

## Mapping syntax onto prosodic structure: evidence for the intermediate phrase in French.

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Within the autosegmental-metrical theory of intonation (Pierrehumbert, 1980; Ladd, 1996), two representative models of French intonation (Jun & Fougeron 2000, Post 2000) postulate the existence of two prosodic constituents: the Intonation phrase (IP) and a lower ranked constituent, which is either tonally defined (the Accentual Phrase or AP in Jun & Fougeron’s model) or rhythmically defined (the Phonological Phrase in Post’s model). When considering the tonal properties of rises, an IP-final rise would roughly correspond to Delattre’s (1966) “continuation majeure” while an AP-final rise would correspond to a “continuation mineure” (Fougeron & Jun 1998, D’Imperio et al. 2007). An intermediate level of phrasing, corresponding to the intermediate phrase (ip) or Major Phonological Phrase (MAP, see Selkirk 2000) postulated in other languages (Beckman and Pierrehumbert 1986) has also been postulated for French. For Jun & Fougeron (2000), this constituent is marked by a L- or a H- edge (depending on the illocutionary value of the utterance) tone, though its distribution seems to be mainly restricted to early focus question and statement utterances.

Di Cristo & Hirst (1998) also showed an intermediate level for French called the “Intonation Phrase segment” (*segment d’Unité Intonative*) to explain specific prosodic structures such as tag-questions, dislocated theme/rheme structures and wh-questions. This means that in these specific structures, there are two Intonation Phrase segments embedded in a wider Intonation Phrase.

The role of alignment constraints on the placement of prosodic boundaries has been shown for various languages (Selkirk, 1995, Truckenbrodt 1995, 1999, Feldhausen 2008). Our assumption is that the emergence of an intermediate prosodic level (ip) in French is not simply linked to a specific focus or marked syntactic structure. Specifically, an ip boundary might appear within an all focus utterance when the syntactic structure allows it. We specifically predict that an alignment constraint (ALIGN-XP,R) conspires to place an ip boundary in correspondence with a major syntactic phrase boundary (see rise on AP3 in Fig.1), such as an NP/VP boundary (Michelas and D’Imperio to appear). These boundaries would be signaled by prosodic cues that are stronger than the ones associated to an ip-internal AP boundary (as the second AP rise in Fig. 1). The alignment between major syntactic constituents and prosodic structure could then be signaled by boundary cues such as a H- edge tone as well as preboundary lengthening

In this study we have investigated the properties of all focus SVO utterances in which the structure of the subject NP was varied in order to obtain either a sequence of 2 or of 3 APs, as exemplified in (1) and (2):

(1) *La mamie*]<sub>AP</sub> *de Rémy*]<sub>AP/ip</sub> *demandait l’institutrice*]<sub>IP</sub>.

(2) *La mamie*]<sub>AP</sub> *des amis*]<sub>AP</sub> *de Rémy*]<sub>AP/ip</sub> *demandaient l’institutrice*]<sub>IP</sub>.

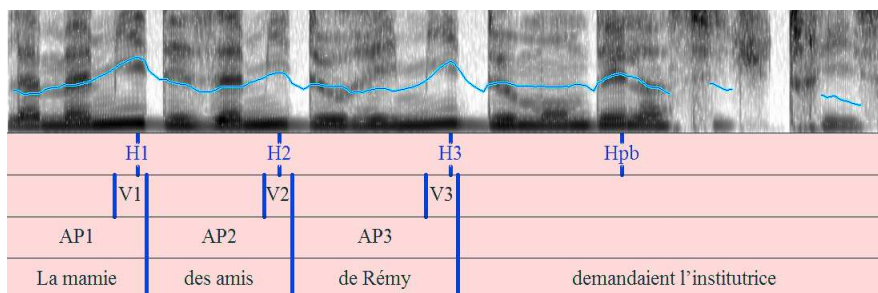
A set of 8 sentences with different NP structure was read 4 times by 2 speakers of French at two different speech rates (normal and fast), since rate has been shown to affect phrasing in a significant way (Fougeron and Jun 1998). Fundamental frequency (F0) values for each target syllable (H1, H2 and H3, corresponding to the syllables in

boldface above) as well as the duration of the vowel [i], were measured. We also measured the height of the first LH\* within the following ip (e.g. within *demandait* in (1) and (2) above), since we postulated that partial reset would occur at the beginning of the second ip within the larger IP. Partial reset has already been observed in Germanic languages such as English (Ladd, 1988), Dutch (Van den Berg et al. 1992) and German (Truckenbrodt, 2002). Concerning the duration measures, we also calculated the total duration of the utterance in order to verify that the rate manipulation was significant. The global duration of the ip-final AP was additionally measured.

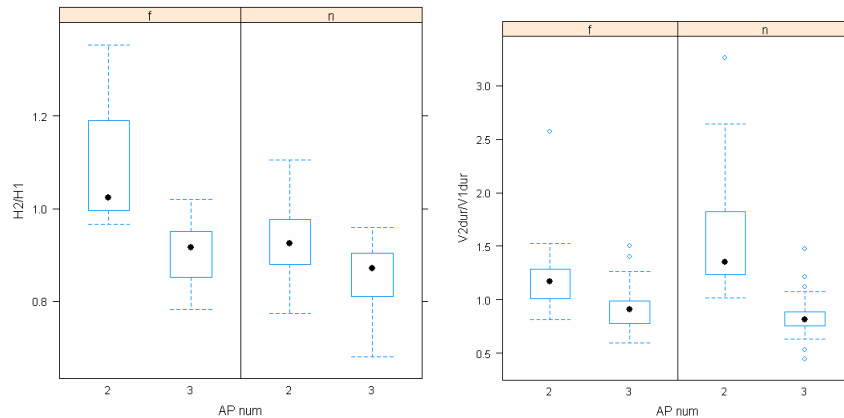
Our hypothesis was that both F0 values as well as vowel lengthening would be greater when the target syllable was in ip-final position (hence, when corresponding to either the second AP in (2) or to the third AP in (3)). H target values were evaluated in a proportional way, as a ratio of the first target peak (H1). This measure was intended to normalize the range variability found both within and across speakers, and allowed us to evaluate register effects. Likewise, lengthening of the target vowel was measured as a ratio of the preceding vowel duration, so that rate variability could be further controlled. We also postulated that downstep of subsequent H peaks for each AP final LH\* would be blocked in ip-final position. In other words, we predicted that the H target would be higher in [mi] when belonging to *Remy* in (2), than when belonging to *amis* in (3), which is non-final within the ip. Recursive downstep of H targets is also described in the model proposed by Post (2000), though only for H\* accents. According to recent theoretical proposals (Truckenbrodt and Féry, 2005) we also expected that phrase internal downstep would be stronger than donstep across subsequent phrases.

Our results show an interesting structuring of subsequent rises within the complex NP, and confirmed our hypothesis. Specifically, the target syllable was produced with significant lower F0 values when non-final within the ip, as shown in Fig. 2 (left panel). Moreover, Fig. 2 (right panel) shows that, as expected, a greater lengthening of the vowel nucleus was also found within ip-final syllables as compared to non-final ones. Note also that both effects were found for both fast and normal speech rates, though the F0 difference between ip-final and non-final H targets was more marked for fast utterances, for which proportionally higher ip-final rises were found.

We hence propose that an ip right boundary is signalled in French through a rising contour, represented by a H- tone, characterized by a return to the register level set by the first H peak of the phrase (H1) as well as by preboundary lengthening. The height of the H- target would not be higher than H1, which sets it apart from H% which would be higher. We also propose that partial reset across the ip boundary is evidence for an internal structuring of the IP, supporting the hypothesis of stronger downstep within than across prosodic phrases (Truckenbrodt and Féry, 2005).



**Fig. 1** F0 curve for the utterance “La mamie des amis de Rémy demandait l’institutrice” (The friends of Remy’s grandmother asked for the teacher), whose NP is produced as a sequence of 3 APs.



**Fig. 2** *F0* height ratio between H2 and H1 in 2 AP phrases and 3 AP phrases in fast (*f*) and normal renditions (*n*) for both speakers (left panel). Vowel lengthening of V2 relative to V1 in 2 AP and 3 AP phrases for both speech rates (right panel).

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