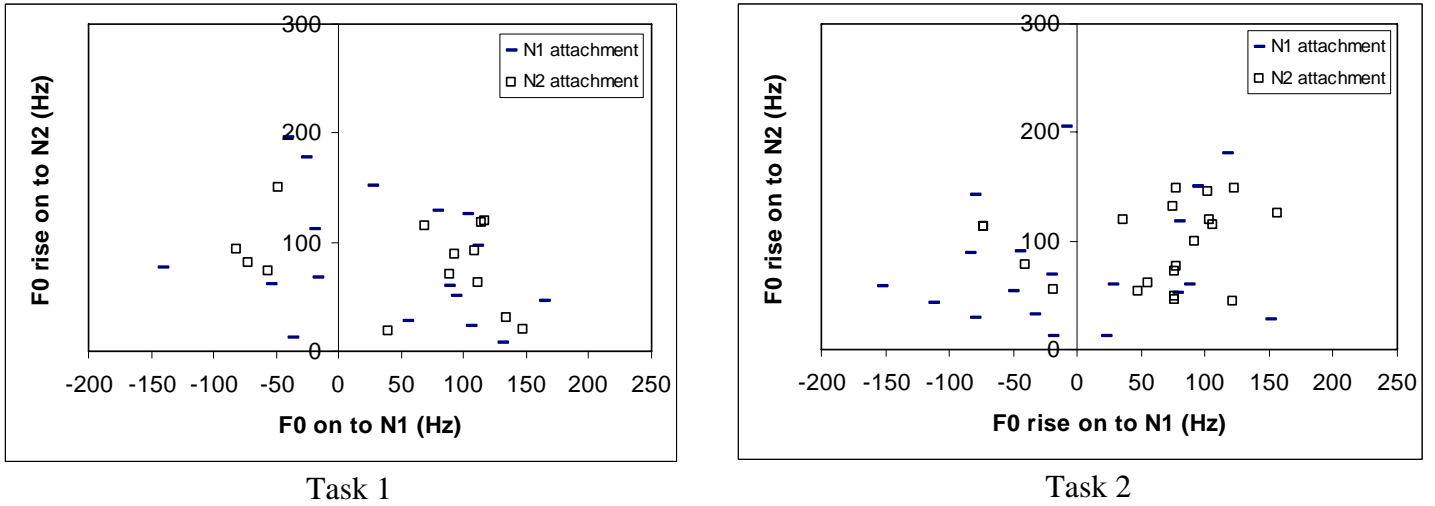


Figure 9. F2: F0 rise differences by attachment on tasks 1 and 2

Discussion

In this section, we will review the three hypotheses that guided this study and consider how accurate the predictions were in light of the data.

Hypothesis 1

This hypothesis predicted performance differences on the basis of task and, as such, only the data from the three speakers who completed both tasks—M2, F1, and F2—were relevant in assessing its predictions. Following this hypothesis, we expected to find clearer contrasts according to interpretation on the more explicit task (task 2) than on the task in which attachment was disambiguated by the context (task 1). This hypothesis was supported for both duration and F0 rise. There are six different comparisons that are relevant for this hypothesis (measures of duration and F0 rise for the three participants). In all but one of the comparisons, the predicted asymmetry is in evidence. Moreover, the

one exception does not in fact disconfirm this hypothesis, as it appears that F2 simply does not use F0 as a means for marking disambiguation; thus, no difference in F0 rise according to interpretation was seen in her data on either task.

Although this result is in line with the hypothesis, the difference on the basis of task raises clear questions related to the interpretation of these patterns. Very generally, the patterns reported in the previous section were only evident in the more controlled, artificial minimal pairs task. We hypothesize that this asymmetry may be due to the fact that task 1 entailed a greater cognitive load; for this task, the speaker was required to remember what happened in the context in order to answer two questions (the one leading to the target sentence and the one that verified that they correctly understood the context). Such an increase in cognitive load might reduce the speed with which the speaker can call up and manipulate the various linguistic resources (including prosodic resources) available to him or her. Although the noted asymmetry may also be an effect of task order (i.e., by the time they reached task 2, the speakers had sorted out how to make the desired distinction), this seems unlikely because, by the same token, we would expect speakers to make greater distinctions by the end of task 1, which was not the case. In any event, the results demonstrate that the participants are capable of prosodically disambiguating structurally ambiguous sentences, and often in such a way that matches predictions made on the basis of theoretical descriptions of the prosodic system under investigation. However, it is not clear from these results that this ability is employed as a strategy in authentic speech situations. Additional research is clearly warranted.

Hypothesis 2

The second hypothesis assumed that prosodic disambiguation of the experimental items would involve prosodic marking of displaced syntactic boundaries and, as such, predictions were made concerning the resultant lengthening effects depending on the positions of these boundaries. In particular, it was predicted that when the RC modified N1 a prosodic (and syntactic) boundary would be found before the RC. As a result of this prosodic boundary, final lengthening effects were expected to be found on the syllable preceding the boundary (final syllable of N2). On the other hand, this hypothesis predicted that attachment of the RC to N2 would result in the grouping of N2 and the RC into one prosodic constituent preceded by a prosodic boundary. In these sentences, it was anticipated that the effects of final lengthening would be seen on the final syllable of N1. In general terms, this hypothesis was found to be supported for M1's data—the speaker from Dekydtspotter et al. (under review)—as well as in the data from the three naïve speakers who participated in this experiment. In the case of M1, M2 (task 2 only), and F1 (both tasks), the predicted asymmetries for both interpretations were instantiated in the data. The asymmetry demonstrated by F2 (on task 2 only), on the other hand, only clearly matched the predictions for final lengthening differences on N2 attachment. More specifically, when the RC attached to N2, the final syllable of N2 was much shorter than was the final syllable of N1. For N1 attachment, however, no asymmetry was evident. Anecdotally, this speaker commented that N2 attachment was easier to express than was N1 attachment. The variability in her N1 data in contrast to the relatively concentrated pattern for her N2 data corroborates her intuition.

Hypothesis 3

The final hypothesis mirrors hypothesis 2, insofar as it is predicted that F0 rise will accompany final lengthening in order to mark different locations of prosodic boundaries in ambiguous sentences. Specifically, this hypothesis predicted that the attachment of a RC to N1 will result in a prosodic boundary immediately before the RC and that this boundary will be signaled by an F0 rise on the syllable preceding the boundary (final syllable of N2). Attachment of the RC to N2, on the other hand, was expected to be signaled by the insertion of a prosodic boundary before N2, marked by an F0 rise on the final syllable of N1. Although it was expected that the findings for hypothesis 3 would be similar to those reported for hypothesis 2, the findings for the two prosodic phenomena are somewhat different; in this dataset, F0 rise and final lengthening do not pattern as closely together as predicted, which runs contrary to the description of prosodic boundary marking in French available in the literature. In particular, only M1 and M2 (second task only) showed the predicted F0 rise pattern for each of the two interpretations. On the other hand, the two women showed F0 rise patterns that were distinct both from the predictions and from each other.

On task 2, F1's placement of the relatively greater F0 rise on N1 versus N2 was significantly different on the two interpretations, but this distinction was precisely the inverse of the prediction: In her data, the noun to which the RC was supposed to attach received the greater F0 rise. In addition to going in the opposite direction of the prediction, this pattern of F0 rise initially appears inconsistent with this speaker's durational data. In terms of final lengthening, F1 appeared to conform to the predictions on both task 1 and task 2. This divorce between F0 rise and final lengthening suggests

that, at least in these sentences, this particular speaker employs the two prosodic phenomena for different ends. The interpretation of this pattern that currently appears most plausible is that final lengthening is the faithful marker of the right edge of a prosodic constituent, whereas F0 rise corresponds to a focal accent. Although not common in French, which generally prefers syntactic strategies such as right or left dislocation for focus effects, Gabriel (2003) mentions the existence of in situ focus accents in French. Moreover, this speaker (like the other three speakers investigated in this project) is a L2 speaker of English. As reported in Schafer et al. (1996), speakers of English tend to interpret an ambiguous RC with a focalized noun, which suggests that speakers may also use this strategy to disambiguate structural ambiguities. That said, it is possible that this speaker's disambiguation strategy constitutes a sort of hybrid between French and English strategies: Prosodic boundaries (as indicated by final lengthening) are located where expected given the hypotheses for French and, in the more explicit task, focal accents (on the final syllable of the focalized noun, consistent with French accentuation patterns) appear on the noun to which the RC is intended to attach. Whether similar so-called hybrid strategies might be found among monolingual speakers of French remains to be examined. Finally, it also bears mention that F1 is the only participant not from the north of France. We acknowledge that what we have tentatively termed a hybrid strategy may in fact be the result of dialectal differences that need to be further explored.

F2, the final speaker, shows a relatively consistent pattern across both tasks and both interpretations: She tends to show a greater F0 rise on N2 than on N1 (true for 48 of 71 total items). As with F1, the findings for F0 rise and final lengthening do not pattern together for F2; however, unlike F1, a clear and plausible division of labor is not

particularly evident from these data. The general F0 rise pattern is consistent with the default French prosodic contour expected with the structure in question; because the RC is expected to normally constitute its own prosodic constituent, a boundary is expected to precede it and the right edge of the preceding prosodic unit should be marked by a high tone. Although the F0 pattern does not appear to differentiate between interpretations, the durational findings on task 2 showed an interpretation-based distinction. The duration measures suggested that F2 placed a prosodic boundary immediately before N2 (and not before the RC) when the RC was interpreted with this NP. With respect to the measures of F0 rise on this same task, 30 of the 40 items were read with a greater F0 rise on N2 than on N1, regardless of the intended interpretation. Thus, at present, the information the speaker intends to convey via F0 rise and the interaction between F0 rise and final lengthening are not clear.

Conclusion

The purpose of this study was to investigate the prosodic strategies (final lengthening and F0 rise) employed by speakers of French in the structural disambiguation of ambiguous RCs. To this end, disambiguation strategies were predicted, and these predictions guided our hypotheses as well as the subsequent acoustic analyses. The results from these analyses revealed that all participants were able to prosodically disambiguate the two attachments, although most only did so on the more explicit task. Moreover, final lengthening was used by more of the speakers than was F0 rise, and all speakers shared the same pattern of final lengthening (the pattern consistent with our prediction). F0 rise, on the other hand, was used less often by the participants, and at least

three different F0 rise patterns are in evidence in these data. Additionally, the presence of a significant difference between the two interpretations on the basis of F0 rise was always accompanied by a significant difference in final lengthening. However, final lengthening differences were found independent of interpretation-based differences in F0 rise.

Thus, as detected by our measures, the use of final lengthening appears to be both more consistent and more regular than the use of F0 rise in the disambiguation of the type of constructions investigated in this project. However, there are several limitations to this study that must be taken into consideration. First, although the number of participants is similar to many other studies of prosody, data from four individuals do not allow us to suggest that these patterns are generally applicable to French speakers. In increasing the number of participants, we would also hope to be able to systematically investigate the variables of dialect and gender that have not been targeted in this project. In addition to adding more speakers, a perceptual test, in which the recordings from this experiment are played to NSs of French, would allow us to gauge the interpretability of the prosodic patterns from the different speakers. Moreover, presenting these recordings to L2 learners of French would provide a further extension of this research, one that to our knowledge has not been the subject of much research.

A final limitation to note concerns a potential task flaw. Our intention in employing two tasks was to design one that would approximate more natural conversation (task 1) and one that would highlight the need for a contrast between the two sentences (task 2). Upon further reflection, we do not believe that our task 1 does in fact resemble natural conversation, even though disambiguation was provided in a less explicit way. In the course of this project, we realized that this task is in reality quite

unnatural: Each participant read a context silently, followed by an out-loud reading of a contextualizing question and a logical response (the experimental item). As a future improvement on this task, we intend to ask the participant to read the context silently, after which the researcher would ask the contextualizing question, to which the participant would have to provide a response. We hope that this modification will allow us to more closely approximate a natural communication setting, as well as to impose more communicative pressure on the expression of which attachment is intended.

References

- Baccino, T., De Vincenzi, M., & Job, R. (2000). Crosslinguistic studies of the late closure strategy: French and Italian. In M. De Vincenzi & V. Lombardo (Eds.), *Crosslinguistic perspectives on language processing* (89-118). Dordrecht, The Netherlands: Kluwer.
- Beach, C. (1991). The interpretation of prosodic patterns at points of syntactic structure ambiguity: Evidence for cue trading relations. *Journal of Memory and Language*, 20, 644-663.
- Beach, C., Katz, W., & Skowronski, A. (1996). Children's processing of prosodic cues for phrasal information. *The Journal of the Acoustical Society of America*, 99, 1148-1160.
- Clahsen, H., & Felser, C. (2006). Grammatical processing in language learners. *Applied Psycholinguistics*, 27, 3-42.
- Crocker, M. (1996). *Computational psycholinguistics: An interdisciplinary approach to the study of language*. Dordrecht, The Netherlands: Kluwer.
- Dekydspotter, L., Donaldson, B., Edmonds, A. C., Liljestrang, A., & Petrush, R. A. (under review). Syntactic and prosodic computations in the resolution of relative clause attachment ambiguity by English-French learners.
- Fodor, J. D. (1998). Learning to parse? *Journal of Psycholinguistic Research*, 27, 285-319.
- Fodor, J. D. (2002). Prosodic disambiguation in silent reading. In M. Hirotani (Ed.), *Proceedings of the North East Linguistic Society 32* (Vol 1, pp. 113-132). GSLA, University of Massachusetts, Amherst.
- Gabriel, C. (2003). Signaling focus in Spanish and French double object constructions. In T. Meisenburg & M. Selig (Eds.), *Nouveaux departs en phonologie* (pp. 183-198). Niemeyer.
- Jun, S.-A., & Fougeron, C. (2000). A phonological model of French intonation. In A. Botinis (Ed.), *Intonation: Analysis, modeling, and technology* (pp. 209-242). Dordrecht: Kluwer.
- Jun, S.-A., & Fougeron, C. (2002). Realizations of accentual phrases in French intonation. *Probus*, 14, 147-172.
- Katz, W., Beach, C., Jenouri, K., & Verma, S. (1996). Duration and fundamental frequency correlates of phrase boundaries in productions by children and adults. *The Journal of the Acoustical Society of America*, 99, 3179-3191.
- Kjelgaard, M. M., & Speer, S. R. (1999). Prosodic facilitation and interference in the resolution of temporary syntactic closure ambiguity. *Journal of Memory and Language*, 40, 153-194.
- Lehiste, I. (1973). Prosodic disambiguation of syntactic ambiguity. *Glossa*, 7, 107-121.
- Lehiste, I., Olive, J. P., & Streeter, L. A. (1976). Role of duration in disambiguating syntactically ambiguous sentences. *The Journal of the Acoustical Society of America*, 40, 1199-1202.
- Marslen-Wilson, W. D., Tyler, L. K., Warren, P., Grenier, P., & Lee, C. S. (1992). Prosodic effects in minimal attachment. *The Quarterly Journal of Experimental Psychology*, 45A, 73-87.
- Pynte, J., & Colonna, S. (2000). Decoupling syntactic parsing from visual inspection: The case of relative clause attachment in French. In A. Kennedy, R. Radach, D.

- Heller, & J. Pynte (Eds.), *Reading as a perceptual process* (pp. 529-547). Oxford: Elsevier.
- Pynte, J., & Prieur, B. (1996). Prosodic breaks and attachment decisions in sentence parsing. *Language and Cognitive Processes, 11*, 165-191.
- Schafer, A., Carter, J., Clifton, C., Jr., & Frazier, L. (1996). Focus in relative clause construal. *Language and Cognitive Processes, 11*, 135-163.
- Scott, D. (1982). Duration as a cue to the perception of a phrase boundary. *Journal of the Acoustical Society of America, 71*, 996-1007.
- Vaissière, J., & Michaud, A. (in press). Prosodic constituents in French: A data-driven approach.
- Van Lancker, D., & Canter, G. J. (1981). Idiomatic versus literal interpretations of ditropically ambiguous sentences. *Journal of Speech and Hearing Research, 24*, 64-69.
- Van Lancker, D., Canter, G. J., & Terbeek, D. (1981). Disambiguation of ditropic sentences: Acoustic and phonetic cues. *Journal of Speech and Hearing Research, 24*, 330-335.
- Zagar, D., Pynte, J., & Rativeau, S. (1997). Evidence for early closure attachment on first-pass reading times in French. *The Quarterly Journal of Experimental Psychology, 50A*, 421-438.

Appendix

Task 1

1. Dans un restaurant, Paul a vu son dentiste Dr. Émail s'emporter contre son serveur. Malheureusement, Paul doit s'en aller sans voir la fin de la dispute pour aller à un rendez-vous chez son avocat. Quand il y arrive, Paul est étonné que le serveur soit déjà assis calmement dans la salle d'attente chez l'avocat. Le serveur est entouré par plusieurs de ses compères, qui sont très en colère. Paul se décide à appeler ce jeune serveur calme.

Qui est-ce que Paul appelle ?

Paul appelle le serveur du dentiste qui attend tranquillement

2. Dans un restaurant, Paul a vu son dentiste Dr. Émail s'emporter contre son serveur. Malheureusement, Paul doit s'en aller sans voir la fin de la dispute, pour aller à un rendez-vous chez son avocat. Quand il y arrive, Paul s'étonne de voir que plusieurs dentistes fâchés attendent de voir l'avocat. En plus, Paul remarque que son dentiste est assis calmement dans la salle d'attente; il est clairement prêt à porter plainte contre le serveur malpoli. Paul décide qu'il vaudrait mieux téléphoner au jeune serveur irrespectueux pour le prévenir de la plainte imminente.

Qui est-ce que Paul appelle ?

Paul appelle le serveur du dentiste qui attend tranquillement

5. Jeanne adore donner des soirées et y inviter des gens avec des intérêts très variés. Jeanne a appris que Dr. Ratiche, le dentiste de son médecin, cuisine tous les jours et apporte toujours de bonnes choses à manger à ses clients. Le médecin de Jeanne, comme tous les autres dentistes qu'elle connaît, n'a aucun talent culinaire particulier. Jeanne décide alors d'inviter Dr. Ratiche à sa prochaine soirée.

Qui est-ce que Jeanne invite ?

Jeanne invite le dentiste du docteur qui cuisine tous les jours

6. Jeanne adore donner des soirées et y inviter des gens avec des intérêts très variés. Lors de sa prochaine visite dentaire, Jeanne apprend que son dentiste a de nombreux clients qui sont médecins et que l'un de ses médecins, Dr. Toubib, cuisine tous les jours. Bien que son dentiste soit tout à fait dépourvu de talent culinaire, Jeanne décide de l'inviter à sa prochaine soirée, dans l'espoir que le dentiste emmènera son client culinairement doué, le médecin Dr. Toubib.

Qui est-ce que Jeanne invite ?

Jeanne invite le dentiste du docteur qui cuisine tous les jours

7. Anne adore donner des soirées et y inviter des gens avec des intérêts très variés. Anne a appris que Dr. Toubib, le médecin de son dentiste, cuisine tous les jours et apporte toujours de bonnes choses à manger à ses clients. Le dentiste d'Anne, comme tous les autres médecins qu'elle connaît, n'a aucun talent culinaire particulier. Anne décide alors d'inviter Dr. Toubib à sa prochaine soirée.

Qui est-ce que Anne invite ?

Anne invite le docteur du dentiste qui cuisine tous les jours

8. Anne adore donner des soirées et y inviter des gens avec des intérêts très variés. Lors de sa prochaine visite médicale, Anne apprend que son médecin a de nombreux clients qui sont dentistes et que l'un de ces dentistes, Dr. Ratiche, cuisine tous les jours. Bien que son médecin soit complètement sans talent culinaire, Anne décide d'inviter son médecin à sa prochaine soirée dans l'espoir que le médecin emmènera son client culinairement doué, le dentiste Dr. Ratiche.

Qui est-ce que Anne invite ?

Anne invite le docteur du dentiste qui cuisine tous les jours

9. Il vous faut trouver un nouveau dentiste et l'un de vos clients vous conseille son propre dentiste à cause de la rapidité avec laquelle ce dentiste comprend les problèmes que lui décrivent ses clients. Vous appelez donc ce dentiste pour savoir s'il prend de nouveaux clients.

Qui est-ce que vous appelez ?

Vous appelez le dentiste du client qui comprend rapidement

10. Il vous faut trouver un nouveau dentiste et l'un de vos clients vous conseille son propre dentiste. Vous faites confiance au jugement de ce client à cause de la rapidité avec laquelle il comprend quand on lui explique de nouveaux concepts. Vous appelez donc ce dentiste pour savoir s'il prend de nouveaux clients.

Qui est-ce que vous appelez ?

Vous appelez le dentiste du client qui comprend rapidement

11. Vous travaillez chez un dentiste et vous êtes impressionné par le fait que l'un des clients du dentiste comprend exceptionnellement vite quand on lui explique des choses. Un jour, vous remarquez que ce client est sur le point de partir sans son chapeau, et vous l'appelez pour lui rappeler de prendre le chapeau.

Qui est-ce que vous appelez ?

Vous appelez le client du dentiste qui comprend rapidement

12. Vous travaillez pour un groupe de dentistes, et un jour vous êtes impressionné par le fait que l'un de ses dentistes comprend extrêmement vite quand un client lui explique un problème compliqué. Quand ce client est en train de partir, vous remarquez qu'il oublie son chapeau, et vous appelez le client pour lui rappeler de prendre son chapeau, mais celui-ci est déjà parti.

Qui est-ce que vous appelez ?

Vous appelez le client du dentiste qui comprend rapidement

13. Charles, un détective amateur, travaille sur un cambriolage de banque mystérieux, et il trouve suspect le fait que l'un des coiffeurs chez qui le banquier se fait parfois couper les cheveux vient de rentrer d'un long voyage au Japon. Charles doute que ce coiffeur puisse se permettre de voyager à l'étranger avec ses moyens limités et l'accuse d'avoir cambriolé la banque.

Qui est-ce que Charles accuse?

Charles accuse le coiffeur du banquier qui revient du Japon

14. Quand un des banquiers de la Banque Nationale revient du Japon, son ami Charles est le premier à lui apprendre que la banque a été cambriolée. Fier de ses talents de détective amateur, Charles croit avoir trouvé le cambrioleur et accuse le coiffeur de ce banquier d'avoir été l'auteur du cambriolage.

Qui est-ce que Charles accuse?

Charles accuse le coiffeur du banquier qui revient du Japon

15. Un coiffeur sympathique du quartier est obligé de fermer son salon de coiffure en même temps que l'un de ses banquiers revient d'un long voyage au Japon. Luc, le plus fidèle client de ce coiffeur, déclare que ce banquier est trop égoïste pour s'intéresser au propriétaire d'un petit commerce et l'accuse d'être responsable pour la fermeture du salon.

Qui est-ce que Luc accuse?

Luc accuse le banquier du coiffeur qui revient du Japon

16. Trois coiffeurs décident de quitter Orléans pour essayer d'ouvrir des salons de coiffure à Tokyo. L'un d'entre eux, pourtant, doit revenir parce que son salon là-bas a fait faillite. L'ami du coiffeur, Luc, déclare que la faillite est la faute du banquier du coiffeur parce qu'il a refusé d'aider le coiffeur dans sa nouvelle entreprise.

Qui est-ce que Luc accuse?

Luc accuse le banquier du coiffeur qui revient du Japon

17. Chez le coiffeur, Claire constate tout à coup qu'elle a perdu son sac à main. Elle le cherche partout, même dans la rue. Elle y voit l'un des autres clients de son coiffeur qui attend le bus. Cet homme vient de retrouver le sac de Claire, et il le lui remet. Ravie, Claire embrasse l'homme impulsivement.

Qui est-ce que Claire embrasse?

Claire embrasse le client du coiffeur qui attend dans la rue

18. En route vers le Musée des Beaux-Arts, Claire croise l'un de ses trois coiffeurs, qui attend un bus dans la rue. Une fois au musée, elle entend que quelqu'un l'appelle, et elle s'étonne de voir un autre client de ce même coiffeur. Ce client a vu Claire laisser tomber son sac à main et il l'a poursuivie pour le lui remettre. Saisie par cette bonne action, Claire embrasse impulsivement le client.

Qui est-ce que Claire embrasse?

Claire embrasse le client du coiffeur qui attend dans la rue

19. Anne se promène dans la rue avec un client avec qui elle va déjeuner. Son client lui fait remarquer que les trois hommes qui quittent un salon de coiffure juste à côté sont en fait tous ses coiffeurs. Plus tard, Anne constate tout à coup qu'elle a perdu son sac à main et elle retrace sa route dans la rue. Elle y voit un des coiffeurs de son client qui attend le bus. Ce coiffeur vient de retrouver le sac d'Anne et le lui remet. Ravie, Anne embrasse impulsivement ce coiffeur.

Qui est-ce que Anne embrasse?

Anne embrasse le coiffeur du client qui attend dans la rue

20. En route vers le Musée des Beaux-Arts, Anne croise un de ses clients qui attend un bus dans la rue. Bien qu'elle ne se souvienne pas de chacun de ses nombreux clients, elle se souvient de celui-ci parce qu'il parle tellement souvent de son coiffeur. Une fois au musée, elle entend que quelqu'un l'appelle et s'étonne de voir le coiffeur de ce même client, qui a vu Anne laisser tomber son sac à main et l'a poursuivie pour le lui remettre. Saisie par cette bonne action, Anne embrasse impulsivement le coiffeur.

Qui est-ce que Anne embrasse?

Anne embrasse le coiffeur du client qui attend dans la rue

21. Mon frère et moi nous arrêtons dans une banque pour discuter de nouveaux comptes. Nous parlons d'abord à un comptable qui travaille avec trois différents banquiers. Pendant que les autres banquiers travaillent, l'un d'entre eux s'affaire à écrire une lettre au journal, et le comptable n'en est pas content: le comptable n'écrit jamais de lettres au journal et pense que le banquier perd son temps. Curieux d'en savoir plus sur cette lettre, nous allons parler au banquier dont il est question.

À qui est-ce que nous parlons?

Nous parlons au banquier du comptable qui écrit au journal

22. Mon frère et moi nous arrêtons dans une banque pour parler de nouveaux comptes. Il y a plusieurs comptables, et chacun travaille avec un différent banquier. Nous nous inquiétons un peu du fait que tous les gens dans la banque semblent ne rien faire. Nous découvrons que le seul comptable en train de faire quoi que ce soit écrit une lettre méchante au journal local. A cause du fait que ce comptable a l'air plus ou moins compétent – et de même pour son banquier – nous décidons de parler au banquier de ce comptable.

À qui est-ce que nous parlons?

Nous parlons au banquier du comptable qui écrit au journal

23. Lorsque nous parlons à un des nombreux comptables de notre banquier, ce comptable nous fait savoir qu'il écrit une lettre furieuse concernant la politique du maire au journal local. Nous demandons au comptable si le banquier s'intéresse lui aussi à écrire une lettre similaire au journal. Alors, le banquier évite tout ce qui est politique et n'écrit jamais de lettre à l'éditeur. A cause de nos propres perspectives politiques, nous continuons à parler au comptable.

À qui est-ce que nous parlons?

Nous parlons au comptable du banquier qui écrit au journal

24. Mon frère et moi nous arrêtons dans une banque pour discuter de nouveaux comptes. Un des quatre banquiers nous mentionne qu'il est en train d'écrire une lettre au journal à propos de la politique du maire. Nous demandons au comptable de ce banquier s'il veut lui aussi écrire une lettre similaire, mais ce comptable n'écrit jamais de lettre à l'éditeur. Curieux de son attitude, nous continuons à parler à ce comptable.

À qui est-ce que nous parlons?

Nous parlons au comptable du banquier qui écrit au journal

25. Marc a bon goût et apprécie des gens qui s'habillent avec goût. En se promenant dans la rue, Marc rencontre son coiffeur et l'équipe de comptables du coiffeur. Marc se

souvent que son coiffeur a de nombreux comptables qui l'aident à gérer ses finances compliquées. Une minute plus tard, un autre comptable du coiffeur descend d'un taxi à côté et les rejoint. Ce comptable porte un costume de 2.000 euros et Marc admire ses habits chics.

Qui est-ce que Marc admire?

Marc admire le comptable du coiffeur qui descend du taxi

26. Marc travaille dans la mode et apprécie les habits très fins. Il se fait toujours couper les cheveux par un coiffeur très réputé qui a son propre comptable. Un jour, Marc voit ce comptable devant le salon de coiffure, où il essaie de se trouver plusieurs autres coiffeurs comme clients. Ce comptable porte un costume neuf Armani, ce qui attire tout de suite l'attention de Marc. Un taxi arrive à cet instant et le coiffeur de Marc en descend, mais Marc n'y fait pas attention parce qu'il est toujours ébloui par le costume Armani que porte le comptable.

Qui est-ce que Marc admire?

Marc admire le comptable du coiffeur qui descend du taxi

27. Jacques travaille dans la mode et apprécie les habits très fins. Jacques et son comptable mal habillé discutent de finances dans un café. Jacques voit le nouveau coiffeur du comptable descendre d'un taxi devant le café; le comptable s'apprête à rejoindre un autre groupe de comptables déjà au café. Immédiatement, Jacques est frappé par le costume Armani de ce comptable.

Qui est-ce que Jacques admire?

Jacques admire le coiffeur du comptable qui descend du taxi

28. Jacques a bon goût et apprécie les gens qui s'habillent avec goût. En se promenant dans la rue, Jacques voit un comptable qu'il connaît descendre d'un taxi. Quelle journée pour des comptables – il en a déjà rencontré deux autres! Mais à ce moment l'attention de Jacques est attirée sur le coiffeur de ce comptable, parce que le coiffeur--aussi en train de se promener--porte un costume tout neuf qui doit coûter 2.000 euros.

Qui est-ce que Jacques admire?

Jacques admire le coiffeur du comptable qui descend du taxi

29. Le voisin de Gaston est un jeune mais plutôt sombre médecin. Le médecin est tellement jeune que tous ses grands-parents sont encore en vie, et ils lui rendent souvent visite. Gaston a remarqué auparavant que l'un des grands-pères du médecin est particulièrement jovial et a un penchant pour raconter des blagues. L'autre grand-père, par contre, est généralement grincheux et de mauvaise humeur. Quand Gaston rentre du

travail, il voit un homme âgé s'approcher de la maison du médecin; c'est le grand-père jovial, probablement en train de penser à une bonne plaisanterie.

Qui est-ce que Gaston voit?

Gaston voit le grand-père du médecin qui plaisante tout le temps

30. Gaston travaille dans un centre d'activités pour personnes âgées et connaît une grande partie de la population âgée de la ville. Malheureusement, Gaston doit s'absenter régulièrement du travail parce qu'il a beaucoup de petits maux qui exigent qu'il ait souvent des visites médicales chez deux différents médecins, qui ont des approches très distinctes. L'un des médecins, Dr. Blague, amuse ses clients avec ses plaisanteries constantes. Le lendemain, quand il travaille au centre d'activités, Gaston voit le grand-père de Dr. Blague mais il l'évite à tout prix à cause du caractère très grincheux du grand-père.

Qui est-ce que Gaston voit?

Gaston voit le grand-père du médecin qui plaisante tout le temps

31. Le grand-père de Mathieu est toujours en vie, mais il lui faut beaucoup de soins médicaux. Le grand-père a donc plusieurs médecins, chacun avec une approche distincte et chacun son caractère à lui. L'un des médecins, Dr. Riant, amuse ses clients avec ses plaisanteries constantes. Un après-midi, quand Mathieu et son grand-père se promènent au parc, Mathieu voit Dr. Riant. Comme le grand-père de Mathieu est particulièrement grincheux aujourd'hui, Mathieu espère que Dr. Riant s'arrêtera leur parler quelques instants.

Qui est-ce que Mathieu voit?

Mathieu voit le médecin du grand-père qui plaisante tout le temps

32. Les deux grands-pères de Mathieu sont toujours en vie. Ils ont tous les deux des caractères très différents. L'un des deux, Papy Alban, a un sens de l'humour excellent, en dépit de son âge, et raconte constamment de nouvelles plaisanteries. Le médecin de Papy Alban, pourtant, est un pessimiste sans réserve dont l'activité principale consiste à se plaindre de tout. Un jour, quand Mathieu se promène au centre commercial, il a un mouvement de recul en voyant le médecin de Papy Alban, car il n'a aucune envie de parler au médecin.

Qui est-ce que Mathieu voit?

Mathieu voit le médecin du grand-père qui plaisante tout le temps

33. Claude a de plus en plus souvent mal aux dents. Le comptable de Claude lui donne le nom d'un groupe de dentistes dont il gère les finances. Claude va chez un de ces dentistes

et attend que le dentiste finisse d'écrire un rapport. Plusieurs autres dentistes sont présents également, mais Claude est frappé par le niveau d'organisation de ce dentiste en particulier.

Qui est-ce que Claude admire?

Claude admire le dentiste du comptable qui écrit au bureau

34. Claude a de plus en plus souvent mal aux dents. Quelques-uns des comptables de Claude lui donnent le nom d'un dentiste dont ils gèrent les finances. Le jour où Claude va chez le dentiste, Claude remarque que ses comptables sont en train de travailler sur les comptes de ce dentiste. Claude attend pendant que l'un des comptables finit d'écrire un rapport à un bureau et les autres comptables bavardent et il est frappé par l'organisation et le professionnalisme de ce dentiste.

Qui est-ce que Claude admire?

Claude admire le dentiste du comptable qui écrit au bureau

35. Franck mange beaucoup de bonbons et il a maintenant une carie. Quelques-uns des comptables de Franck lui donnent le nom d'un dentiste pour qui ils travaillent. Le jour où Franck se rend chez le dentiste, il remarque que ses comptables sont en train de travailler sur les finances du dentiste. Franck attend pendant que l'un des comptables finit d'écrire un rapport à un bureau et les autres bavardent, et il est frappé à quel point ce comptable paraît professionnel et organisé.

Qui est-ce que Franck admire?

Franck admire le comptable du dentiste qui écrit au bureau

36. Franck mange beaucoup de bonbons et il a maintenant une carie. Le comptable de Franck lui donne le nom d'un groupe de dentistes dont il gère les finances. Le jour où Franck se rend chez ces dentistes, il remarque que son comptable est en train de travailler sur les finances des dentistes. Franck attend pendant que l'un des dentistes rédige un rapport et que les autres dentistes bavardent, et il est frappé à quel point ce comptable paraît professionnel et organisé.

Qui est-ce que Franck admire?

Franck admire le comptable du dentiste qui écrit au bureau

37. Yves fréquente le même boucher dans sa petite ville depuis des années. Il semble que chaque année quand il va chercher son jambon de Noël, Yves y voit beaucoup de médecins de sa ville. Il semble à Yves que le boucher doit être généreux envers un des médecins, son client le plus fidèle, car le docteur Pascal semble grossir chaque fois que

Yves le voit. Mais ceci n'a pas eu de mauvais effet sur sa personnalité ; le docteur Pascal est un homme jovial, et tout le monde dans la ville, Yves y compris, l'adore.

Qui est-ce que Yves adore?

Yves adore le docteur du boucher qui grossit chaque année

38. Depuis des années, Yves fréquente les mêmes deux bouchers, M. Lerond et M. Lepetit, de sa petite ville. Chaque année quand Yves va chercher son jambon de Noël, M. Lerond semble avoir grossi, alors que Lepetit a l'air plus maigre. Le médecin de M. Lerond, un homme jovial que Yves adore, conseille à M. Lerond de réduire sa consommation de saucissons.

Qui est-ce que Yves adore?

Yves adore le docteur du boucher qui grossit chaque année

39. Il y a beaucoup de bouchers dans la ville de Georges. Le médecin de Georges insiste que son boucher, M. Leboeuf, a les meilleurs steaks du monde. Ceci doit être vrai, car M. Leboeuf, lui-même gourmand, semble prendre du poids chaque année, tandis que les autres bouchers de la ville se débrouillent pour rester en forme. Mais M. Leboeuf est généreux, et Georges l'adore.

Qui est-ce que George adore?

Georges adore le boucher du docteur qui grossit chaque année

40. De nombreux amis de Georges – tous médecins – fréquentent le même boucher depuis des années. Un des médecins, le docteur Moreau, semble vraiment abuser des filets mignons, car Georges, lors de son bilan annuel, remarque que le docteur Moreau semble avoir pris du poids. Ce n'est pas la faute du boucher ; celui-ci un homme gentil et sympa, et Georges l'adore.

Qui est-ce que George adore?

Georges adore le boucher du docteur qui grossit chaque année

Task 2

1. Paul appelle le serveur du dentiste qui attend tranquillement (c'est le serveur qui attend)
2. Paul appelle le serveur du dentiste qui attend tranquillement (c'est le dentiste qui attend)
3. Jean appelle le dentiste du serveur qui attend tranquillement (c'est le dentiste qui attend)
4. Jean appelle le dentiste du serveur qui attend tranquillement (c'est le serveur qui attend)
5. Jeanne invite le dentiste du docteur qui cuisine tous les jours (c'est le dentiste qui cuisine)
6. Jeanne invite le dentiste du docteur qui cuisine tous les jours (c'est le docteur qui cuisine)
7. Anne invite le docteur du dentiste qui cuisine tous les jours (c'est le docteur qui cuisine)

8. Anne invite le docteur du dentiste qui cuisine tous les jours (c'est le dentiste qui cuisine)
9. Vous appelez le dentiste du client qui comprend rapidement (c'est le dentiste qui comprend)
10. Vous appelez le dentiste du client qui comprend rapidement (c'est le client qui comprend)
11. Vous appelez le client du dentiste qui comprend rapidement (c'est le client qui comprend)
12. Vous appelez le client du dentiste qui comprend rapidement (c'est le dentiste qui comprend)
13. Charles accuse le coiffeur du banquier qui revient du Japon (c'est le coiffeur qui revient)
14. Charles accuse le coiffeur du banquier qui revient du Japon (c'est le banquier qui revient)
15. Luc accuse le banquier du coiffeur qui revient du Japon (c'est le banquier qui revient)
16. Luc accuse le banquier du coiffeur qui revient du Japon (c'est le coiffeur qui revient)
17. Claire embrasse le client du coiffeur qui attend dans la rue (c'est le client qui attend)
18. Claire embrasse le client du coiffeur qui attend dans la rue (c'est le coiffeur qui attend)
19. Anne embrasse le coiffeur du client qui attend dans la rue (c'est le coiffeur qui attend)
20. Anne embrasse le coiffeur du client qui attend dans la rue (c'est le client qui attend)
21. Nous parlons au banquier du comptable qui écrit au journal (c'est le banquier qui écrit)
22. Nous parlons au banquier du comptable qui écrit au journal (c'est le comptable qui écrit)
23. Nous parlons au comptable du banquier qui écrit au journal (c'est le comptable qui écrit)
24. Nous parlons au comptable du banquier qui écrit au journal (c'est le banquier qui écrit)
25. Marc admire le comptable du coiffeur qui descend du taxi (c'est le comptable qui descend)
26. Marc admire le comptable du coiffeur qui descend du taxi (c'est le coiffeur qui descend)
27. Jacques admire le coiffeur du comptable qui descend du taxi (c'est le coiffeur qui descend)
28. Jacques admire le coiffeur du comptable qui descend du taxi (c'est le comptable qui descend)
29. Gaston voit le grand-père du médecin qui plaisante tout le temps (c'est le grand-père qui plaisante)
30. Gaston voit le grand-père du médecin qui plaisante tout le temps (c'est le médecin qui plaisante)
31. Mathieu voit le médecin du grand-père qui plaisante tout le temps (c'est le médecin qui plaisante)
32. Mathieu voit le médecin du grand-père qui plaisante tout le temps (c'est le grand-père qui plaisante)
33. Claude admire le dentiste du comptable qui écrit au bureau (c'est le dentiste qui écrit)
34. Claude admire le dentiste du comptable qui écrit au bureau (c'est le comptable qui écrit)
35. Franck admire le comptable du dentiste qui écrit au bureau (c'est le comptable qui écrit)
36. Franck admire le comptable du dentiste qui écrit au bureau (c'est le dentiste qui écrit)
37. Yves adore le docteur du boucher qui grossit chaque année (c'est le docteur qui grossit)
38. Yves adore le docteur du boucher qui grossit chaque année (c'est le boucher qui grossit)
39. Georges adore le boucher du docteur qui grossit chaque année (c'est le boucher qui grossit)
40. Georges adore le boucher du docteur qui grossit chaque année (c'est le docteur qui grossit)