Compression in French: Effect of length and information status on the prosody of post-verbal sequences[*]

Compression in French

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This paper sheds light on the conditions for post-focal and post-verbal compression in French canonical sentences. We report on a production experiment, which results suggest that arguments and adjuncts are phrased differently, and that length and information structure only exert a significant influence on the realization of adjuncts. We formalize these results in terms of *phrasing*, arguing that French, as opposed to English for instance, does not allow compression at any prosodic level, but only in syntactically motivated prosodic phrases. We motivate the variation in our data via optional phrasing.

Keywords: Post-focal compression, Givenness, French, Syntax-Phonology interface

1. Introduction

This paper investigates the conditions for F_0 *compression* (Ladd 1980) on post-verbal constituents in French canonical sentences. While a large literature is dedicated to this phenomenon in Germanic languages, the issue is still very much debated for French. The literature on English acknowledges that any prosodic constituent can be deaccented if it is the size of a syllable (see Artstein 2002). Although French tends to heavily rely on syntactic transformations in contexts of focus marking, many recent influential studies have shown that, beside the well-documented influence of syntax (see Hamlaoui 2009; Lambrecht 1994) information structure also exerts an influence on prosody (see Jun and Fougeron 2000; Delais-Roussarie et al. 2002; Beyssade, Hemforth, Marandin and Portes 2015; German and D'Imperio 2010), leaving us with an open question as to how exactly prosody is used. Furthermore, there is presently no consensus on how given constituents are realized, that is, whether post-focal compression in fact exists (see Post 2000 and Delais-Roussarie et al. 2002 for different opinions). If it does exist, a natural follow-up question concerns the level at which compression occurs. Put slightly differently, can any prosodic constituent be compressed, as is the case in Germanic languages, or is there a restriction on the prosodic domain affected?

These are the questions that we set out to test in this paper by way of a production task. Anticipating the results slightly, we find that adjuncts and arguments are indeed realized differently, the former being more prone to be

subject to post-focal compression than the latter. We will show that adjuncts are phrased independently from the verb—even more clearly when they are long—and that arguments are usually forming a prosodic phrase together with the preceding verb. Furthermore, we argue that the use of compression in French can only take place in domains that are at least the size of a prosodic phrase, unlike in Germanic languages, where all prosodic constituents—even syllables—can be changed prosodically as a result of their information structural status.

The remainder of the paper is structured as follows: After discussing background information on French prosody in Section 2, we turn to presenting the experimental task (Section 3) and reporting on its results (Section 4). We conclude the paper with a general discussion and some final remarks (Section 5).

2. Background on French prosody

Most studies on French, a language without lexical stress, agree that a prosodic phrase (Φ henceforth) is an important prosodic constituent. This constituent consists minimally of a prosodic word. It has received different names in the literature: The Accentual Phrase (Verluyten 1982; Jun and Fougeron 1995, 2000; Delais-Roussarie et al. 2015, among others), the Rhythmic Unit (Hirst and Di Cristo 1993 among others), and the Phonological Phrase (Delais-Roussarie 1996; Post 2000 among others). Here, we assume a recursive model of prosodic structure. In such a model, the prosodic

structure is organized into different levels of prosodic domains, which are mapped onto the syntactic structure in the following way: a syntactic word roughly corresponds to a Prosodic Word (ω-word), a syntactic phrase corresponds to a Prosodic Phrase (Φ-phrase), and a clause corresponds to an Intonation Phrase (ι-phrase); see also Ito and Mester's (2012) and Selkirk's (2011) "Match constraints" for this view of the mapping between syntax and prosody in different languages. This model implies recursivity of prosodic structure, accounting for the fact that a prosodic constituent can be embedded into a larger prosodic constituent of the same level, in the same way as a syntactic phrase can be embedded in a larger syntactic phrase. It acknowledges, at the same time, the fact that prosody is simpler than syntax because prosody has less structure and less constituents altogether. We assume that Φ is primarily syntax-based, but following other authors on French prosody, we also acknowledge that information structure can change the prosodic constituency of sentences, and that phonological wee-formedness constraints can change the prosodic phrasing resulting from a simple syntax-prosody mapping. From a phonetic point of view, a non-final Φ is typically (but crucially not always) delimited by a rising tonal excursion usually accompanied by syllable lengthening. Opinions differ as to how to analyze this rise; certain scholars argue that it should be analyzed as a pitch accent (Delais-Roussarie 1995; Post 2000), while others argue that it is a demarcative tone, thus a boundary tone (Fonagy 1979; Féry 2014). In this paper, we follow the latter approach and do not exclude that it is also a mark of promi-

nence. In all evidence, the rising contour is usually there, regardless of the information status of the constituent. Several authors assume an obligatory phrase-final stress and an optional phrase-initial stress in the prosodic phrase, that are invariably realized with a pitch excursion each (see Hirst and Di Cristo 1993; Jun and Fougeron 2000 among others for this view). According to these authors, the phrase-final stress, apart from bearing prominence, also has a demarcative function: it marks the end of of the prosodic phrase/accentual phrase. As for the initial stress, is has several pragmatic functions, its most famous one being that of marking emphasis (see Di Cristo 1998 and Rossi 1985 for a distinction between different types of initial accents according to their function). Its exact location may vary along different dimensions: it can be initial, rhythmical or marking information structure (see Rossi 1985; Pasdeloup 1990; Di Cristo 1998; Jun and Fougeron 2000; Delais-Roussarie 1996; and Delais-Roussarie et al. 2015 for an overview). In each case, it can be on the second or third syllable if needed.

3.   The production experiment

3.1 Hypotheses

As discussed in Section 2, the past literature on French intonation shows that prosodic phrasing plays an important role in the intonational system of French. While several factors are assumed to affect the phonetic correlates of phrasing, the experiment discussed hereafter aims to test three specific

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ones—(i) the type of Post-Verbal Constituent (argument or adjunct); (ii) its Prosodic Length (short or long); and (iii) its Informational Status (given or new)—and thus, test the following four hypotheses, which we link to posited OT constraints.

Hypothesis 1: **Arguments and adjuncts are phrased differently**. Due to the syntactic structure of sentences, the constraint MATCHPHRASE (from Selkirk 20011) in (1) predicts that an argument will be phrased with the preceding verb, but that an adjunct is realized in a separate Φ-phrase, see (6) for examples showing both types of constituents. It further predicts a recursive phrasing corresponding to the syntax as illustrated with one of our experimental stimuli in (2). The Φ-phrase corresponding to the prepositional phrase *de caramel* is inserted into the larger Φ-phrase corresponding to the nominal phrase *le voleur de caramel*. The subject, always a proper name in our examples is phrased independently, and the entire VP forms a larger Φ-phrase including the object.

> (1)   MATCHPHRASE: A phrase in syntactic constituent structure must be matched by a corresponding prosodic constituent in phonological representation.
>
> (   )Φ (((   )Φ)Φ)Φ
>
> (2) *Jérémy   a reconnu   le voleur   de   caramel*
>
>   'Jeremy recognized the caramel's thief'

Hypothesis 2: **Long and short constituents are phrased differently**. The length of a constituent will affect its prosodic realization, such that regardless of their syntactic structure, a long constituent may be phrased separately while a short constituent may be phrased with an adjacent Φ-phrase containing the preceding verb. MINIMALBINARITY (Selkirk 2011) in (3) is a prosodic well-formedness constraint acting on the weight and length of a Φ-phrase. When ranked highly, it will change the phrasing obtained by syntax.

(3) MINIMALBINARITY (MINBIN): A prosodic phrase needs to consist of at least two prosodic words to be well formed.

Hypothesis 3: **Given and new/focused constituents are realized differently**. The information status of a constituent has an independent effect on its prosodic realization. Specifically, given constituents have a lower F_0 range than focused ones (Pierrehumbert & Hirschberg 1988, Ladd 2008), leading to post-focal compression, and this accounted for by the GIVEN constraint, adapted from Féry and Samek-Lodovici (2006) in (4).

(4) GIVEN: A post-nuclear given constituent is compressed.

Hypothesis 4: **In French, if a given element is not at least the size of a Φ-phrase, it cannot be compressed.** We assume that only entire Φ-phrases can be subject to register changes because of information structure, see Hamlaoui, Féry & Coridun (2012), as well as Féry (2014) for empirical results pointing to this conclusion. However this effect was found on a limited amount of data, and the study presented here should shed some light on

the validity of the findings. If the restriction is confirmed, we hypothesize that post-focal compression in French will affect entire Φ-phrases. Thus, post-focal adjuncts should be subject to compression but arguments should not, because arguments form prosodic constituents together with the preceding verb, as illustrated in (2). REGISTERCHANGE in (5) will mitigate the results of GIVEN (see details in section 5).

(5) REGISTERCHANGE (RC): Register change only affects an entire Φ.

Figure 1 below illustrates the effect of focus and of post-focal givenness in Germanic languages: The focused constituent is raised and the post-focal part is compressed. These effects are shown by stylized pitch accents reaching higher values because of focus, and lower values because of givenness, respectively. The high and low solid lines stand for high and low reference lines of a Φ, i.e. the highest and lowest voice value of the speaker's voice. Raising and lowering of pitch accents, indicated by the arrows and the dotted lines can affect prosodic constituents smaller than a Φ.

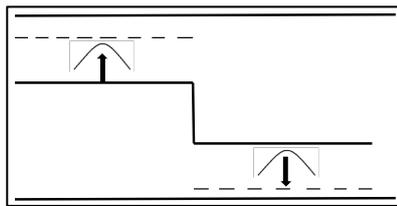

Figure 1. Effect of focus and post-focal givenness in Germanic languages.

Figures 2, on the other hand, shows the predictions for French. The higher and lower solid lines stand for the lowest and highest register of a speaker.

If givenness affects part of a Φ, no compression is expected—only down-step. Thus, in the lefthand panel of Figure 2, the second tone is only slightly lower than the first one because both tones are in the same Φ (see example (2) for recursive phrasing of an object), and the lowering of register between the verb and the following adjunct can only be small. Compression is predicted if givenness affects an entire Φ, as shown in the righthand panel of Figure 2. This is the case when an adjunct is given (see example (6b) for a sentence containing an adjunct). In this case, lowering of register between a verb and the following argument should be larger.
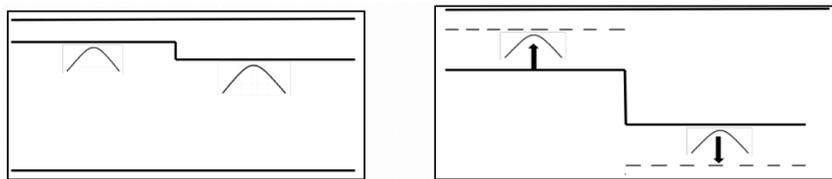

Figure 2. Predictions for the effect of focus on post-focal givenness in French: (left) with an argument, (right) with an adjunct.

3.2   Participants

A total of 16 native speakers of Standard French participated, although we discarded the recordings of 5 participants; 3 because of disfluencies and the only 2 male participants in the experiment to obtain a homogeneous group concerning F0 measures. Therefore, we report on results from 11 female speakers (aged between 25 and 46).

3.3 Materials and procedure

We used scripted material to elicit production, with target sentences placed in the answer component of question-answer pairs. As mentioned in 3.1, we manipulated three factors: (i) the type of Constituent present in the post-verbal sequence, (ii) its Prosodic Length, and (iii) its Informational Status. The first factor had two levels; the Post-Verbal Constituent was either an argument as in (6a) or an adjunct as in (6b).

(6)   a.   *Jérémy   a   reconnu   **le   voleur***
            Jérémy   has   recognized the thief
            'Jérémy recognized the thief'

      b.   *Jérémy   l'   a   reconnu   **dans la   rue***
            Jérémy   CL.3SG has   recognized in   the   street
            'Jeremy recognized him on the street'

Although the experimental design also included test sentences that contained both "V + argument + adjunct", for reasons of space we concentrate on single constituent sentences in this paper.

In the case of "V + adjunct" in (6b) and as just mentioned, the argument was also present but in the form of a pre-verbal clitic (*cl*) as the direct object of a transitive verb. This was done to ensure the same lexicalizations across all our experimental stimuli. Since a right-dislocated argument necessarily implies the presence of a clitic on the verb, whereas a right-dislocated adjunct has no clitic resumption whatsoever, we do not exclude that a given adjunct could be right-dislocated in the speech of our informants, while that

is impossible in the case of the argument: a sentence with a post-verbal argument never contained an additional clitic pronoun.[1] We briefly note that even though the question of whether the adjunct was realized as a right-dislocated element is not our primary concern here, we assume that neither the arguments nor the adjuncts are intrinsically right-dislocated. Both types of constituents are taken to sit in their canonical post-verbal position and be part of the main clause. For now, we concentrate on the prosodic phrasing rather than on the syntactic structure of the sentences but will return to the issue of right-dislocation in the general discussion (Section 5).

The second factor manipulated was the Length of the target constituent, and also had two levels: short (i.e. three syllables), as in the sentences (6a) and (6b) or long (i.e. seven syllables), as in (8a) and (9a).

Finally, we controlled for the Information Status (IS henceforth) of the post-verbal constituent (here *à la sortie du village*) by manipulating the question in the stimuli, which triggered one of three levels: narrow focus, part of an all-new (henceforth AN) focus (8) or given (9).

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[1] An example of a sentence with both post-verbal constituent "V + argument + adjunct" is given in (i).

    (i)   *Jérémy a   reconnu   **le   voleur dans la   rue***
        Jérémy   has recognized the thief   in   the street
        'Jeremy recognized the thief on the street'

Although we ignore them for the time being, we note that these sentences bear on the issue of the intrinsic difference between argument and adjunct, since, in this case, both constituents are realized as full DPs. In other words, there is no clitic in place of the argument, which has been proposed by some to induce right-dislocation of the adjunct. In fact, we do not observe a difference of behavior of the adjunct when the argument is realized in full and when it is just a clitic. In both cases, the adjunct is sometimes compressed and sometimes not.

(8) Q: *Qu'est-ce qui s'est passé avec le voleur?*

'What happened with the thief?'

A: [*Jérémy l'   a   reconnu   à la sortie du village*]_{AN}

Jeremy CL.3SG has   recognized at the exit of the village

'Jeremy recognized him at the exit of the village.'

(9) Q: *Qu'est-ce qui s'est passé avec le voleur à la sortie du village?*

'What happened with the thief at the exit of the village?'

A: [*Jérémy l'   a   reconnu*]   [*à la sortie du village*]_{Given}

Jeremy CL.3SG   has recognized   at the exit of the village

'Jeremy recognized him at the exit of the village.'

This 2 x 2 x 3 design resulted in 12 experimental conditions, for each of which we created four different lexicalizations, thus a total of 12 x 4 = 48 "V + single constituent" test sentences. These were pseudo-randomized amongst 16 fillers into a single experimental list, so that a filler appeared roughly after every sequence of three target sentences (1:3 ratio).[2] Fillers were used to break the monotony of the task. Thus, each participant read all items in all conditions, and this in order to maximize the total number of target sentences recorded.

All recordings were done in a soundproof booth, on a Tascam DR-100 digital audio recorder. One participant at a time sat across from the experimenter (the first author) who asked the question, while the participant read the answer component out-loud, as naturally as possible, from a printed handout. They were instructed to listen carefully to the question and make

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[2] Filler items consisted of Q-A pairs targeting grammatical subjects.

sure they understood it before reading the prompt, and this to ensure they understood the desired information-structural articulation of the target sentence. The order of the sentences was the same for each participant. After each sequence of 10 sentences, participants took a short break.

In sum, we collected a total of 484 "V + single constituent" sentences, however, due to mispronunciation and disfluencies on the speakers' part, we dicarded 10 "V + single constituent" sentences after a first round of listening, so our results are based on the analysis of 474 sentences.

3.4 Data treatment & analysis

Prosodic transcription and measurements: We first segmented each sound file per word boundaries and perceivable pauses by hand with the software PRAAT (Boersma and Weenink 2013). The data was then automatically annotated for the words of interest by using the automatic phonetic alignment tool EasyAlign (Goldman 2011). The phonetic correlates of phrasing investigated were F_0 and duration (see Féry and Kügler 2008, among many others). To obtain measurements on the target phrase, we used PRAAT scripts to extract measures of duration (word duration in msec) and pitch (lowest and highest F_0, henceforth F_{0min} and F_{0max}, respectively) on the verb (verb + preceding clitic in the No-Argument condition) and every following constituent independently. For long constituents, F_0 measurements were taken at two locations, specifically on the third and sixth syllables.

Statistics: All F_{0max} and duration data were log-transformed in order to improve normality, then analyzed using linear mixed-effects regression models implemented using the lme4 library in the R environment (GPL-2j GPL-3, v.3.3.3; R Core Team 2017). All fixed-effect predictors were treatment-coded prior to analysis; i.e. Constituent (argument -1, adjunct 1), Length (short -1, long 1) and Information Status (narrow focus -1, all-new 0, given 1). All three factors were allowed to interact. Speaker and Item were included as random-effects. All models included the maximal by-speaker and by-item random effect structure (RES) that would converge with random effect slopes for each factor and their interaction when applicable. We report on the main effect of each factor individually and the effect of the double and triple interaction (estimates, standard errors, and t-values, with statistical significance reached if the t-value is greater than |1.96|, see Bayeen 2008).

4   Results

4.1 Post-verbal Constituent

Hypothesis 1 posited that there would be an effect of the post-verbal constituent on the phrasing of the post-verbal sequence. As mentioned in section 2, a recurring result in the literature on French phrasing is that a non-final Φ is delimited by a rising tonal excursion (see Delais-Roussarie 1995; Post 2000; Jun and Fougeron 2000, 2002 and many others). This implies that a Φ is separated from a preceding one by a high target on the final syllable of the preceding Φ. Some authors also systematically found a longer

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duration at the end of Φ (see for instance Jun and Fougeron 2000; D'Imperio and Michelas 2014). Thus, we expected the presence of a higher boundary tone (i.e. a higher F_{0max}) and a slightly longer duration on the verb in cases where the verb is phrased separately from its following constituent, that is in $[V]_Φ$ + $[Adjunct]_Φ$ sequences but not with arguments ($[V + Argument]_Φ$).

Results revealed, as predicted, a main effect of Post-verbal Constituent, with V's F_{0max} being consistently lower ($β = 2.5$, $SE = 5.8$, $t = -8.27$) and V's duration being consistently shorter ($β = 0.038$, $SE = 0.02$, $t = -4.22$) when V is directly followed by an argument compared to an adjunct. Another indicator of phrasing was the number and length of pauses that occurred between the verb and its following constituent. In the sentences with a short adjunct, six pauses occurred right after V that had an average duration of 0.25 sec. In sentences with a long adjunct, we observed a total of 18 pauses, which also occurred right after V and had an average duration of 0.15 seconds (see Figure 3, left panel). On the contrary, there were no pauses between V and arguments (see Figure 3, right panel), but occasional pauses between the subject and the verb. Even if the data set for calculation of the pauses is small, it unambiguously shows that the phrasing of sentences consisting of a verb followed by an adjunct differs from the one of the phrasing of sentences consisting of a verb followed by an argument.
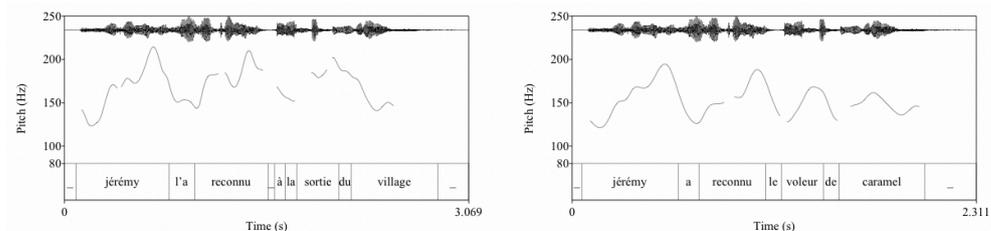
Figure 3. Realization of "V + long adjunct" (left), vs. "V + long argument" (right) in all-new focus condition.

Thus, Hypothesis 1 appears substantiated, suggesting that phrasing does differ according to the type of post-verbal constituent, with adjuncts being more apt to build a separate phrase from the verb than arguments.

4.2 Prosodic Length

We turn to assessing the validity of Hypothesis 2, which examines the effect of length on phonological phrasing. We expected that adjuncts, which are more prone to being phrased separately, will be more affected by length than arguments. If this is confirmed, we expect V to end on a higher tone and to be lengthened when it precedes a longer constituent as in (11) than when it precedes a short one, as in (10).

(10) *Jérémy l'a reconnu **dans la rue**.*SEP

'Jeremy recognized him on the street.'

(11) *Jérémy l'a reconnu **à la sortie du village**.*

'Jeremy recognized him when leaving the village.'

We fit a mixed-effects linear model to the data predicting F_{0max} and duration

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from the two predictors Length and Constituent, and their interaction. Results for V F_{0max} revealed a main effect of each predictor (Length: $\beta = 32.9$, SE = 21.6, t = -5.77; Constituent: $\beta = -7.29$, SE = 3.3, t = -2.67), but no significant interaction between the two ($\beta = 80.2$, SE = 26, t = -1.36). Analysis of V duration revealed similar results—there was a main effect of Length ($\beta = -0.03$, SE = 0.009, t = -4.09) and Constituent ($\beta = -0.11$, SE = 0.008, t = -12.94), but no significant interaction ($\beta = -0.01$, SE = 0.017, t = -0.64). Finally, when comparing all nested models, the ones that included the interaction did not give a better fit to the data compared to the models including either of the individual predictors, and the models that gave the best fit were those that included both predictors (For V $F0m_{ax}$: $\chi^2(1) = 26.96$, p < 0.001; For V duration: $\chi^2(1) = 150.6$, p < 0.001).

These results suggest that, although Prosodic Length plays an important role in predicting phrasing—i.e. a long constituent is phrased separately from an adjacent Φ-phrase containing the preceding verb, while a short constituent does not—it only emphasizes the phrasing of post-verbal constituents that already form a separate phrase based on syntactic structure; arguments, regardless how prosodically heavy, seem to remain phrased with the preceding verb. In sum, only partial support is given for Hypothesis 2.

4.3 Information status

Finally, we explore the influence of Information Status on phrasing, seeking to determine whether French allows all constituents to be compressed as a

result of being given (Hypothesis 3), or whether compression affects only given constituents phrased in their own Φ, thus adjuncts (Hypothesis 4). When present, compression should be observable on the constituent itself, i.e. F_{0max} and duration are expected to decrease when the argument or adjunct is given as opposed to when it is focused. So here, F_{0max} and duration were examined on the post-verbal constituent itself.

Statistically, we fit a mixed-effects linear model predicting both dependent measures from IS, Constituent and Length and the triple interaction between these factors. Results revealed a main effect of the single predictor IS only in the case of the IS condition where the adjunct is given; its $F_{0\ max}$ decreased significantly more than when it was focused (β = -41.61, SE = 30.85, t = -2.45), and likewise, its duration was shortened (β = -0.04, SE = 0.015, t = -2.77). Stronger effects were found when the factor Length was added to the model: A model that included the addition of both predictors performed better than models containing either of the two factors for F_{0max} ($\chi^2(1) = 5.99$, p = 0.01, $\chi^2(1) = 9.39$, p < 0.001), and for duration ($\chi^2(1) = 54.74$, p < 0.001, $\chi^2(1) = 65.95$, p < 0.001), or a model with an interaction (for $F_{0\ max}$: $\chi^2(2) = 2.23$, p = 0.33; for duration: $\chi^2 = 2.99$, p = 0.22). Finally, there was no significant interaction between the three factors (for $F_{0\ max}$: β = -194.6, SE = 121.3, t = -1.6; for duration: β = -1.5, SE = 001.3, t = -0.27). Results for the adjunct can be visualized in Figure 4, where the left panel illustrates F_{0max} and the right panel shows duration, both as a function of information structure and length.

Turning more specifically to the effect of IS on the dependent measures for the preceding verb, and this for each post-verbal constituent, we found that V ended on a lower tone (β = -17.0,8 SE = 4.57, t = -4.21) and was significantly shorter (β = -0.72, SE = 0.012, t = -6.02) when followed by a given adjunct than by a focused one.[3] Thus, as expected, the correlates of phrasing were adapted to the informational status of post-verbal adjuncts and post-focal compression could be established on those constituents, both when short or long, though with a larger effect in the latter case.
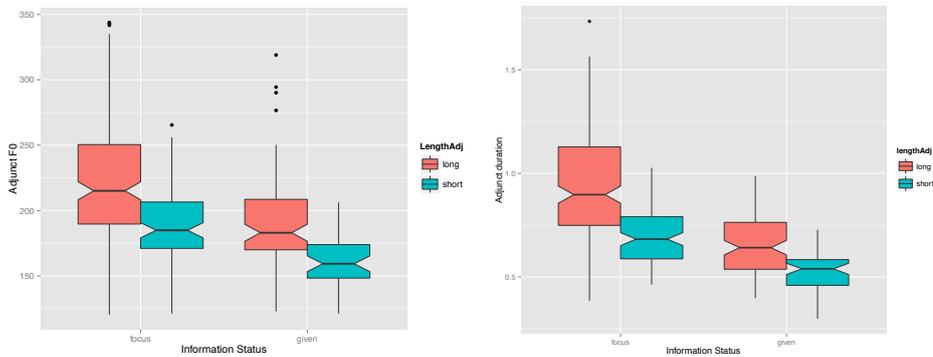

Figure 4. Adjunct F_{0max} (left) and duration (right) as a function of Information status and Length (for sentences with a single post-verbal adjunct constituent).

As for the arguments, visual inspection of Figure 5 reveals that results were much weaker.

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[3] This result may seem surprising, since in case the adjunct is given, the verb is focused, which means that, by all we know, it should have a higher F_0. We return to this apparent anomaly in section 5.
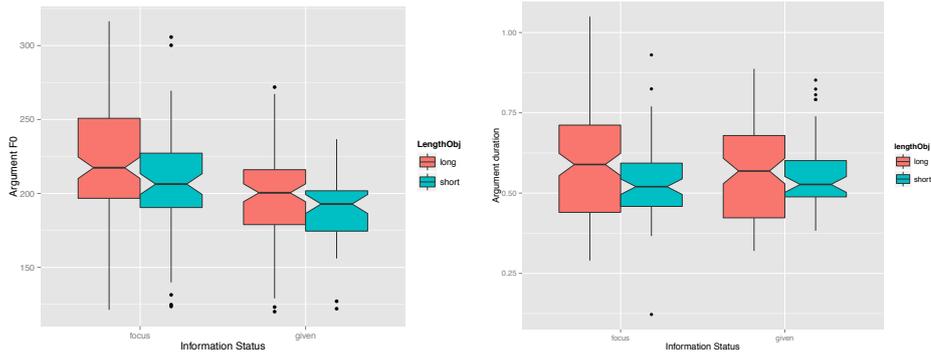
Figure 5. Argument F_{0max} (left) and duration (right) as a function of Information status and Length (for sentences with a single post-verbal adjunct constituent).

We found a small effect of IS on the argument's F_{0max}, with the strongest effects found in a model that included both predictors Length and IS but no interaction ($\chi^2 = 12.53$, $p < 0.001$), revealing that a long given argument tends to have a lower tone than a long focused one ($\beta = -12.74$, $SE = 5.37$, $t = -3.15$) and likewise, a short, given argument tends to be lower than a short, focused one ($\beta = -9.48$, $SE = 2.6$, $t = -5.13$). As for duration, there was no significant effect of IS in arguments; we found no difference between a short, focused argument and a short, given argument ($\beta = -0.025$, $SE = 0.034$, $t = -0.18$), and similarly for long ones ($\beta = -0.065$, $SE = 0.037$, $t = -1.16$). And finally, no effect of IS was found on the verb when the following constituent was an argument. In this case, both F_0 ($\beta = -8.55$, $SE = 5.53$, $t = -1.35$, $\chi^2 = 1.61$, $p = 0.32$) and duration ($\beta = -0.002$, $SE = 0.004$, $t = -0.35$, $\chi^2 = 1.15$, $p = 0.72$) remained stable, regardless of the information status of the argument.

To conclude, the results presented seem to support hypothesis 3 that constituents are generally compressed when given. They further show that IS only has a slight effect on post-verbal arguments. We interpret this result as constituting supportive evidence for hypothesis 4 that, in French, the phrasing necessary for a given constituent to undergo post-focal compression is required to be an independent Φ, although the slight compression found in the case of the argument requires an explanation. This explanation is provided in the next section.

5. Discussion and conclusions

We begin our discussion by briefly summarizing the main findings that emerged from our experiment.

First, and in support of Hypothesis 1, a difference between the phrasing of the argument and the adjunct was established. In case of the adjunct, the preceding verb had a significantly higher final high tone and the verb was also significantly longer (see section 4.1). Both cues were interpreted as phonetic indicators of phrasing: the verb was delimited with a boundary tone, indicating the end of a Φ, and the beginning of another one. There is also a high tone delimiting the verb from a following argument, but this high tone is lower than in the case of the adjunct, and also less prone to change under the influence of length. The Φ of an argument is analysed as embedded into the larger Φ formed by the VP in which it is included.

Second, in partial support of Hypothesis 2, the effect of length of the

post-verbal constituent was found to differ in the case of an argument and of an adjunct. When preceding an adjunct, the verb had a significantly higher final high tone and it was significantly longer, indicating a clear prosodic boundary, but when preceding an argument, no effect of length could be established on the verb, neither in pitch nor in duration (see section 4.2).

Third, Hypothesis 3 was supported. We found an effect of givenness of the post-verbal constituent: Adjuncts were systematically and significantly lower in pitch when given than when focused. Moreover, unlike the results in Jun and Fougeron (2000), but similar to Dohen and Loevenbruck (2004), an effect of information structure on duration could be observed, with given adjuncts being significantly shortened compared to focused ones. As for the arguments, the duration was not affected, only the F_0 was, and this to a lesser extent than for the adjunct, and in this case, no difference on the verb as a result of IS could be established (see section 4.3). On the basis of these results, it is safe to assume that arguments and adjuncts are phrased differently, and that the effect of syntax is pervasive. Finally, we also found support for Hypothesis 4, which predicts that final compression only affects entire prosodic constituents. We return to this result below.

Let us next illustrate the optimality-theoretic constraints introduced in Section 3.1. First, the tableaux in T1 to T4 illustrate dominance of MATCHPHRASE over MINIMALBINARITY. In line with MATCHPHRASE, a verb and a following argument are phrased together. Similarly, the prosodic phrasing of a verb followed by an adjunct is invariant: an adjunct is always

phrased in another Φ from the preceding verb. As for MINIMALBINARITY, it requires that a Φ is two prosodic words long. In our data, the long arguments and adjuncts satisfy MINIMALBINARITY but the short ones do not. Short constituents are thus predicted to be phrased with the preceding verb, while long constituents should be phrased independently. Notice that MATCHPHRASE and MINIMALBINARITY predict different phrasing for arguments, but not for adjuncts. In each of the Tableaux 1 to 4, two candidates are evaluated: one in which the verb and the following constituent are phrased together, and one in which they are phrased in two different Φs. T1 shows the competition for phrasing in a sentence with a short argument, T2 for a long argument, T3 for sentences with a short adjunct and finally, T4 for sentences with a long adjunct. In all tableaux, the subject *Jérémy* is phrased independently. This may be an idealization, but in this article, we are not concerned with the phrasing of the subject and thus do not count the violations it may cause. A MATCHPHRASE violation emerges when the syntactic and the prosodic structures do not match, and a MINBIN violation when a Φ consists of less than two ωs. Note also that in T3 and T4, the direct object is a pre-verbal clitic that cannot form its own Φ because it does not even be the size of a syllable. It is just pro-cliticized to the following auxiliary to which it provides an onset.

T1. V + short argument

[Jérémy]$_{DP}$ [a reconnu [le voleur]$_{DP}$]$_{VP}$	MATCH-PHRASE	MIN-BIN
☞ a. (Jérémy)$_\Phi$ (a reconnu (le voleur)$_\Phi$)$_\Phi$		
b. (Jérémy)$_\Phi$ (a reconnu)$_\Phi$ (le voleur)$_\Phi$	*!	**

T2. V + long argument

[Jérémy]$_{DP}$ [a reconnu [le voleur [de caramels]$_{PP}$]$_{DP}$]$_{VP}$	MATCH-PHRASE	MIN-BIN
☞ a. (Jérémy)$_\Phi$ (a reconnu (le voleur (de caramels)$_\Phi$)$_\Phi$)$_\Phi$		
b. (Jérémy)$_\Phi$ (a reconnu)$_\Phi$ (le voleur (de caramels)$_\Phi$)$_\Phi$	*!	*

T3. V + short adjunct

[Jérémy]$_{DP}$ [[l']$_{CL}$ a reconnu]$_{VP}$ [dans la rue]$_{PP}$	MATCH-PHRASE	MIN-BIN
a. (Jérémy)$_\Phi$ (l'a reconnu (dans la rue)$_\Phi$)$_\Phi$	*!	
☞ b. (Jérémy)$_\Phi$ (l'a reconnu)$_\Phi$ (dans la rue)$_\Phi$		**

T4. V + long adjunct

[Jérémy]$_{DP}$ [[l']$_{CL}$ a reconnu]$_{VP}$ [à la sortie [du village]$_{PP}$]$_{PP}$	MATCH-PHRASE	MIN-BIN
a. (Jérémy)$_\Phi$ (l'a reconnu (à la sortie (du village)$_\Phi$)$_\Phi$)$_\Phi$	*!	
☞ b. (Jérémy)$_\Phi$ (l'a reconnu)$_\Phi$ (à la sortie (du village)$_\Phi$)$_\Phi$		*

The higher-ranked MATCHPHRASE always determine the phrasing.

MINIMALBINARITY is not at stake in the data, although we saw that the phonetic cues separating a long adjunct from its preceding verb are larger than in the case of a short one. This can be analyzed as a gradient phonetic effect. When the post-verbal constituent is an adjunct, it is phrased separately, but the phonetic correlates of the separate phrase can be realized more or less forcedly. In other words, the phrasing, being part of the syntax-prosody mapping, is categorical, but the phonetic correlates realizing it can vary according to the length of the constituents. The gradient characteristic of the correlates of phrasing has been assumed by several researchers before us (see for instance Calhoun 2010).

The effects of givenness, expressed by the constraint GIVEN, are not as straightforward; in fact, we need to discuss the effects on adjuncts and arguments separately. In the case of an adjunct, GIVEN, as formulated in (4), can have its full effect, and the entire Φ is lowered in pitch as an effect of givenness. REGISTERCHANGE (RC), as formuated in (5), does not restrict the effect of GIVEN because an adjunct always forms a separate Φ. This is shown in T5 (for short adjuncts) and T6 (for long adjuncts). Again, two candidates are compared in each tableau: one in which the post-verbal constituent has a compressed register, and one where the compression does not take place (recall Figure 2 for illustration).

T5. The effect of givenness in short adjuncts

T5. (Jérémy)$_\Phi$ (l'a reconnu)$_\Phi$ [(dans la rue)$_\Phi$]$_G$	RC	GIVEN
☞ a. Adjunct is compressed		
b. Adjunct is not compressed		*!

T6. The effect of givenness in long adjuncts

T6. a.(Jérémy)$_\Phi$ (l'a reconnu)$_\Phi$ [(à la sortie (du village)$_\Phi$)$_\Phi$]$_G$	RC	GIVEN
☞ a. Adjunct is compressed		
b. Adjunct is not compressed		*!

Given that adjuncts are often realized much lower than arguments and are thus deaccented or dephrased. This might be related to the fact that a post-verbal given adjunct may be right-dislocated (see among others, López 2016). Recall that a right-dislocated adjunct does not need a clitic in the main clause, which means that right-dislocation in this case is not accompanied by any morpho-syntactic cues. As a result, it is often only signaled by prosody. Thus, it could be that some of the speakers chose to dislocate the given adjunct, an analysis compatible with the occasional short breaks found between the verb and the adjunct and in line with the separate phrasing of the adjunct. Moreover, this agrees with results of several authors, including Jun and Fougeron (2000) and Delais-Roussarie et al. (2002) who found compression of similar adjuncts in their own data. Beyssade et al. (2015:47-50) compared new and given adjuncts in otherwise identical sentences and

found that when the adjunct is given–and the preceding direct object is focused–the adjunct is nevertheless realized with a final nuclear accent in 40% of the cases. In the remaining cases, the given adjunct had no nuclear accent and no other prosodic correlate of prominence. Their result is therefore very similar to ours. However, it is important to understand that the difference between the phrasing of an argument and the one of an adjunct cannot be reduced to the presence of right-dislocation. There is an intrinsic difference between argument and adjunct in their obligatoriness: In the case of transitive verbs, such as those we used in our experiment, the argument is always obligatory, and the adjunct is always optional. What we found is that a given adjunct is often compressed, and a new one can also be compressed, but less often so. Due to the lack of morpho-syntactic correlate, right-dislocation of an adjunct is just a matter of appreciation and judgment. We estimate that it was often made by our speakers, as for instance in Figure 7 where the compressed pattern of the given adjunct is clearly visible. In sum, the difference in phrasing between argument and adjunct is real and measurable, but the analysis in terms of dislocation is not compulsory. We thus cannot decide formally which realization was a dislocation and which was not.
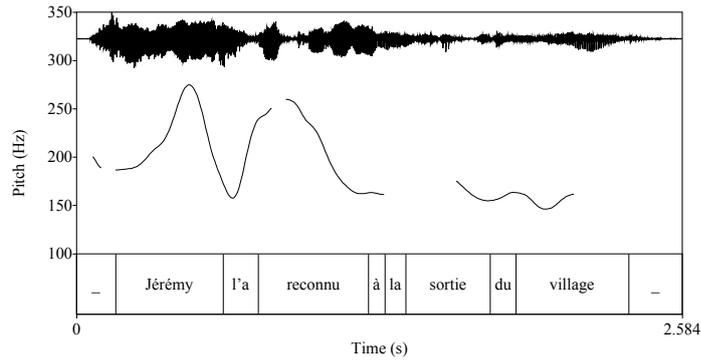
Figure 7. A given argument and a verb with a falling contour

The F_0 lowering effect that a given adjunct has on the preceding verb (see footnote 5) is explained by the realization of the adjunct. As shown in figure 7, the verb is falling in this condition, whereas it is rising when the following constituent is not completely deaccented.

As for the argument, it was observed that its pitch register was slightly lowered, as well, though not as much as in the adjunct (i.e. no effect on duration and smaller effect on F_0 could be observed). We attribute this effect to the recursive structure of a verb plus argument. Because of the embedded Φ, compression is achieved, but since the concerned Φ is part of a larger Φ, it is not as large as the one found in a separate Φ, as in the case of the adjunct. This is illustrated in Figure 8 (to be compared with Figures 1 and 2).
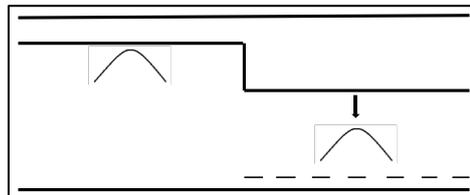

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Figure 8. Φ embedded in a larger Φ: If only part of larger Φ compression is expected but less so that when an entire Φ is given

The simple dominance relation between GIVEN and RC illustrated in T5 and T6 for adjuncts is not sufficient in the case of arguments. This is because compression is possible on the argument, which forms its own Φ, but at the same time compression is more limited because the larger Φ formed on the VP, and comprising the Φ of the argument, blocks compression to fully apply. The result seems to be a compromise: compression is possible, but it is much less than in the case of adjunct. In the OT grammar developed so far, the effect of GIVEN that requires a given constituent to have a compressed register, must be mitigated by REGISTERCHANGE (RC), see (5), that blocks a change of register when it would concern only part of a Φ. In a way, these two constraints cancel each other, though this happens only in case of recursive prosody. We do not try to implement this complication in our simple OT grammar.

We conclude by taking up the question of the interpretation of the experimental results. In Rooth's (1992) semantic approach to focus, a constituent is focused when F-marked (and receives main prominence), and it is given when not F-marked. Specifically, focus in English is realized with a pitch accent, and givenness with compression. In other words, Rooth assumes a prosodic realization of focus. However, it was shown above that French does not react to givenness the same way as English does, and the

question may be asked what triggers this difference. The hypothesis that we have investigated in this paper is that, due to the difference in the tonal realization of prominence in French as compared to English, French expresses focus and givenness not by increasing the prominence of a single pitch accent on the focus exponent and by decreasing the prominence of given ones, but by increasing and decreasing the register (F_0 range) of entire Φs, and concretized by phrasal and prominent tones. This hypothesis was confirmed; the prosodic constituent Φ was found to be crucial for post-focal compression, confirming the relation between entire prosodic constituents and syntax plus information structure.

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