

A Predictive Approach to the Analysis of Intonation in Discourse

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Abstract

This paper presents an approach to the analysis of prosody in French discourse, based on a prediction of the unmarked default intonation matching the lexical and syntactic properties of the sequence. By confronting this default intonation with the actual intonation used by the speaker, all marked intonation elements can be identified. The prediction of default intonation takes into account word stress, syllable count, syntactic dependency relations, and syntactic construction. In the process, criteria are proposed for the definition of discourse units based on both syntactic and prosodic formal criteria.

1. Introduction

We propose an approach for analysing the role of intonation in discourse. It aims to make explicit the contribution of intonation to the structuring of information and to the expression of the speaker's attitude towards both the information content and the communication context.

The role of intonation in discourse is of interest to many linguistic domains, including the study of prosody (e.g. Rossi 1999, Di Cristo *et al.* 2004), discourse analysis (e.g. Roulet *et al.* 1985, Simon 2003), and the study of information structure (Lambrecht 1994, 2001). Analysis is frequently based upon an interpretation of the meaning of the interaction.

Certain discourse analysis models for French start by segmenting the speech chain into minimal discourse units, then establish a hierarchical organisation of these units based on the semantic, logical or pragmatic relations between them. Only then are the ways examined in which intonation contributes to this segmentation and structuring of discourse.

Information structure analysis, based on K. Lambrecht's approach, goes a long way in making semantic and pragmatic information explicit. Such analysis makes use of notions including presupposition, assertion, aboutness, « mémoire discursive », topic, and focus. These refer to facts which cannot be observed directly, and assume the presence and activation of information and knowledge in the mental representation of the speakers.

The interpretative nature of such an analysis raises some methodological questions. As the meaning of an utterance is based simultaneously on several aspects, which include lexical information, morphological elements, syntactic construction and pragmatic context, how the semantics of prosodic forms is interpreted is critical, especially with regard to establishing objectivity.

The analysis proposed here aims at reducing the amount of interpretation by the linguist and at making verifiable and reproducible statements about the

contributions of prosody to syntactic structure and to the organisation of information in discourse. This procedure exploits empirical properties of spoken language, either syntactic or prosodic, as well as the relationship between both aspects and their synchronisation.

At the syntactic level the speech chain is organised into local dependency networks (defined below). The very nature of dependency relations assigns to each dependent a particular type, acting either as a valency argument, a peripheral complement or an adjunct. In turn, these autonomous dependency networks may be embedded in larger syntactic or prosodic constructions, as with dislocation, cleft, pseudo-cleft, by a general mechanism of prosodic grouping, by register changes, and so forth.

It is possible to calculate the unmarked prosodic properties of such networks and constructions. This procedure identifies syllables with word stress, delimits prosodic units and assigns them prosodic boundaries of relative strength. This results in a prediction of unmarked prosody, which will be read alongside the actual, pronounced prosody. Each element by which the actual prosody differs from the predicted form acquires a marked status and as such introduces prosodic meaning. Some prosodic forms make the informational status of an utterance part explicit, while others may fulfil a pragmatic, emotional or additional function.

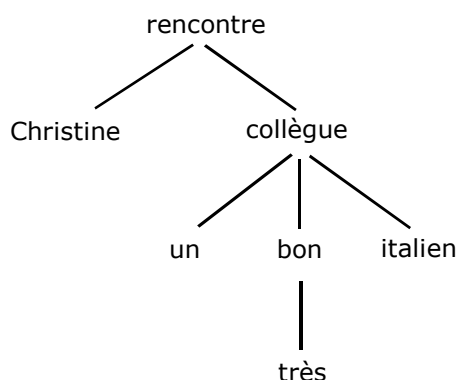
The structure of this article follows the analysis stages. First (§2) the descriptive framework used in syntactic analysis is briefly presented. Then (§3) the representation of prosodic forms and their semantics is discussed. The next section (§4) examines the relations between the prosodic and syntactic levels. Finally (§5) these elements are combined in a procedure for discourse analysis based on the prediction of default intonation from syntactic information.

2. The descriptive framework for syntactic analysis

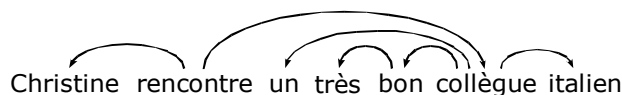
For syntactic analysis, we adopt the framework of dependency grammar proposed by L. Tesnière (1959), refined with concepts from valency grammar, in particular from the pronominal approach (Eynde *et al.* 1978, Blanche-Benveniste *et al.* 1984, Blanche-Benveniste *et al.* 1990, Eynde & Mertens 2003). The choice of this framework is no coincidence, as the combination of dependency relations and valency allows for a simple and concise formulation of rules on the interfacing of syntax and prosody, whereas a conventional approach based upon constituency would require more complex rules and in some cases would be inadequate.

In dependency grammar, syntactic structure is seen as a network of dependency relations between words. This network results from elementary relations between word pairs, called connections. A connection (Tesnière's *connexion*) is an asymmetrical relation between two elements: a *head* and a *dependent*. The linguistic debate about the notion of the head is not engaged, as dependency relations may be defined without it. Whereas a head may have several dependents, each dependent has only one head. A dependent that is governed by a head may in turn govern other elements. This results in a network in which all elements are either directly or indirectly connected. Each

network contains a *root*; it is the single element in the network that does not depend upon another element.



The *structural order* of an utterance corresponds to the network of hierarchical relations between its elements, and the *linear order* to the sequence of these elements in the speech chain or in writing. The representation above (Tesnière's *stemma*) indicates the structural order of an utterance: each edge indicates a connection and the vertical position of the connected elements designates their hierarchical relation, the head being placed above its dependents. In the stemma, linear order is not necessarily respected. As intonation is inseparable from linear order, an alternative but equivalent representation is used in which connections and their orientation are indicated by arrows.



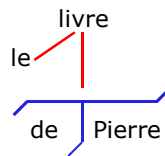
A dependency *cluster* (Tesnière's *nœud*) corresponds to the network formed by a head along with all (directly or indirectly) dependent elements. A cluster may contain embedded clusters. Clusters may be classified into verbal, nominal, adjectival and adverbial clusters according to the part of speech of their head.

Dependency relations cannot be freely exchanged. The relation between a verb and a pronominal dependent differs from that between a noun and its adjectival determiner: it is impossible to swap both dependents. Moreover, verb dependents are non-interchangeable in most cases: « Peter observes the movement », but « * The movement observes Peter ». As a result the type and nature of dependency relations should be specified.

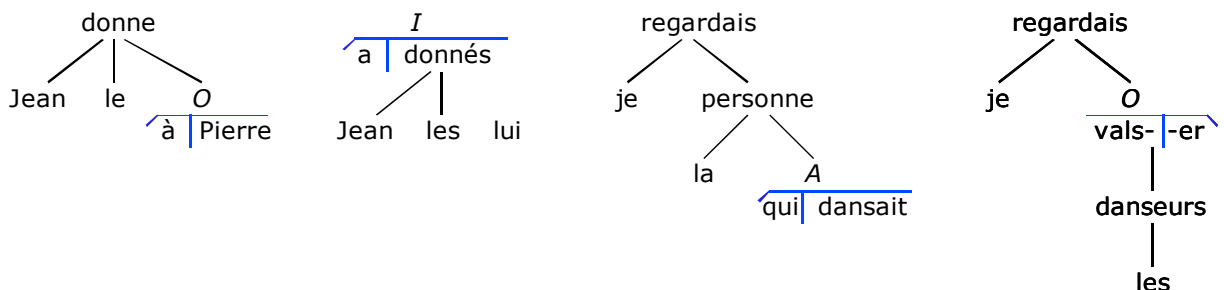
Tesnière distinguishes two major classes of verbal dependents: *actants* (valency complements) and *circonstants* (peripheral complements), as well as three subtypes for the former. However his classification is based on semantic rather than syntactic considerations. Below a more detailed classification of verbal complements is given.

Obviously, the dependency relation does not cover the full range of syntactic relations. Tesnière provides a general syntactic mechanism of type

casting which he calls *translation*, which enables a form (word), called the translative (*translatif*), to combine with a cluster of a given type in order to form a cluster of another type. For instance in « le maire de Paris », the preposition « de » allows the noun « Paris » to form a cluster « de Paris » that behaves like an adjective, similar to « le maire parisien ».



Tesnière treats the following categories as translatives: prepositions, auxiliaries, relative pronouns and certain conjunctions. This casting mechanism is also applied to certain derivational morphemes, such as the infinitive marker.



The description of the relation between syntax and prosody requires further extensions to the apparatus for syntactic analysis. We will firstly consider the typology of complements, then the nature of valency complements, followed by the notion of syntactic construction.

Among the dependency relations headed by a full verb, and the corresponding complements, several types may be distinguished, namely, valency arguments, peripheral complements and adjuncts.

Valency arguments (*compléments essentiels*, Tesnière's *actants*) are largely mandatory and vary from one verb to the next (« il observe le mouvement », « *il observe au mouvement »), and even from one verb sense to the next (« il affecte une grande détresse », « on affectera cette somme au ravalement », « son départ l'a beaucoup affecté »). Together, the arguments specific to a given verb use constitute the *subcategorisation frame*. A verb is *saturated* when all its valency arguments are present in the linear form (i.e. in the cluster dependent on that verb).

Peripheral complements may be used with all full verbs and are always optional (« le matin, dans son atelier, il travaille méticuleusement »).

The pronominal approach proposes a typology of verbal dependents in French, based on the *proportionality* relation between a lexicalized constituent and a pronoun. For an introduction, cf. Eynde *et al.* 2002, Eynde & Mertens 2003.

The term adjunct (*adjonction, adjoind*) will be used to designate a verbal complement lacking a relation with a proportional pronoun.

décidément, en voilà un bel exemple
je ne le pense pas
je suis d'un autre avis, comme tu sais
avec ça, je me demande comment on va faire
puisque tu insistes, il prendra le train suivant

The term *verb kernel* will be used to indicate a sequence in which the syntactic structure corresponds to a saturated verb cluster consisting of the verbal head and all required valency arguments, possibly one or more optional ones, peripheral complements, but no adjuncts. When the root is a finite verb form, the cluster will be called a finite verb kernel.

The term (*verb*) *construction* will be used here to designate a sequence of elements, with saturated valency, in which each part can be identified on the basis of its syntactic or prosodic properties, or on the basis of its lexical identity (e.g. « ce » in « c'est lui qui y a pensé »). Main examples of syntactic properties of the construction parts include the root status of the verb, the syntactic function of the dependents (i.e. the nature of the dependency relation between the head and the dependent), a coreference relation. The following table enumerates some constructions in which the prosodic properties will be analyzed in detail below. Terms used in the pronominal approach¹ and widely used terminology will both be employed. The abovementioned constructions can be found for almost all full verbs. The list of construction is not intended to be exhaustive.

The unmarked construction (*dispositif direct*) consists of a verb kernel with unmarked word order, i.e. where word order is predictable on the basis of the clitic or lexical nature of the forms, cf. Blanche-Benveniste et al. 1984: 145.

¹ Blanche-Benveniste *et al.* (1984 : 37, 144ss), Blanche-Benveniste *et al.* (1990 : 55-66)

Dispositif direct		<i>Il jette les livres</i>
Double marquage à gauche	Left Dislocation	<i>Les livres, il les jette.</i>
Double marquage à droite	Right Dislocation	<i>Elle lui profite, cette attitude.</i>
Dispositif d'extraction	Cleft	<i>C'est les livres qu'il jette. C'est à lui que cette attitude profite</i>
Pseudo-clivée	Pseudo-cleft	<i>Ce qu'il jette, ce sont les livres</i>
Dispositif de binarisation	Dislocation	<i>A lui cette attitude profite</i>
	Presentational construction	<i>Il y a Pierre qui jette les livres.</i>
	Restrictive construction	<i>Il n'y a qu'à lui que cette attitude profite.</i>
Combinations of constructions		<i>Les livres, c'est lui qui les jette.</i>

3. The descriptive framework for prosody

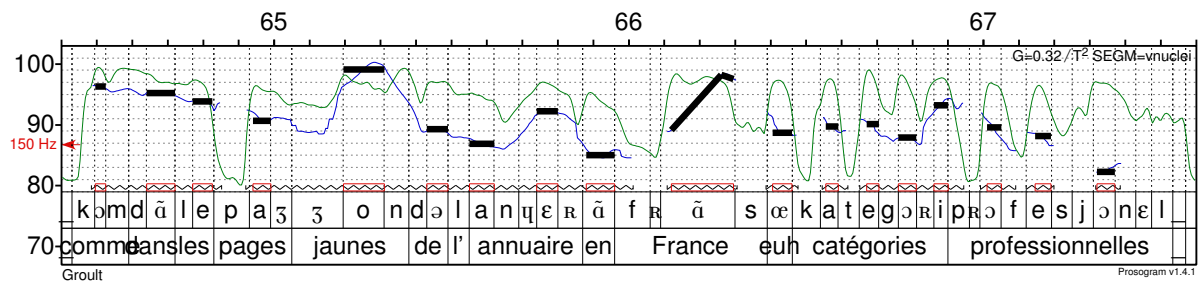
This section enumerates prosodic concepts required to present the approach. These concepts are simply outlined here. For a full introduction to the model used, the reader is referred to Mertens *et al* 2001a : §3. Additional references to publications are provided in the footnotes.

3.1. The intonation unit

Most intonation models for French adopt a prosodic unit consisting of a sequence of syllables with a characteristic pitch contour. Terminology varies substantially. The term intonation group² (*groupe intonatif*, GI or IG) used here designates a sequence of one or more syllables in which the last full syllable carries final stress (defined below). In the example below, pronounced by a female speaker, the underlined syllables are stressed and the resulting segmentation into intonation units is indicated by brackets. The illustration below shows the prosodic parameters of intensity and fundamental frequency for the utterance, as well as the simulated perceived pitch (thick line), as obtained in a prosogram, cf. Mertens 2004b.

*(comme dans les pages jaunes) (de l'annuaire) (en France) (catégories)
(professionnelles)*

² For a detailed definition of the « groupe intonatif », see e.g. Mertens 1987, Mertens *et al* 2001a : §3.3.



Once the intonation group is defined and can be located consistently in the speech chain, an inventory of the pitch contours accompanying such units can be made, in order to examine the relation between such units and the entities of the syntactic layer, to facilitate the interpretation of the semantics of these contours, and to observe their use and function in speech communication. The speech chain can then be analyzed as a sequence of intonation units involving a linguistic code.

3.2. Two stress types

Our definition of the GI is based upon prosodic stress. However, locating the stressed syllables is not without difficulty. Stress remains an inevitable ingredient for almost all phonological models of prosody. Indeed, the communicative status of a pitch form, e.g. a pitch rise or a high level tone, varies according to whether or not that form appears on a stressed syllable. Stress is an essential concept, because it constitutes the anchor point for the alignment between the syllabic chain and pitch contours. If intonation were reduced to a sequence of pitch movements, it would still be necessary to position such movements on the linear chain, which can only be done on the basis of stress.

In the case of French, the issue of stress is complicated further by the fact that there are two types of stress in the language: final stress (*accent final*, AF) and initial stress (*accent initial*, AI). They need to be distinguished because only final stress entails a right hand boundary of the intonation unit. Both types of stress are distinguished by their articulatory and distributional properties³.

3.3. Pitch levels and tones

There are many ways to characterize pitch variations in speech, depending on the nature of the representation. The illustration given above shows both the acoustic and simulated perceptual representations. In linguistic description, symbolic (either phonological or morphological) representations are used; here pitch variation is characterized rather coarsely by a sequence of discrete elements, viewed as pitch targets. In such symbolic representations, the pitch continuum is reduced to a small set of pitch levels, such that each target is on one level. Common notation systems show a large diversity as to the number of pitch levels and the location of the targets. The most widely used system has just two pitch levels, which is clearly insufficient for the description of pitch variations commonly found in spontaneous speech. In our work on French, we

³ cf. Mertens 1987, 2002.

have adopted the system proposed by Dooren & Eynde (1982), in which pitch levels are established progressively from left to right on the basis of both local pitch intervals and the speaker's pitch range. The low (L) and high (H) pitch levels are separated by a major melodic interval. The extra low (L-) and extra high (H+) levels correspond to the floor and the ceiling of the pitch range, respectively. The levels L and H may be raised or lowered due to the presence of a minor interval, resulting in the levels /L, /H, \L and \H. The size of the major interval is defined in a relative manner, on the basis of the pitch range in the utterance, which typically corresponds to an interval of ≥ 5 ST (semitones).

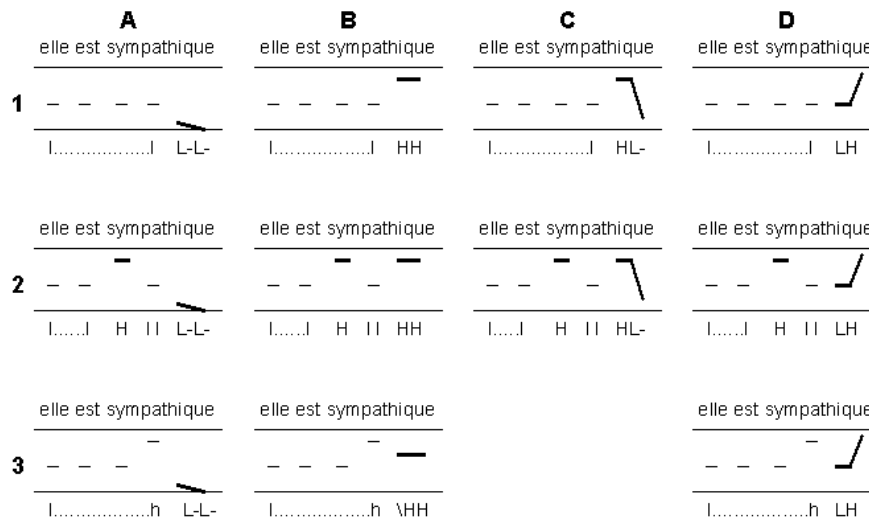
The term *tone* is used here to indicate the pitch level associated with a syllable, or the set of pitch levels, in case of an intrasyllabic pitch glide.

3.4. Internal structure of the tone unit

Speech corpora provide numerous samples of pitch contours found on intonation units. These contours mainly differ through features such as the number of syllables in the unit, the phonetic nature of the sounds in these syllables, and the presence of an initial accent. The systematic analysis of such contours reveals an underlying internal structure, in which the syllable carrying final stress (AF) occupies a central position, given its obligatory character in the intonation group. Some intonation groups contain only this final stressed syllable (« oui ! », « où ? », « là ! »). In others it is preceded by an unstressed syllable (« ici », « elle vient ») or by several (« il arrive », « on en reprend »). This results in two parts: the stressed syllable and the preceding sequence of unstressed syllables. In intonation groups also containing an initial stress (« c'est inacceptable »), the internal structure consists of up to four parts: leading unstressed series (unstr), initial stress (AI), unstressed series, final stress (AF). The structural representation below resumes all forms into a single structural pattern, with optional parts indicated between parentheses.

$$GI = ((unstr) (AI)) (unstr) AF$$

The internal organisation of the intonation group is suggested not only by the presence of the stresses, but also by the observation that pitch contours found for complete groups can be viewed as concatenations of pitch forms found in each of their component parts. In the illustration below, contours 1A to 1D are identical to the exception of the pitch movement of the final stressed syllable. In contrast, contours 1A, 2A and 3A share the contour for their final stress, but differ elsewhere in the intonation unit.



Given the internal structure of the GI and the notion of tone, a contour can be analysed componentially, as a sequence of tones.

3.5. The appendix

In the following utterances, the final part of the utterance (« en quelque sorte », « les autres ») will be pronounced with a flat pitch contour on an extra-low pitch level, without stress, and with decreased intensity. This contour will be referred to as the appendix contour. Note that the appendix is found only after certain final tones.

et c'est comme ça que l'histoire marche en quelque sorte (R. Barthes)
j'aime bien comprendre comment ça marche les autres (F. Giroud)

The lack of a stressed syllable in such sequences makes segmentation into GI units problematic. This can be solved if the appendix is either considered to be a special type of intonation group (GI), or as an optional part of the GI, following the final stress (AF). Both analyses present certain advantages, but as the appendix never appears alone, without a preceding GI, we have opted for the second analysis. As a result, the structural pattern of the GI is modified as follows:

$GI = ((unstr) (AI)) (unstr) AF (appendix)$

Table 1 shows the tone inventory for all positions in the intonation group.

unstr	AI	unstr	AF	appendix
l	l	H	l l	L-L-
h	h	L	h h	H+H+
				HL-
				H/H
				/HH
				\HH
				HL
				LH
				HH
				/LL
				LL
				\LL

Table 1. Distribution of tones in the maximal intonation group (i.e. containing the maximum number of positions). AF = accent final, AI = accent initial, unstr = unstressed sequence. Horizontal lines indicate constraints on the combination of elements in the paradigms crossed by the line. For instance: l- tones only combine with tones L-L-, HL- and H+H+ of part AF.

3.6. Interpreting the intonation contours

To describe the meaning of intonation contours, we start from the pitch form associated with the parts of the intonation group. For each of these forms, all occurrences can be collected in a speech corpus and the meaning associated with a particular form can largely be grasped by examining the meaning in the particular uses and attributing a common denominator.

Considering the tones in final stress position, each final tone in French implies a boundary of a given strength. The largest boundary corresponds to a final tone ending in pitch level L- (i.e. tones L-L-, HL-, and LL-⁴). The presence of an L- tone results in the completion of a maximal prosodic unit, and hence in a completed information object. The tones \LL, LL, /LL, HH, H/H indicate increasing boundary levels. For these tones, the boundary level increases with pitch level.

Certain final tones go beyond this demarcative and organising function, informing the listener about how the speaker conceives the information in the intonation group carrying these tones. The table below provides a short description of the meaning of such tones. The suggested characterisation of intonational meaning is not discussed here, as the precise meaning attributed to these tones is irrelevant for the behaviour of the model.

Initial stress is a means to mark the start of an information object in the linear chain. This allows for a delimitation of strings of lexical elements *within* the domain of an intonation group, from the AI to the first following AF, or alternatively, to delimit a string exceeding the limits of a single intonation group, from the AI to the AF with a major boundary. Initial stress is particularly useful to highlight lexical elements that do not carry lexical stress and do not allow final stress.

⁴ LL- is a variant of L-L-.

In spontaneous speech the unstressed penultimate syllable of the GI plays an important role. As it is followed by a stressed syllable, which itself carries a tone, it is not always clear to what extent the semantics of the contour should be attributed to one or the other. The table indicates the two most common combinations: « ...h L-L- » and « ...h \HH ».

The appendix has a particular distribution; its role will be discussed below.

Still other prosodic phenomena play a role, such as register changes (marking parenthesis), declinations and inclinations, used as organisational or expressive means. However, analysis of these phenomena is beyond the scope of this study.

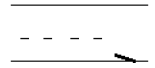
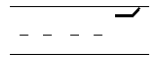


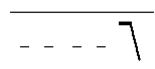

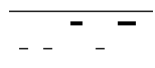
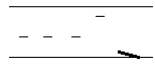
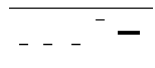
	tone	general meaning	connotation in context
	L-	finality	assertiveness, peremptory
	H/H	major continuation	
	HH	intermediate continuation	
	/LL, LL, \LL	minor continuation	
	HL, HL-	center of attention, focus	important or new information, involvement of speaker
	LH	major continuation	invitation to listener to respond
	H+H+	involvement of speaker in message	conviction, important information
	AI	start of object	stress on object
	...h L-L-	evident to speaker	assertiveness, peremptory
	...h \HH	evident to listeners	common wisdom
	appendix	background information	accessory information

Table 2. Characterisation of the general meaning of individual tones and their connotations in context.

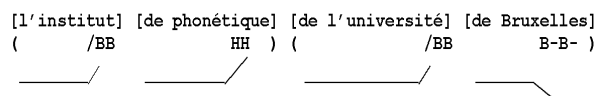
To sum up, intonation contours convey various types of information, of a demarcative, organising, pragmatic, and communicative nature, which is expressed by the tones at specific locations in the contour. The resulting meaning is obtained compositionally by combining the contributions of the contour parts, i.e. of the tones of the syllables.

3.7. Prosodic grouping

Intonation can disambiguate strings which would otherwise be ambiguous. In some cases this is related to alternative segmentations into intonation groups (a, b), in others to the constitution of larger blocks due to the relative strength of prosodic boundaries (c, d). This in fact results from a general mechanism of prosodic grouping.

- (a) (soixante dix-sept) (quatre-vingt) (treize) (zéro zéro) (dix-huit)
- (b) (soixante) (dix-sept) (quatre-vingt treize) (zéro zéro) (dix-huit)
- (c) (le bébé_{HH}) (il dort_{L-L}) (avec sa mère_{HH}) (ça va très bien_{L-L})
- (d) (le bébé_{HH}) (il dort_{LL}) (avec sa mère_{L-L}) (ça va très bien_{L-L})

Each contour of an intonation group implies a prosodic boundary, given by the final tone. With the exception of the maximal boundary, associated with the L- tone, boundaries are proportional to the pitch level at the pitch peak within the final stressed syllable: the higher the pitch, the stronger the boundary. The sequence of intonation groups with their respective boundaries gives rise to both their hierarchical *organisation*, and their articulation in prosodic constituents. The principle of prosodic grouping is very simple. When a boundary is followed by a stronger one, their intonation groups merge into a larger unit, while preserving the internal hierarchy, resulting in a prosodic package (*paquet intonatif*). For a sequence of two boundaries of equal strength or when the first is the stronger, no package is formed; both units simply remain independent. To obtain the organisation of prosodic packages for a given sequence of intonation groups, the basic principle is applied to each pair of successive groups, starting with the first and shifting to the next group after each application.



The example⁵ above contains four intonations groups, indicated between brackets. The boundary of the first group is weaker than that of the next, hence both groups form a package, as indicated by the parentheses. Next, we compare the boundaries of groups 2 and 3, which illustrates the opposite situation: strong boundary followed by weak boundary, hence juxtaposition. Groups 3 and 4 show another case of inclusion. Moreover, since tone L-L- corresponds to the maximal boundary, a second order package is obtained, incorporating the two packages already found: « l'institut de phonétique » and « de l'université de Bruxelles ».

⁵ In this example, the low (L) pitch level is noted as B, and L- is noted as B-.

(nous) (on y cherchait) (un nouvel) (appartement)
 AL ◦ . . . ◦ . . . ◦ . . . ◦
 GA (-) (. . . -) (. . . -) (. . . -)

Clitic elements (such as clitic pronouns and determiners) merge with the stress group to the side of their head, which is either to the right, or to the left:

(lui avait-elle) (envoyé) (cette lettre)
 AL . . ◦ . . . ◦ . . ◦
 GA (. . . -) (. . -) (. -)

The final stress falls on the last full syllable of the intonation group. When this last syllable belongs to a clitic element (for instance a clitic pronoun, as in “avait-elle”), then it is this clitic that carries the stress⁷. Stressed syllables are indicated by a plus sign in the tier labelled **GI**.

(lui avait-elle) (envoyé) (cette lettre)
 AL . . ◦ . . . ◦ . . ◦
 GA (. . . -) (. . -) (. -)
 GI (. . . +) (. . +) (. +)
 GI (. . . - . . +) (. +)

An intonation group (**GI**) consists of one or more stress groups (**GA**), but the way in which the latter are grouped depends upon several factors. For instance, adjacent final stresses (or stress clash) are avoided⁸. The possible groupings also depend on the syntactic relations between the stress groups (cf. *infra*). Sometimes a speaker forms a rather long intonation group to present the sequence as a single information object⁹. Other factors, that have little to do with information, play a role as well such as speech rate or speech type (read vs spontaneous speech).

3.9. Word stress and part of speech categories

The clitic nature of an element depends both on its position in the syntactic construction and its part of speech: « nous » is non-clitic in « nous, on le leur demandera » and clitic in « nous le leur demanderons ». Except for syntactically marked positions that require non-clitic forms, as described below, the following rules can be applied. The following categories are non-clitic elements in French: verbs, nouns, adjectives, adverbs (except for the particle “ne”), numerals and “mots-phrases”¹⁰. Pronouns behave differently according to their minor category. Some personal pronouns are always clitic: “je, tu, il, ils, on, le, la, les, me, te, se...”; whereas others, like “moi, toi, eux...”, are non-clitic. A small number of personal pronouns, “nous, vous, elle, elles, lui, leur”, are clitically ambiguous: in fact they are homonymous pairs, one belonging to a clitic paradigm, the other to a non-clitic paradigm. All other pronouns are non-clitic: indefinites, interrogatives and relative pronouns (except “que”), and demonstratives (“ceux-ci, celles-là...”, except “ce, c”). Determiners are clitic, except indefinites (“certains enfants”) and predeterminers (“tous mes livres”). Prepositions and conjunctions function as clitics in most cases. Compound

⁷ There is an exception: clitic “je” never carries final stress, even when following its verbal head.

⁸ cf. Mertens 1992

⁹ cf. Mertens 1987: 111, 1993: 49-50.

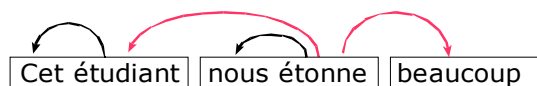
¹⁰ A term used by Tesnière 1959: 94-96. These are elements that do not depend on others and that form an independent utterance, e.g. “non, bonjour, salut, parbleu, soit, allez, voyons...”.

prepositions (“à la *suite* de”) and compound conjunctions (“à *condition* que”) function as sequences of elements each of which is potentially clitic depending upon its part of speech¹¹.

4. Intonation and syntax

4.1. Agreement between intonation and syntax

Two elements in a dependency relation are *connected*. In « cet étudiant nous étonne beaucoup », the pairs of connected elements are « cet + étudiant », « nous + étonne », « étudiant + étonne » and « étonne + beaucoup ». In intonation analysis, significant dependency relations are those between adjacent stress groups, as found in the prosodic skeleton of the linear form. In French, prosodic organisation relies on the strength of the boundaries carried by the tones in final stress position, and stress groups are the smallest units that can carry final stress and as such can participate in prosodic structuring. Two stress groups are connected if their respective heads connect. In the following example, the pairs of adjacent connected stress groups are « cet étudiant + nous étonne » and « nous étonne + beaucoup ». In general, as with stress groups, two objects are connected if their local heads are connected.



A verb kernel may be pronounced in several ways, by varying intonation. However these intonations are well formed only if they respect certain constraints made explicit in the prosodic skeleton.

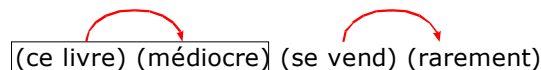
Stress position is constrained: only syllables in final position of a stress group can carry a final stress (AF) and only the start (initial or second syllable) of lexical element can carry initial stress (AI).

The utterance « ce livre médiocre se vend rarement » contains four stress groups. It can be pronounced in four, three, or two intonation groups. So, certain prosodic variants of the same string differ by the number of final stresses. This type of variation can be described as the merger of two or more stress groups into a single intonation group. In (a), each stress group is realized as an independent intonation group; in (b), the first two stress groups are merged into a single intonation group.

- (a) (ce livre) (médiocre) (se vend) (rarement)
- (b) (ce livre médiocre) (se vend) (rarement)
- (c) (ce livre) (médiocre) (se vend rarement)
- (d) (ce livre médiocre) (se vend rarement)
- (e) *(ce livre) (médiocre se vend) (rarement)
- (f) ?(ce livre médiocre se vend rarement)

¹¹ In “à condition que tu partes”, stress falls on the syllable “tion” rather than on the syllable “que”. In contrast with clitic pronouns, final prepositions and conjunctions that are part of a prepositional or conjunction compound are not integrated in the **GA** they precede.

However (e), with groups 2 and 3 merged, is not well-formed. The explanation lies in the presence or absence of a dependency relation. Whereas in examples (a) to (d), the parts that are grouped together, are also connected, this is not the case for (e).



This is captured by the rule below.

(MCSG) *Merger of connected stress groups*: Only stress groups that are connected may be merged into one intonation group.

Variant (f) is unnatural, although the MCSG constraint is respected. This is explained by the length of the linear chain: an intonation group of six syllables is exceptional, although not impossible.

The following examples all consist of two stress groups. The common pronunciation as two intonation groups, exemplified in the first two items, would be strange for the third, because it would result in two adjacent syllables carrying a stress of type AF.

- (a) (il habitait) (dans un appartement)
- (b) (il habitait) (ailleurs)
- (c) (il habitait là)
- (d) ? (il habitait) (là)

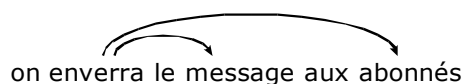
We formulated the following rule.

(SMSG) *Spontaneous merger of stress groups*: If the second of two connected stress groups is monosyllabic, they are normally merged into one intonation group.

The above constraints involve the *possibility* for a stress group to become stressed. The following paragraph examines constraints on the *selection of tones* used in stressed position.

Prosodic grouping results from the tones in final stress position and more particularly from the boundary levels of these tones. Example (a) below has a well-formed intonation; the sequence of the final tones /LL and HH results in the grouping of the first two GIs into one single package; then, the sequence HH L-L- creates a second package that includes the first one. In contrast, example (b) results in a prosodic grouping that sounds wrong.

- (a) $\{((on\ enverra_{LL}) (le\ message_{HH})) (aux\ abonnés_{L-L})\}$
- (b) $*\{(on\ enverra_{HH}) ((le\ message_{LL}) (aux\ abonnés_{L-L}))\}$



Let's examine the dependency relations between the intonation groups in this utterance, i.e. between the basic units of prosodic organisation. The second and third groups correspond respectively to the direct and indirect object; hence

they are dependents of the verb, i.e. of the first group. In (a) prosodic grouping links connected elements: verb and object, in the first package, and verb and indirect object in the larger package. In (b), however, the same mechanism results in the grouping of two unconnected dependents (direct object and indirect object). A systematic analysis of combinations of intonation group contours, the dependency relations at play and the grammaticality of the resulting utterances, leads to the following generalization:

(PGCE) *Prosodic grouping of connected elements*: Within a dependency cluster, only connected parts may be grouped by intonation.

This rule predicts for instance that in « j'ai divisé en catégories ces comportements étranges », the prosodic boundary after « en catégories » should be stronger than that following « j'ai divisé ». Similarly, in « il publie souvent des livres », the adverb will be grouped with the verb, rather than with the object. Given two prosodic boundaries A and B, the notation « A < B » will indicate that the boundary level of A should be lower than that of B; the interpretation of « > », « ≤ » and « ≥ » is analogous.

GA [(j'ai) (divisé) (en catégories) (ces comportements) (étranges)]
 GI () () () ()
 /LL < HH > /LL < L-L-

GA [(il publie) (souvent) (des livres)]
 GI () () ()
 /LL < HH ≤ L-L-

GA [(il publie) (souvent) (des auteurs) (américains)]
 GI () () () ()
 /LL < HH > /LL < L-L-

It should be stressed that this constraint only applies to intonation groups that belong to the same dependency cluster. Below, examples are provided in which two unconnected intonation units are grouped in one intonation package, but their clusters are independent.

4.2. Default intonation

The few constraints above enable us to calculate the default intonation of simple syntactic constructions, consisting of a verbal, nominal or adverbial cluster. By default intonation we mean *unmarked intonation*. Unmarked intonation follows from the syntactic relations between the elements in the linear chain and merely reproduces these relations. It should be kept in mind that determining unmarked intonation aims at identifying objectively and explicitly marked prosodic forms in actual utterances. Therefore, this unmarked intonation is not an obligatory form, nor a “normal” one, that would be the only one possible for the syntactic structure under analysis, but rather a *virtual* intonation that will serve as a reference form for the analysis of the intonation used by the speaker. The default intonation only specifies final stress, as the use of initial stress constitutes a marked form by itself.

First the computation of default intonation in simple constructions consisting of a single cluster is presented. Afterwhich, it will be extended to complex syntactic constructions involving several adjacent clusters, or in prosodically marked constructions such as clefts.

In an utterance consisting of a single (verbal, nominal, adverbial) cluster, the entire cluster receives a final stress which will be placed on the last element of the corresponding linear form, i.e. at the right boundary of the cluster (examples a, b). When the cluster contains two or more stress groups, of course it is possible to have several stresses, provided the constraints given above are met (examples c to f).

(a)	(attention)	nominal cluster
	with 1 SG	
(b)	(il en apportera)	verbal cluster with
	1 SG	
(c)	(il viendra) (ce soir)	verbal cluster with
	2 SG	
(d)	(il viendra ce soir)	id.
(e)	(on enverra) (le message) (aux abonnés)	verbal cluster with
	3 SG	
(f)	(on enverra le message) (aux abonnés)	id.

A cluster of several stress groups is usually pronounced in several intonation groups when the length of the linear form exceeds four syllables. Multiple intonation groups are obtained, the internal organisation of which will follow the constraints described above.

(a)	un enfant qui joue // oublie le monde extérieur \\\
(b)	un enfant / qui joue // oublie le monde extérieur \\\
(c)	*un enfant // qui joue oublie // le monde extérieur \\\
(d)	*un enfant // qui joue / oublie // le monde extérieur \\\
(e)	un enfant // qui joue / avec ses jouets // oublie le monde extérieur \\\

In the above examples, the symbols /, // and \\\ indicate *relative intonation boundaries* of minor, major or terminal strength, respectively. The major boundary is introduced by tones HH, H/H or LH, the minor boundary by /LL, \LL or LL and the terminal boundary by L-L-, LL- or HL-.

Example (a) illustrates the pronunciation as two intonation groups; the first IG corresponds to a nominal cluster that depends on the head of the following IG. In (b) the subject cluster appears as two IGs. Form (c) goes against constraint *MCSG*, since « qui joue » and « oublie » are unconnected, although they belong to the same cluster. Similarly, form (d) breaks constraint *PGCE*. In spite of the similarity between the intonations of (d) and (e), intonation (e) is well-formed, since constraints *MCSG* and *PGCE* are met.

In such cases, where a nominal phrase is followed by a relative clause, the question of whether the intervening boundary should be marked prosodically by a stress on the nominal phrase arises. This appears to be impossible to answer on the basis of constituent type alone, as the dependency network, the number of syllables and the relative strength of boundaries need to be taken into account. However, these factors apply to other types of constituents as well. In other words, constituent type is not required to predict prosodic structure.

Besides lexical elements and dependency relations, syntactic structures usually include *translative* elements, such as prepositions, relative pronouns,

auxiliary verbs and subordinating conjunctions. Their prosodic status needs to be defined.

As for clitic translatives, their prosodic behaviour is analogous to that of other clitics (clitic pronouns, articles, possessive determiners...). In the example « (la personne) (que tu vois) (était) (mon voisin) », the translative (clitic relative pronoun) « que » is integrated in the stress group of the verb « vois ». The translative's behaviour is like that of the pronoun « tu », which also depends upon the verb.

Auxiliaries are non-clitic translatives. The following examples contain the auxiliary « avait », which, as a verb, generates its own stress group.

- (a) *(la panique_{HH}) (qui avait saisi_{HH}) <(la société_{L-L})*
- (b) *(la panique_{HH}) >((qui avait_{LL}) <(saisi_{HH}) <(la société_{L-L})*
- (c) ** (la panique_{HH}) (qui avait_{HH}) ((saisi_{LL}) (la société_{L-L}))*

Intonations (a) and (b) are well-formed. In (a) the auxiliary is integrated in the IG of the main verb. In (b) it gives rise to an independent IG, but its boundary should be weaker than that of the main verb, such that together they form a package. As a matter of fact, when this is not the case, an ungrammatical utterance is obtained, in which prosodic grouping results in a package « saisi la société » (c), whereas the well-formed utterances contain the package « avait saisi ». This behaviour is predicted directly by the rules given thus far, provided that the auxiliary is considered to be a dependent of the main verb. This leads to the following hypothesis: prosodically, a non-clitic translative (such as the auxiliary) behaves like a dependent of the syntactic head of its argument. This observation is significant for syntactic analysis. If the translative's prosodic behaviour is analogous to that of a dependent, it would be strange to consider it to be the syntactic head of the verb cluster. Indeed, this would mean that one and the same element is syntactic governor and at the same time prosodic dependent.

4.3. Intonation and syntactic construction

So far we have explored simple syntactic constructions consisting of a single cluster. Consideration is now given to the prosodic properties of syntactically marked constructions.

4.3.1. Obligatory prosodic boundary

Before starting the systematic analysis of the intonation of such constructions, a clear understanding of the notion of *obligatory prosodic boundary* is required.

- (a) *(l'année_{LL}) (universitaire_{HH}) (commence_{LL}) (demain_{L-L})*
- (b) *(l'année universitaire_{HH}) (commence_{LL}) (demain_{L-L})*
- (c) *(l'année_{HH}) || (elle commence_{LL}) (demain_{L-L})*
- (d) ** (l'année elle commence_{LL}) (demain_{L-L})*

In « l'année universitaire commence demain » (a, b), the stress on « année » is optional: the stress group may be stressed (a), or it may be merged with the following SG into one IG (b). However, in « l'année, elle commence demain » (c, d), not only is the stress on « année » obligatory, but the

construction also requires a major boundary after that IG. This obligatory prosodic boundary (OPB) will be noted by a double vertical line ‘||’. As shown below, several constructions contain such a boundary at a particular point of their internal structure. The prosodic phenomenon of the OPB results from an *underlying boundary* in the syntactic construction. Therefore, syntactic constructions are not neutral with respect to intonation. On the contrary, they possess prosodic properties that are lost in written language.

4.3.2. Left dislocation

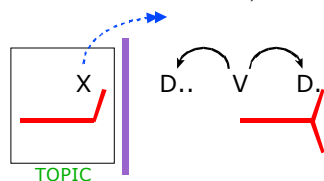
In the *dislocation* construction (*double marquage*) a referent governed by the verb appears twice, once as a clitic and then or again in a non-clitic, usually lexical, form. Two distinct types of dislocation can be discerned, left and right, according to the position of the non-clitic element before or after the verbal cluster: « Les livres, il les jette. Elle lui profite, cette attitude ». Both types also differ by the marking of syntactic case, obligatory in the case of right dislocation.

- (a) *ces livres || il y tient* (dislocation of referent)
 (b) *il y tient || à ces livres* (dislocation of syntagm)

A left dislocation construction consists of at least two parts. The central part consists of a verb kernel headed by a finite verb and containing one or more direct or indirect dependents, one of which takes a clitic form. This central part is preceded by a front (anteposed) part, consisting of a saturated dependency cluster that is coreferent with one of the clitic dependents of the central part (note that coreference does not require agreement of syntactic function).

- (a) *ce disque || on le demande partout*
 (b) *Jean-Christophe || je lui ai dit de revenir demain*

At the prosodic level, the front and central parts are separated by an OPB, leading to a tone with a major boundary on the front part. The end of the central part carries a major or terminal boundary tone. These properties are made explicit in the scheme below, in which a full arrow indicates a dependency relation, a dotted arrow a coreference relation, and the vertical line the OPB.



As for information structure, the front part is interpreted as the *topic* of the assertion expressed by the finite verbal cluster, i.e. as the referent the assertion is about and for which it expresses relevant information (cf. Lambrecht’s definition).

In left dislocation with multiple anteposed elements (autonomous clusters), the OPB appears after the last element before the central part. The boundaries between the anteposed elements will have a strength lower or equal to that of the OPB. Their relative strength can result in their prosodic grouping as in (c).

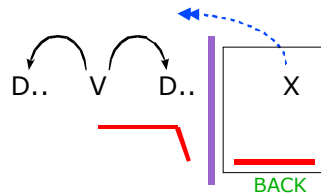
- (a) *Jean-Christophe, ≤ la voiture || je lui ai dit de la nettoyer
demain*
 (b) *Le vélo, || le guidon || ils sont cassés*
 (c) *Le vélo, < le guidon || il est cassé*

4.3.3. Right dislocation

Right dislocation also involves a central part in the form of a saturated finite verb cluster, followed by an autonomous cluster coreferent with one of the immediate clitic dependents of the verb. At the prosodic level, an OPB separates the central part from the following peripheral part. The latter carries a low appendix contour when preceded by a terminal tone.

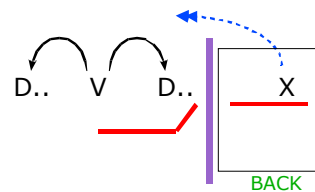
At the level of information structure, the right part is interpreted as *background information*, adding little to the information provided by the central part.

- (a) *On les voit partout \ ces graffitti*
 (b) *Ca devrait être objectif \ la science*



In the case of a non-terminal tone on the central part, a high appendix contour is found.

- (c) *Tu l'a déjà vu // ce graffitti*



4.3.4. Cleft construction

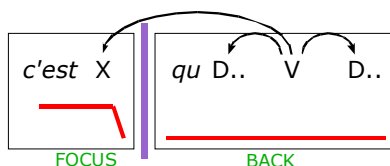
The cleft construction follows the scheme « c'est X qu.. + verb cluster ». Two parts may be identified¹²: the first construction part is introduced by « c'est », the second is introduced by a relative pronoun and contains a saturated or unsaturated verb cluster. The X element in the left part functions as a (valency or peripheral) dependent of the verb cluster in the right part. The relation between both parts is syntactically marked by the relative element. Both parts are separated by an OPB. Two prosodic configurations occur.

In the first configuration, the left part is accompanied by a terminal boundary (tones HL- or L-L) and the right part carries an appendix contour. The

¹² For a similar analysis, see Lambrecht (2001). Instead of Lambrecht's terms « phrase relative » et « phrase matrice » we use the term « construction parts ».

left part is interpreted as a prominent information element and the right part as background information.

- (a) *c'est les livres_{HL} \ qu'il jette_{L-L}*
 (b) *c'est lui_{L-L} \ qui jette les livres_{L-L}*
 (c) *c'est à lui_{L-L} \ que cette attitude profite_{L-L}*



In the second prosodic configuration, the left part receives a major boundary, and the right part receives a terminal boundary. In this case both parts have equal informational importance; in the absence of an appendix, no part is marked as background information.

- (d) *c'est précisément là_{HH} \ que des problèmes d'emploi_{LL} surgissent_{L-L}*
 (e) *c'est lui_{HH} // qui jette les livres_{L-L}*

The existence of two prosodic configurations points to a syntactic contrast. The first intonation, which entails focus on the cleft element, answers a partial question, about a single referent: « qui jette ces livres ? — c'est lui_{L-L} \ qui jette les livres_{L-L} ». The second intonation type does not: example (d) does not answer the question « où surgissent les problèmes d'emploi ? ».

4.3.5. Combinations of constructions

The combination of left and right dislocation results in three parts: front, central, and back parts. Their syntactic, prosodic and informational properties match those of the corresponding parts of simple constructions.

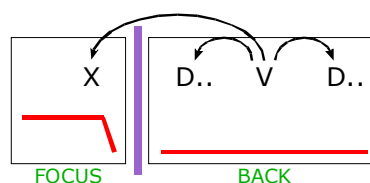
Jean-Christophe \ je lui ai dit de la nettoyer demain \ la voiture

Cleft construction and left or right dislocation may also combine. These complex constructions once again maintain the syntactic, prosodic and informational properties of the corresponding parts in basic constructions.

Anne Catherine_{HH} \ c'est là_{HH} \ qu'elle les a achetés_{L-L} \ ces disques_{L-L}
Anne Catherine_{HH} \ c'est là_{HL} \ qu'elle les a achetés_{L-L} ces disques_{L-L}

4.3.6. The binarisation dispositive

The pronominal approach uses the term *dispositif de binarisation* for utterances like « Du gâteau_{HL} on a mangé_{L-L} » or « À lui_{L-L} cette attitude profite_{L-L} », in which a dependent of a saturated verb cluster is anteposed before the verb cluster. In contrast with dislocation, binarisation does not involve a clitic pronoun coreferent with the anteposed element. The latter takes a terminal tone, and is followed by both an OPB and an appendix. Given these prosodic markers, the anteposed element appears as the only relevant information element in the utterance; the governing verb cluster, on the other hand, takes a background position and its role is limited to indicating the syntactic function of the focalized referent in the proposition.



4.3.7. Cluster-internal prosodic break

In the following examples from broadcast interviews, a terminal tone HL- appears in utterance-internal position and whatever follows that tone is pronounced with an appendix contour. In such a configuration, the semantics of the HL- tone affects the element carrying the tone, or more precisely its denotation. The words in question are highlighted and interpreted as being essential to understand the message.

*Ça a changé de forme aujourd'hui. Tout le monde **sait**_{HL-1} que la culture est misogyne₁.*

(Speaker: B. Groult)

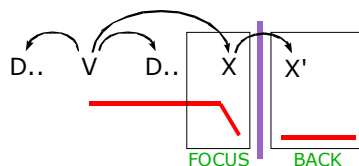
*Il a contribué puissamment à la destruction du **mythe**_{HL-1} littéraire₁.*

(Speaker: R. Barthes)

The information « la culture est misogyne » was already activated before the utterance started and the listener understands that the speaker insists not on the information itself, but on the fact that it is known to everyone.

The intonation contour « HL- + appendix » also appears in right dislocation, where the postposed part carries an appendix. However, both cases differ as to the alignment between syntactic structure and intonation: whereas in right dislocation the terminal tone appears in cluster-final position, here it appears *inside the cluster*.

Default intonation does not allow a terminal tone in a position internal to the cluster. The use of a terminal tone inside the verb kernel is a highly marked prosodic form since it causes the decomposition of the cluster by the insertion of a major prosodic boundary. The boundary is inserted at an internal syntactic boundary¹³. In the first example, the object « que la culture est misogyne » is separated from the governing verb; in the second, the adjective « littéraire » is separated from its nominal head.



In these examples, prosody and syntax are out of phase, so to speak. Sometimes this kind of phase shift is the only way to focus a particular lexical

¹³ cf. Mertens 1997 : §4.4.2

element. Word order plays a role in explaining these phenomena. In the noun phrase « mythe littéraire », the adjective necessarily follows the noun, but the unmarked position for the terminal tone is at the end of the cluster; this combination of constraints prevents the noun from being the sole focus, without a simultaneous focus on the adjective. However, when the HL- tone is placed on the noun, the nominal cluster is broken, and the appendix forces the adjective into the background.

4.3.8. Adjuncts

Certain adjuncts preceding or following the verb kernel behave like the dislocated elements in dislocations: an obligatory prosodic boundary follows the fronted adjunct, whereas in postposition the adjunct carries an appendix contour. This is the case for so-called sentence adverbs:

décidément || *il faudra trouver quelqu'un d'autre pour le faire*
je ne sais plus comment faire *franchement*
je suis d'un autre avis *comme tu sais*
avec ça || *je me demande comment on va faire*
puisque tu insistes || *il prendra le train*

4.3.9. Appositions and parentheticals

Appositions are delimited by OPBs. This also holds true for parentheticals, which are usually accompanied by a register change.

Babar || *le jeu roi des éléphants* || *et sa femme* || *la reine Céleste* ||
viennent de partir en ballon pour faire leur voyage de noces.
mais je crois que c'est à ces problèmes essentiels que nous devons
consacrer || *si monsieur Fabius naturellement en est d'accord* || *notre*
entretien de ce soir
(Speaker: J. Chirac)

4.3.10. Other constructions

The *dispositif restrictif*, as found in « Il n'y a qu'à lui que cette attitude profite. », shares the syntactic, prosodic and informational properties of the cleft construction.

The presentational construction matches the scheme « il y a X qu.. + *verb cluster* », which is similar to that of the cleft. However, whereas the utterance « Il y a Pierre qui demande la clé » is proportional to « il y a ça » but not to « il/qui demande la clé », the utterance « c'est Pierre *qui demande la clé* » is proportional to « il/qui demande la clé » but not to « c'est qui/lui ». The second part of the presentational construction does not call for an appendix contour.

5. A predictive approach to the analysis of intonation in discourse

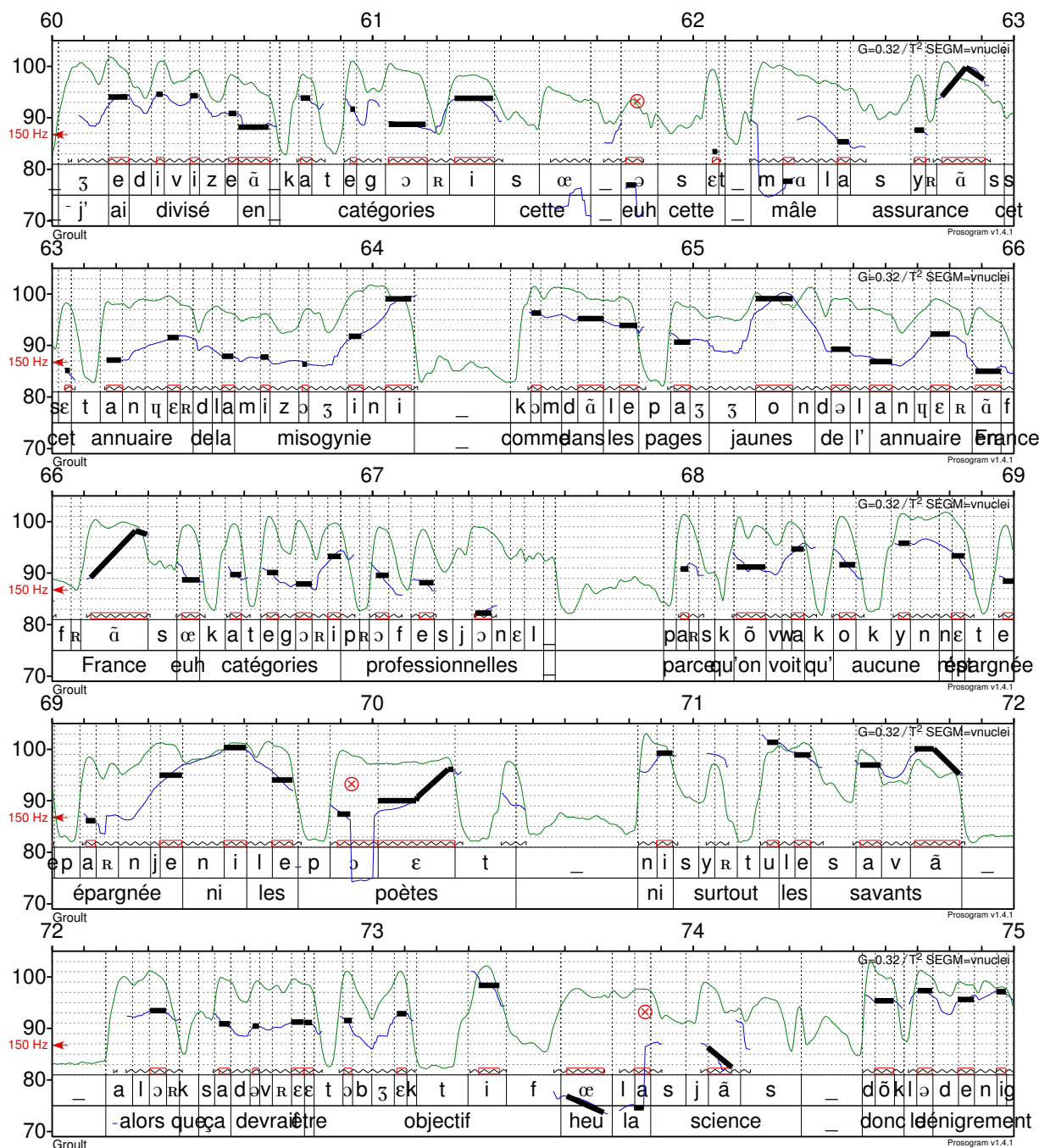
A framework for syntactic analysis, based on dependency, « translatifs », valency and constructions, was described above. Principles for the behaviour of intonation in French were formulated, including the formation of stress groups, their possible developments given the syllabic material and the dependency relations, prosodic grouping and its relation with the dependency network, and

prosodic properties of syntactic constructions. These principles may be used in a procedure for discourse analysis, aiming at making explicit the role of intonation in spoken language.

This analysis procedure consists of two major steps. First, default intonation is determined on the basis of the syntactic properties of the sequence. This virtual form is then confronted with the actual pronounced intonation. Differences between both default and actual forms enable marked prosodic forms to be pinpointed. This provides an objective basis for interpreting the contribution of intonation to meaning. As stated above, in certain syntactic constructions in French, the role played by intonation largely coincides with that of syntactic structure, both aspects being closely related. As the approach is based on the comparison of two intonation forms, namely default intonation, as predicted by syntax, and actual intonation, it qualifies as a *predictive approach*.

To illustrate this approach, the procedure is applied to a corpus fragment. This is part of an interview by Benoîte Groult on Swiss radio.

j'ai divisé en catégories ce ce cette "mâle assurance" cet annuaire de la misogynie comme dans les pages jaunes de l'annuaire en France catégories professionnelles parce qu'on voit qu'aucune n'est épargnée ni les poètes ni surtout les savants alors que ça devrait être objectif la science. (B. Groult, 58.9s)



First the speech chain is divided into autonomous dependency networks (ADN), which are demarcated by brackets in the notation below. For instance, the sequence « j'ai divisé en catégories cette "mâle assurance" » forms a single ADN since all elements are both directly or indirectly connected *and adjacent*. In general, an element is located at the right boundary of an ADN when there is no direct or indirect dependency relation between the element and the next element. Note the treatment of hesitations and *clitic* repetitions: they are treated like clitic elements, and are incorporated in the stress group on the right.

[j'ai divisé en catégories ce ce cette mâle assurance]
 [cet annuaire de la misogynie]

[comme dans les pages jaunes de l'annuaire en France]
 [catégories professionnelles]
 [parce qu'on voit qu'aucune n'est épargnée]
 [ni les poètes ni surtout les savants]
 [alors que ça devrait être objectif la science]

The segmentation into ADNs is not always obvious.

In the fragment above, the sequence « cet annuaire de la misogynie » may be analysed in two ways. First, as an autonomous dependency cluster; indeed, the object slot of the verb « ai divisé » is already saturated by « cette mâle assurance » and each valency position can be saturated only once. Alternatively, it may be analysed as the second instance of the referent already denoted by « cette mâle assurance », by a well-known phenomenon of incremental development¹⁴ of a referent. The possible relation between « assurance » and « annuaire » does not originate from a dependency relation between both elements, or between each of them and the verb, but rather from the role that each of these elements *could* play in relation to the verb « ai divisé ». Here we will assume the first analysis; however the alternative analysis would result in the same default intonation.

The sequence « comme dans les pages... » can function as a dependent (manner complement) of « ai divisé » and as such constitute part of the verb kernel. However it is separated from that kernel by another ADN (« cet annuaire de la misogynie »).

When reading the fragment, one may tend to relate « catégories professionnelles » to « comme dans les pages... », although there is no syntactic motivation for doing so, as contiguity does not imply the presence of a syntactic relation. Alternatively, assuming « catégories professionnelles » is an apposition, it will be delimited by OPBs.

« alors que », a subordinating conjunction according to traditional grammar, is however separated from its governor by other ADNs and therefore constitutes an ADN in its own right. The subordination relation, suggested by the meaning of the conjunction, cannot be determined here on syntactic grounds and therefore supposes an interpretation by the listener.

After segmentation into ADNs, we calculate the prosodic skeleton and apply prosodic constraints, to obtain the default intonation (DI).

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  [(j'ai) (divisé) (en catégories) (ce ce cette mâle) (assurance)]
GA ( o ) ( . . . o ) ( . . . . o ) ( . . . o ) ( . . o )
GI (      ) (      ) (      ) (      )
DI          /LL <          HH >          /LL          |||

  [(cet annuaire) (de la misogynie)]
GA ( . . o ) ( . . . . o )
GI (      ) (      )
DI          /LL <          |||

```

The stress group formation rule produces five groups for the first ADN; they are delimited by parentheses on the layer labeled GA. These stress groups

¹⁴ cf. Blanche-Benveniste *et al.* (1990 : 17-29).

are reorganised into GIs by the application of the MCSG, SMSG, PGCE principles. The following phenomena are expected.

1. The merger of the groups « j'ai divisé » into one GI: the elements are connected and the auxiliary is monosyllabic.
2. The prosodic boundary after « divisé » should be weaker than that after « catégories », since both elements are connected.
3. The boundary after « catégories » should be stronger than that after « mâle », since both elements are unconnected.

The boundary after « assurance » requires a major prosodic boundary (|||), either a terminal boundary (L-L-), when the speaker presents the cluster as a completed information structure, or a non-terminal boundary (HH, H/H, LH...), when the intention is to complete it by other elements, in other words when the speaker wants to keep a link with what follows. Obviously, the non-terminal boundary may also be used as a strategy to avoid the loss of speaker turn.

The comparison of the default intonation (DI) with the intonation that was actually pronounced (RE) reveals both similarities and differences.

GA	[(j'ai) (divisé) (en catégories) (ce ce cette mâle) (assurance)]
GI	() () () ()
DI	/LL < HH > /LL
RE	\LL H H'H H H/H

GA	[(cet annuaire) (de la misogynie)]
GI	() ()
DI	/LL <
RE	HH H/H

On the whole, the predicted forms match the forms used by the speaker: as the two ADNs end in major prosodic boundaries, the relative strength of the internal boundaries is respected resulting in the predicted intonation packages. There are two exceptions: by putting an initial stress on « mâle », the speaker isolates the sequence « mâle assurance », indicating that it should be understood as a single semantic unit; in the same way the word « catégories » is made prominent.

The two ADNs take a major non-terminal prosodic boundary. The speaker thus indicates that the information structure is incomplete and that additional elements are required to complete it. The information structure started here will remain open until the terminal contour on « professionnelles » is reached two ADNs later.

The ADN « comme dans... » is terminated by a LH tone on « France », expressing both continuation and requesting approval. The initial stress on « comme » marks the start of the comparison and makes it prominent. The continuation on « France » and the finality after « professionnelles » creates an intonation package that covers the two ADNs linking them by prosodic means, which compensates for the absence of a syntactic link.

GA	[(comme dans les pages) (jaunes) (de l'annuaire) (en France)]
GI	() () () ()
DI	< HH /LL
RE	H HH /LL LH

GA [(catégories) (professionnelles)]
 GI () ()
 DI /LL < |||
 RE HH L-L-

GA [(parce qu'on voit) (qu'aucune) (n'est) (épargnée)]
 GI () () ()
 DI HH > /LL < |||
 RE /LL /LL HH

GA [(ni) (les poètes) (ni) (surtout) (les savants)]
 GI () () ()
 DI HH > /LL < |||
 RE H LH H HH HL-

GA [(alors) (que ça devrait) (être) (objectif) euh (la science)]
 GI () () () ()
 DI /LL /LL ||| APP
 RE /LL /LL HL- 1-.....1-

The subordinating conjunction « parce que » calls for a governing proposition, at least according to traditional grammar. Here, it is preceded by a maximal prosodic boundary, indicating that it opens a new proposition or discourse unit. In spoken language « parce que », like other conjunctions, may be used independently of a governing verb cluster¹⁵.

The syntactic relation between « parce qu'on voit qu'aucune n'est épargnée », on the one hand, and « ni les poètes, ni surtout les savants », on the other, is not obvious. However the two clusters are brought together by the prosodic grouping which turns it into a single maximal package.

The ADN « ni les poètes, ni surtout les savants » presents several marked tones. Initial stresses mark the start of the two parts introduced by « ni », underlining the symmetry of the construction. Whereas the use of the LH tone on « poètes » involves the listener in what is said, the HL- tone stresses the importance of the word « savants » for the message, which will be further commented on by the speaker in what follows.

The last part of the fragment provides an example of dislocation embedded in a proposition introduced by the conjunction « alors que ». The construction is accompanied by the predicted prosodic markers: OPB between the saturated verb cluster and the dislocated element, terminal contour on the verb cluster, and appendix contour on the dislocated part. The HL- tone on the verb cluster shows the importance of the word « objectif » to the assertion, while signaling the involvement of the speaker.

The contribution of intonation observed in the analyzed fragment can be summed up as follows. First, intonation subdivides the speech chain into three major units, terminated by a maximal prosody boundary. These units may or may not be coextensive with traditional syntactic phrases, as indicated by the autonomy of subordinate clauses.

1 ([j'ai divisé en catégories ce ce cette mâle assurance] //
 [cet annuaire de la misogynie] //
 [comme dans les pages jaunes de l'annuaire en France] //
 [catégories professionnelles L-L-])

¹⁵ cf. also Berrendonner 2002: 28.

- 2 ([parce qu'on voit qu'aucune n'est épargnée] //
 [ni les poètes ni surtout les savants HL-])
 3 ([alors que ça devrait être objectif HL- la science])

Second, it makes explicit the internal structure of these major units, by means of prosodic grouping. This allows for the association of parts without segmental, morpho-syntactic indications. Initial stress provides additional internal structure. These two aspects may be visualised as follows.

- 1 ([j'ai divisé en catégories ce ce cette mâle assurance] //
 [cet annuaire de la misogynie] //
 ([comme dans les pages jaunes de l'annuaire en France] //
 [catégories professionnelles L-L-]))
 2 ([parce qu'on voit qu'aucune n'est épargnée] //
 [ni les poètes ni surtout les savants HL-])
 3 ([alors que ça devrait être objectif HL- la science])

Third, intonation adds information that could not be expressed in another way, e.g. by lexical, morphological or syntactic means. This is the case of marked intonation morphemes such as final and initial stress tones.

- 1 ([j'ai divisé en catégories ce ce cette mâle assurance] //
 [cet annuaire de la misogynie] //
 ([comme dans les pages jaunes de l'annuaire en **France LH**] //
 [catégories professionnelles L-L-]))
 2 ([parce qu'on voit qu'aucune n'est épargnée] //
 [ni les poètes ni surtout les savants HL-])
 3 ([alors que ça devrait être objectif HL- la science])

6. Discussion and conclusion

Nowadays, there seems to be a consensus (Blanche-Benveniste 2004, Berrendonner 2004) that the notion of the sentence, as inherited from traditional grammar, does not constitute an operational unit for the *segmentation* of the speech chain into *minimal discourse units*. Several alternative units have been proposed for French. In her critical analysis of these alternatives, Simon 2003: 131 observes a tendency towards a fragmentation of discourse into smaller units, some smaller than the syntactic proposition. However, the definitions of these alternative units refer to the mental representation of discourse information by the speaker and the listener, and it is not clear how one can verify statements about these representations. In contrast, the segmentation proposed here relies on several types of information, namely dependency relations, syntactic construction and prosodic form, which are readily observed and reproducible and largely unambiguous. In a first step, the establishment of the dependency network leads to the identification of autonomous dependency networks, which are combined into larger structures by means of syntactic constructions or prosodic grouping. This results in a reproducible segmentation based on formal criteria that are both objective and verifiable.

In common approaches to discourse analysis, prosody is often treated with low regards. Typically, the *hierarchical organisation* of the analyzed discourse fragment is set out, on the basis of logical or pragmatic relations between the discourse units. Only then is prosody considered in order to

determine to what extent it confirms the assumed organisation. In the predictive approach, in contrast, prosody receives a prominent role, equal to other organising principles in syntax such as valency, dependency and construction. It is intonation that determines whether two otherwise independent units are part of a larger structure, and whether or not an information unit is completed.

Moreover, in our approach, the *role of intonation* is not limited to the hierarchical organisation of bits of speech. On the contrary, a variety of prosodic forms are identified which make explicit other types of information, such as the informational status of this or that element or the way in which the speaker presents that information.

The prediction of default intonation enables a separation between informational aspects linked to syntactic structure and aspects contributed by intonation. It appears that *syntactic constructions* are not neutral with respect to prosody. Default prosody allows a characterisation of the informational status of elements, without the need for a preliminary semantic interpretation of the message or pragmatic context. Instead of providing *a priori* definitions of notions such as topic, focus, assertion, we merely observe that specific parts in some constructions, given their prosodic properties, will be interpreted as topic, focus, information background, and the like. Our analysis moves from form to meaning, not the reverse.

We do not deny that discourse presents levels of organisation other than those indicated by syntactic or prosodic relations. We do not question the existence of anaphoric relations, coreference relations, logical relations between propositions, world knowledge representation, or the dynamic nature of conversation. As it is not obvious that linguistics is able to provide the tools required to describe the inferences made by speakers, it is wise to take full advantage of tangible aspects such as prosody and syntax.

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