Phonetic Evidence of Narrow and Wide Temporal Scope for Prosodic Constituents in French

Louise Levac, Henrietta J. Cedergren, Hélène Perreault
Département de linguistique
Université du Québec à Montréal
C.P. 8888, Succ. A., Montréal, Québec, Canada H3C 3P8

ABSTRACT

This research addresses the issue of motivating surface prosodic structure in spontaneous French corpora through the use of three complementary methods: auditory, acoustic-phonetic and distributional analyses. This hybrid phonetic-phonological approach has allowed the identification of four distinct levels of prosodic grouping: the intonational phrase, the rhythmic group, morphophonological binding and the syllable.

INTRODUCTION

Recent developments in phonological theory have argued for the existence of prosodic structure as an interface component between surface syntactic representation and phonological representation. Prosodic structure defines the domains of application of phonological processes which cannot be described solely on the bases of their phonotactic environments; it delimits the domains within which patterns of prominence and patterns of timing are defined. While proponents of phrase phonology agree on the hierarchical nature of prosodic structure and assume that the syllable and the foot constitute lower levels of the hierarchy (Nespor & Vogel, 1986; Selkirk, 1986), the degree of hierarchical complexity mediating between syllables and intonational phrases is still under discussion.

This research investigates the motivation of hierarchical complexity in surface prosodic structure in spontaneous French. Auditory, acoustic-phonetic and distributional analyses provide evidence of four distinct levels of prosodic grouping: the intonational phrase, the rhythmic group, morphophonological binding and the syllable.

METHODS

A data-base has been constructed which consists of excerpts of running speech of approximately three minutes in length extracted from hour-long recordings of spontaneous conversations from a subsample of a socially balanced sociolinguistic corpus of Montreal French. The sample consists of eight speakers differentiated according to sex, age and social class. Speaker ages correspond to two generational categories: twenty to twenty five years of age or fifty five and over; an equal number of working class and middle class speakers were selected.

AUDITORY ANALYSIS

The orthographic transcription of the selected excerpts was parsed and coded for perceived prosodic grouping and prominence. Thus, as illustrated in Table 1, three levels of prosodic organization were identified: phonetic syllables, rhythmic groups and intonational phrases. Perceived prominence was distinguished as either demarcative,

associated with the right boundary syllable of rhythmic groups or intonational phrases, or non-demarcative, secondary prominence, associated with non-final syllables.

Table 1. *Exemplification of prosodic transcription.*

(1) Ah! La boxe] Disons qu'elle comprend] *cinq entraînements principaux*]

(2) s ~e k) / ~a / t R ɛ n / m ~a / } p R ~ɛ / s p o /]
258 102 253.5 134 182 230 (ms)

(3)] = intonational phrase boundary, } = rhythmic group boundary,
/ = syllable boundary,) = secondary prominence.

ACOUSTIC ANALYSIS

The speech excerpts were digitized on a microcomputer at a sampling frequency of 16 kHz. Segment boundaries were identified by manually placed cursors on digital spectrograms time-aligned with a waveform; segment durations and labels were stored in an automatically generated file which was also coded for prominence and prosodic grouping.

Linear regression analysis was used to model the relationship between syllable duration and features of surface prosodic structure and syllable composition. Estimate values revealed characteristic differences in temporal effects that are sensitive to prosodic constituent type. Intonational phrase boundary is systematically implemented as the lengthening of the last two syllables in the prosodic constituent, while there are interspeaker differences for rhythmic groups. In contrast, non-demarcative prominence or secondary stress targets only a single syllable. Moreover, degrees of temporal marking contributes to the distinction of hierarchical levels.

DISTRIBUTIONAL ANALYSIS

We have further undertaken a limited distributional analysis to clarify the relationship between surface prosodic structure and underlying linguistic structure. This line of research was thus initiated by taking a long and hard look at lexical sequences that were produced with secondary prominence. All of the expressions with secondary prominence were classified according to morphosyntactic categories; they consisted of sequences of two nouns (N N), noun followed by preposition and noun (N de N or N à N), noun followed or preceded by an adjective (N A or A N), verb plus noun (V N), numeral adjective plus noun, and a few colloquial expressions.

A corpus of all similar morphosyntactic categorial sequences in the data set was then tested, first in a judgement acceptability experiment, and second in a relational analysis of normalized durations. The corpus consisted of 252 lexical sequences, such as, *Ville Laval, école anglaise, petit cousin, faire une carrière, trois fois, disons que, etc.*

Acceptability experiment

Two native speakers participated in the acceptability test. The first speaker's task was that of producing each lexical sequence with three distinct prosodic configurations: 1) a neutral prosodic configuration without secondary stress, 2) a prosodic configuration with secondary stress on the first lexical item in the sequence, and 3) a minor prosodic phrase

boundary after the first lexical item. The second speaker's task was that of judging the acceptability of each production either as good (+), unacceptable (-) or uncertain (?).

As illustrated in Table 2, the results revealed that although secondary prominence is optional, all sequences where judged acceptable when produced with non-final prominence; this was also true for the neutral prosodic configuration. The test also revealed that a minor subset of the data was judged unacceptable when the lexical sequences were produced as separated by a minor prosodic boundary; thus providing evidence that prosodic phrasing assignment is constrained by the categorial status of lexical sequences. Compound lexical units were judged unacceptable when produced with an internal prosodic boundary in contrast to syntactic phrases.

Table 2. *Examples of acceptability judgements for lexical sequences. Data taken from young middle class male speaker.*

Lexical sequence	Neutral prosodic configuration	Internal minor prosodic boundary	Non-demarcative prominence
corde à danser	+	+	+
goût à (la) musique	+	?	+
Ville Laval	+	-	+

Relational analysis

Z-score normalization of the durations of all segments in a speaker's dataset was used to determine syllable lengthening or shortening in standard units. A relational analysis of word final syllables in each lexical sequence used for the acceptability test from a young middle class male speaker in the sample showed two patterns in the dataset. With few exceptions, word final syllables in sequences defined as phrases in the acceptability test revealed a pattern whereby the final syllable in the first lexical unit appeared to be subject to shortening as evidenced by a negative z-score value. In contrast, compound lexical units revealed a pattern whereby the final syllable in the first lexical unit appeared to be subject to lengthening as evidenced by a positive z-score value. These patterns which we interpret in metrical terms as W(eak) when the value is negative and as S(trong) when the value is positive are represented in Figure 1.

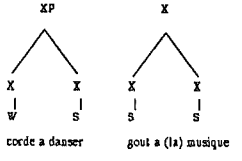

Figure 1. *Relational contrasts of lexical unit sequences and lexical phrases sequences as revealed by z-score values.*

Although, in general, the results of the acceptability test and the relational analysis of z-score transforms coincide, there are some exceptions. Further analyses which take into account the whole context of the utterances in the dataset should shed light on these exceptions.

CONCLUSIONS

We have presented evidence that surface temporal patterns in our dataset of spontaneous speech differentiate between properties of phrasing and secondary prominence. As revealed by statistical analysis, rhythmic group and intonational phrase boundaries are associated with lengthening of the last two syllables of the prosodic constituent, we call this modality of implementation wide scope prominence marking, while secondary prominence targets only one syllable, and thus is interpreted as narrow scope prominence marking.

A distributional analysis of a subset of the corpus has allowed us to examine some of the relationship between auditorily derived prosodic units and morphosyntactic categories. Thus lexical compounds in Montreal French cannot be split by a minor prosodic boundary. Moreover, lexical compounds appear to have a characteristic rhythmic pattern. The first lexical unit in the sequence is lengthened as measured by z-score normalization. This contrasts with sequences that may be interpreted as syntactic phrases. These sequences may be split by a minor prosodic boundary, and the first unit in the sequence is subject to shortening as measured by z-score values.

The structural constraints on prosodic phrasing are not paralleled by the distributional properties of secondary prominence; both lexical compounds and syntactic phrases may be produced with secondary prominence on the first unit. However secondary prominence, although optional, is positionally constrained; it targets the last syllable of the first lexical constituent, and thus provides evidence of an intermediate morphophonological prosodic domain in the dialect of French under analysis. Further research will extend and clarify the relationship between abstract phonological structure and phonetic patterns.

ACKNOWLEDGEMENT

This research was supported in part by the Social Sciences and Humanities Research Council of Canada under Grant No. 410-92-1840.

REFERENCES

F. Grosjean and A. Deschamps (1972), "Analyse des variables temporelles du français spontané, *Phonetica,* Vol. 26, pp. 129-156.

M. Nespor and I. Vogel (1986), *Prosodic Phonology* (Foris Publications, Dordrecht).

L. Santerre (1991), "Incidences du trait phonologique de durée vocalique sur la prosodie du français québécois", *Proc. 12th Internat. Cong. Phon. Sc., Aix-en-Provence, 19-24 August 1991,* Vol. 4, pp. 254-257.

E. Selkirk (1986), "On derived domains in sentence phonology", *Phonology Yearbook,* Vol. 3, pp. 371-405.

J. Vaissière (1991), "Perceiving rhythm in French?", *Proc. 12th Internat. Cong. Phon. Sc., Aix-en-Provence, 19-24 August 1991,* Vol. 4, pp. 258-261.