

The role of prosody on the syntactic parsing of speech: from level of prosodic boundaries to depth of syntactic breaks

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A fundamental question that remains to be answered is how listeners are able to parse prosodic structure in spoken utterances and build syntactic phrases out of them. For French, recent studies have shown that prosodic cues at Phonological Phrase boundaries seem to be employed to parse syntactic structure (Millote, 2008). Models of French intonation generally include two levels of prosodic phrasing i.e. the Intonation Phrase (IP) and a smaller constituent defined differently according to theories (i.e. syntactically defined: the Phonological Phrase, or tonally defined: the Accentual Phrase or AP, Jun & Fougeron, 2002). Recent studies have shown evidence for an additional level of phrasing (the intermediate phrase or ip) ranked between the AP and the IP (D'Imperio et al. 2010). The ip right boundary appears to be cued through a phrase accent (H-) which is responsible for blocking downstep of subsequent pitch accents within the ip, as well as by greater preboundary lengthening relative to AP-final syllables. As Figure 1a shows, the second pitch accent in the utterance is downstepped relative to the first, while when an ip boundary is present this is not the case (Fig 1b). The present study tested whether an ip right boundary is interpreted by listeners as cueing a major syntactic break (such as a Noun Phrase/Verb Phrase break) while an AP right boundary would cue a weaker syntactic break, such as an NP-internal boundary.

Pairs of Noun Phrases (NP) whose segmental structure was identical up to the sixth syllable, but differing in the potential placement of either an AP or an ip boundary at their right edge, were employed (Appendix). If only the segmental material is taken into account, the two sequences, up to *sauna* 'sauna' could either be completed by a Verb Phrase (VP) or an internal complement of the NP, a Prepositional Phrase (PP). However, the prosodic characteristics of the second AP (*du sauna*) are different between the two conditions, since only in the first condition the AP is lowered in pitch. A pilot study showed that in a two-forced choice completion task (VP or PP) participants gave more VP responses (significantly different from chance) when an ip boundary was presented in the stimulus relative to when only an AP boundary was presented. This is taken as evidence that prosodic boundary level can influence the syntactic parsing early in the utterance. In the present study we tested which acoustic cues (duration or tonal cues) are relevant in the perception of an ip boundary. Since recent accounts of the prosodic hierarchy in French are mainly based on tonal cues, we hypothesized that tonal indices are sufficient to have an effect on participants' responses.

20 pairs of sentences, containing either an AP or an ip boundary at the right edge, were produced by a French native speaker. We modified the tonal and duration cues associated to AP and ip boundaries through resynthesis by means of PRAAT. Utterance bases containing AP boundary were used. In the *tonal condition*, we manipulated f0 values of the second pitch accent while target durations were set to ambiguous values (Table I). In the *duration condition* we manipulated degree of preboundary lengthening associated to AP and ip boundaries while we rendered the sequences tonally ambiguous. Finally, both duration and f0 values were non ambiguous in the *tonal-duration* condition. The 120 test sequences created were auditorily presented to 60 French listeners in a forced choice completion task. 6 lists containing sequences and fillers were administered to 6 groups.

In contrast with our hypothesis, preliminaries results lead on 20 participants show that responses were not significantly different from chance when only tonal or duration values were coherently marking the potential boundaries (AP/ip-tonal and AP/ip-duration conditions). Only when both duration and f0 values were associated, listeners could perform the completion task, which is in line with recent studies supporting mixed marking of prosodic boundaries in French (D'Imperio and Michelas, 2010).

Figures

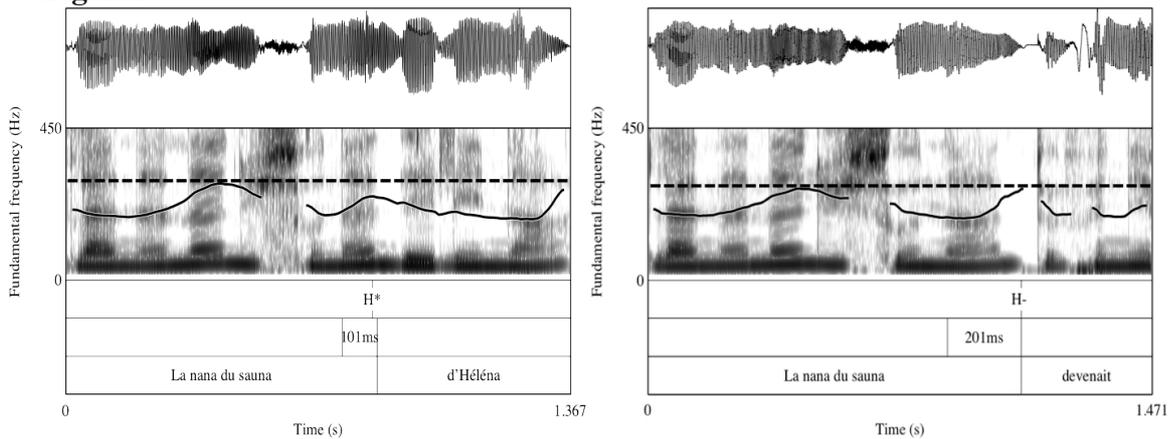


Figure 1. F0 contour for two target noun phrases (*La nana du sauna d'Hélène devenait vraiment méchante*) of the tonal-duration condition extracted from our corpus. The noun phrases are segmentally matching up to the sixth syllable, which could either be associated to an Accentual Phrase (AP) boundary (left) or to an Intermediate Phrase (ip) boundary (right). Acoustic cues associated to AP and ip boundaries were artificially adjusted: the target pitch accent is downstepped relative to the first pitch accent for the AP condition and not for the ip condition. Note that the target was set to a weaker degree of preboundary lengthening for the AP than for the ip condition.

		Manipulations through resynthesis	
		Tonal cues associated to target vowels	Duration cues associated to target vowels
Tonal condition	AP-tonal	The target pitch accent is lowered relative to the first AP final rise of the sequence	Ambiguous value which was halfway between AP and ip conditions
	ip-tonal	The target pitch accent is at the the height of the first AP final rise of the sequence	Ambiguous value which was halfway between AP and ip conditions
Duration condition	AP-duration	Ambiguous f0 value (at the average between AP and ip conditions)	Duration value at the average of target values produced by the speaker in the AP condition
	ip-duration	Ambiguous f0 value (at the average between AP and ip conditions)	Duration value at the average of target values produced by the speaker in the ip condition
Ton-dur condition	AP-ton-dur	Target pitch accent at the average of target values reached for AP condition	Duration value at the average of target values produced by the speaker in the AP condition
	ip-ton-dur	Target pitch accent at the average of target values reached for ip condition	Duration value at the average of target values produced by the speaker in the ip condition

Table 1. Modifications of tonal and duration cues associated to AP and ip boundaries through resynthesis for the tonal condition, duration condition and tonal-duration (ton-dur) condition.

Appendix: Example of a pair of utterances used in the experiment.

a. *La nana*[AP *du sauna*]AP *d'Hélène*[ip *devenait vraiment méchante*].

The girl who manages Helena's sauna became really nasty.

b. *La nana*[AP *du sauna*]AP/ip *devenait vraiment méchante*.

The girl who manages the sauna became really nasty.

References

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