

Cross-linguistic prosodic transcription: French vs. English

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CROSS-LINGUISTIC PROSODIC TRANSCRIPTION: FRENCH VERSUS ENGLISH

Introduction

Every language makes use of variations in fundamental frequency (Fo), duration and intensity. Universal tendencies have been observed (Bolinger, 1978), but it is now established that there are "semantic", "systemic", "realizational" and "phonotactic" distinctions in intonational structure between languages (Ladd, 1996). Language comparison is very challenging, since some of the aspects of intonation are universal whereas others are highly language-specific. Hirst and Di Cristo (1991) hope that a "third generation" model of intonation will come to light, a model which will go beyond single-language descriptions (the "first generation") and multi-language descriptions (the "second generation"), defining independent levels of representation determined by general linguistic principles. But research in this field faces major methodological difficulties. The "second generation" has not reached full development yet. The obvious problem is the lack of a comparable way of describing prosody in different languages.

This paper aims to give an insight into some specific traits of French prosody. By illustrating the specificity of French, the aim is to bring to light some characteristics which make French prosodically very different from English and other stress languages. The discussion thus comes to grips with the difficulties of elaborating a unique way of describing prosody across languages.

An introductory part deals with some of the current methods for describing intonation. Well-known notions concerning French prosody are then recalled succinctly. Finally, some basic traits of French are expounded and illustrated.

The present strand of thought is not based on one particular corpus. It draws from knowledge accumulated over the years. The data for both languages (French and English) is partly based on the literature: essentially Maeda for syntactic intonation in English; Pierrehumbert, 1980 for pragmatic intonation in English; Ladd for useful discussions about Pierrehumbert's work; for French: Delattre, di Cristo, Faure, Rossi and Martin. (I cannot attempt here a full review of the works on French prosody which, over the years, have shaped my present view on French prosody.) My own, first-hand analysis of French and English is another source: it consists in research into prosodic modeling for speech synthesis and speech recognition. See also Vaissière, 1993, and Vaissière, 1995 on language comparison.

1) The search for a common prosodic transcription

In order to conduct multi-language comparison, several kinds of prosodic transcription would have to be used: an acoustic-phonetic one (broad and narrow), a perceptual transcription for the perceptually relevant events in duration, intensity and melody, a phonological transcription, and a functional transcription.

This is much more than is allowed for by the International Phonetic Alphabet. The IPA provides symbols for annotating a certain number of durational, melodic and junctural events: long, half-long and extra-short syllables, a global rise or fall, lexical tones (for which five levels are provided), *downstep* and *upstep*, as well as a certain amount of contour tones and minor and major groups. These notations do not meet the requirements of a full prosodic transcription: two acoustic (or perceptual) transcriptions may sometimes be variants of the same underlying functional (or phonological) contour. Conversely, two different phonological contours may under certain circumstances be represented by the same acoustic profile.

Those who attempt transcriptions that go beyond the IPA will be attracted to current systems which are based on (i) individual targets such as High and Low, (ii) movements such as *rising*, *falling*, or *level*, (iii) levels (*extra high, high, mid, low, extra low*), or (iv) integrated patterns such as the Hat pattern. Let us take a close look at three systems which make different choices in this respect: **INTSINT** (an INternational Transcription System for INTonation developed at Aix-en-Provence in France), the **IPO** way of transcribing (at the Instituut voor Perceptie Onderzoek in Eindhoven, Netherlands), and the **ToBI** system (Tone and Break Indices), in the States, which was originally developed for English (Silverman *& al*, 1992).

a) INTSINT is production-oriented. It is the most-language independent of these systems. Originally, INTSINT aimed to give a surface phonological representation, but it can be adapted to a phonetic transcription, in the same way as ToBI. It has been used for the description of Fo curves in several languages (Hirst and Di Cristo, 1998). A limited number of symbols are used to transcribe relevant prosodic events. Some are absolute (*Top, Mid, Bottom*), others relative (*Higher, Lower, Same, Upstepped, Downstepped*). The terms have the advantage of being easy to learn. They also have a disadvantage: they relate to Fo alone.

b) The **IPO** transcription (t'Hart *et al*., 1990) is listener-oriented. Contours are stylized as sequences of pitch movements and connecting segments. Only the movements that are found to be perceptually relevant are represented. The distinctions are based on whether the movement is a rise or a fall, on whether it extends over one or over more than one syllable, on its temporal position in the syllable, and on its excursion size. The intonation pattern dictates the local choice among various pitch movements, and the order in which they may appear; this vision of things contrasts with a strictly linear approach.

The perceptual relevance of the symbols, which are grounded in perceptual tests, is a clear advantage. But it does not mean that IPO transcriptions are absolute and not relative: research in this field depends on the tools used; recent experiments drawing on state-of-the-art technology led to the recognition of an increased number of relevant pitch movements (Gussenhoven and Rietveld, 2000).

c) **ToBI** was originally devised for labeling computerized corpora of English. It was then adapted to other languages. It is derived from Janet Pierrehumbert's influential Ph.D. thesis (Pierrehumbert, 1980), whose aim was to describe the phonetics and phonology of American English Intonation. Her work has been the source of much inspiring research. Pitch accents, organized in a linear sequence, are considered as the building blocks of an intonation contour (see

Ladd, 1996, for a comprehensive overview of Pierrehumbert's approach). If one stands back to take a global view of ToBI, it appears as a hybrid and somewhat perplexing system. First, it is based on Pierrehumbert's abstract *phonological* description of English prosody, but in fact ToBI is often used as a *phonetic* transcription, since it aims to account for Fo curves as they are actually observed. Using the same symbols as Janet Pierrehumbert may therefore cause confusion. Secondly, the symbols used for describing Fo curves (the "To" part of ToBI) have not been systemically tested perceptually (unlike IPO symbols). The "BI" part, "Break Indices", relates to the perceived cohesion between successive words. This part of the transcription therefore refers to perception, while the "To" part refers to the acoustic, perceptual and phonological side of things. Thirdly, the "To" part uses functional labels such as "boundary tones", which suggest the *function* of the tones (i.e., "boundary tones" have a demarcative function). But the definition of the pitch accents was not originally based on their functional load. The To part thus implies a bit of a functional transcription. To be fair to the original spirit of Janet Pierrehumbert, who intended to describe American English and carefully avoided generalization in her thesis, applying ToBI symbols to a new language requires a prior re-evaluation of the underlying principles.

d) In addition to these three approaches, there are also others, which have a rich tradition behind them. For example, for the advocates of a morphological approach (in the spirit of the Prague school), meaning and function play the front role. Intonation is viewed as a sequence of prosodic morphemes, such as Focus, Theme, Topic, etc. The prosodic morphemes are axioms of the theory. The syntactic-pragmatic intonation of French has been convincingly described using such a method (Rossi, 1999). An abstract representation in terms of relational "holistic gestalts", integrated tonal and temporal whole word profiles, with pitch range variations, also seems well suited to represent attitudinal patterns (see, for French, the work done at ICP in Grenoble, by Aubergé, Bailly and Morlec, Morlec, 1997). A description in terms of levels is also quite acceptable for French (though it is now out of fashion!), at least for the purpose of synthesis: such a description brings to light a set of interesting phenomena, such as the fact that two or more levels may collapse into one depending on the speakers, who use differently their usual Fo range.

Each of these descriptions puts its own constraints on the shape of the representation. They all have the advantage of putting emphasis on one of the indispensable aspects of prosody, i.e. production, perception, phonology, or functional aspects. They are in some way complementary, but they are nonetheless very difficult to relate. More work is needed to draw bridges between them. First, while Fo turning points are often considered as crucial in perceptual accounts, some may not be written down by a corresponding symbol in ToBI. Second, as is well known, an acoustic final rise may be perceived as a fall depending on the preceding Fo curve (Hadding-Koch and Studdert-Kennedy, 1964): a transcriber may hesitate between the curve he observes (a rise) and what he actually hears (a fall). Third, a final rise may have several uses: it generally indicates a question (intoneme [Question]), an unfinished clause (intoneme [Continuity]), or an exclamation; moreover, it often ends statements in spontaneous speech; it may also be used for “keeping the floor” and various stylistic purposes. These roles of the final rise are clearly different. A phonological transcription should avoid using one and the same symbol (for example, H%), as these types of rises, which may sometimes correspond to the same Fo contours, are perceptually distinguished (Fonagy and Bérard, 1973). A "morphological" transcriber may be influenced by what he feels as the norm, and transcribe a final rise at the end of the sentence as a fall, deliberately choosing to ignore what he sees and what he hears. Fourth, categorical tonal distinctions appear to depend primarily on the pitch in *successive* syllabic nuclei and the presence or absence of an immediately following pitch change, at least for accented syllables (Hermes and Rump, 1993). The perception of a tone therefore depends on its context. The principle of an

independent choice of the successive tones has to be called into question, at least at the perceptual level. This, in turn, raises the question of the optimal size of the window (in terms of number of syllables) to perform a perceptual transcription. Fifth, the extension or diminution of the pitch range (local or global), or a change in overall mean pitch and pitch excursion size, are all relevant features of pitch changes (Bolinger, 1986): a phonological transcription should provide symbols for all the prosodic phenomena that are relevant at the functional level. Whereas a phonetic transcription may reveal neutralization, a phonological transcription should provide two different strings of symbols for two different functions. Sixth, not only boundary tones may play a demarcative role: a host of other factors come into play, such as Fo resetting, Fo downstep, Fo declination, pause, inter-stress interval, final syllable lengthening, and possibly laryngealization. Restricting a prosodic transcription to the description of Fo contours means running the risk of incompleteness. I would therefore submit that no uniform way of transcribing can be optimally adapted to the representation of all types of intonational events, syntactic, modal, pragmatic and attitudinal. Each transcription is adapted to one particular set of data. For English, Chomsky and Halle's abstract rules on stress levels in neutral utterances, on the theoretical side, supplemented by the use of the Hat Pattern principle and Fo resetting to account for the way they are actually realized, are very effective for describing Fo curves in neutral read sentences (S. Maeda, 1976; Vaissière 1993). A superpositional approach commends itself to describe the interaction between modality and focus in English. Janet Pierrehumbert's linear approach certainly fits the pragmatic aspects better. Integrated contours are necessary to describe some attitudinal aspects. Prosodic clichés are better described by holistic wholes than by a string of theoretically marked symbols. At a time when more and more works reveal that the brain does not treat all aspects of intonation in the same way (not even in the same hemisphere), why use a uniform way of transcribing which imposes artificial, a priori constraints?

There is also a problem of vocabulary. It is not at all clear how units like the tone group, rhythmic group, minor phrase, intermediate phrase, "*continuation mineure*", prosodic word, intermediate phrase, syntagma, "buntetsu" relate to one another.

Moreover, the interpretation of the data, and the data itself, are obviously influenced by the type of corpus (interviews, monologues, dialogues, read speech, text, or isolated sentences, or sentences produced by the researcher himself), the degree of formality (and the speaking style generally speaking), the position of the speakers, their social status, the dialect they speak, the rate of speech (Fougeron, 1998), and, neither last nor least, the potential use of means other than intonative (lexical, morphological, syntactic).

In addition to these, it is no simple task to master a foreign language well enough to get a good grasp of its intonational, syntactic and morphological aspects, with the result that there is a clear lack of comprehensive comparative studies for the establishment of language-dependent and language-independent features (see, however, some inspirating works by Delattre, 1962; Beckman and Pierrehumbert, 1986; Hirst and Di Cristo, 1998; Blum, 1999).

Proponents of the Prague School have always insisted that phrasing in an utterance was determined by pragmatics rather than by syntax. Many studies in the seventies have however been concerned exclusively with the relationship between prosody and syntax. The use of read speech was at that time an acceptable --and indeed comfortable!-- paradigm. That approach led to considerable progress, both on the theoretical front and on applications (generation of prosodic parameters for speech synthesis by rules). Today, there is increasing interest in units larger that the sentence and in *communicative function* rather than *linguistic form*: pragmatics, text linguistics and discourse analysis are the object of much academic scrutiny. This state of affairs is mirrored in the prosodists' growing interest in the role of prosody in everyday conversation. The demand for more natural and unconstrained speech material in speech synthesis and speech recognition encourages

this trend. The renewed attention directed to spontaneous production puts again into light a certain number of factors which had been neglected by the generative approach in the seventies, such as the prosodic expression of attitude and the effect of emotion. Such factors were convincingly emphasized by Fonagy for French (1983) and Bolinger (1978, 1986) for English. The research community has now gained a global view of the many functions of intonation, syntactic, pragmatic, attitudinal, discursive, etc. and of the constraints on performance. The enormous problem to be faced now is the modeling of the interaction between phrasing, modalities, topicalisation, focus marking, the rheme/theme division, attitudes, turn-taking markers, and still other factors. Attempts to integrate them are beginning to appear in the literature (see, for French, Rossi, 1993), a trend which will no doubt develop. For the moment, most studies of interaction tackle only two factors (three at the most, in the latest papers), such as phrasing and modalities, or phrasing and focalisation. There is a measure of progress in this direction, but a satisfying global solution is still far ahead.

2) French prosody in broad strokes

a) French as a fixed-stress language

French is considered as a *fixed stress language,* as opposed to *free stress* languages such as Russian or English (Trubetskoy 1939; Garde 1968). Since the position of word stress is fixed in French, it is not distinctive at the word level, but demarcative at the utterance level. The existence of an underlying abstract lexical word stress in French is regularly called into question by French researchers. It does not correspond to any cognitive reality. The notion of (lexical) stress is indeed very elusive for French natives. They only discover the existence of that unnatural and unnecessary complication when they have to learn a foreign language. However, the hypothesis that French has word stress is motivated by the historical fact that the word-final "stressed" syllable corresponds to a stressed syllable in Latin. Lexical stress is quantitative (Delattre, 1938), the final syllable being the (potential) site of final lengthening (and of boundary tones), the first consonant the site of consonantal lengthening. Things are made a little more complex by the fact that lengthening at the end of the word corresponds to final (pre-boundary) lengthening, which is a lengthening of the rhyme, and not to accentual lengthening (see Campbell, 1992, on the difference between these two types of lengthening in English). Put more simply, final lengthening is cognitively bound to word demarcation, not to "stress". A speaker of French will interpret the segmentally identical "bordures" (pronounced *short-long*) and "bords durs" (pronounced *long-long*) as different things: the first is heard as consisting of one word, the second as consisting of two words. The difference is not perceived as a difference in "stress". When asked which syllable is most prominent in an isolated French word, a naive Frenchman is likely to be puzzled. He may say that it is the word's initial syllable which is stressed. In fact, when a word is pronounced in isolation, the last syllable is often reduced and breathy; it may even disappear. In context, the intensity of the last syllable of words is often reduced (Delattre, 1938). Depending on the pragmatic context, a word like "intéressant" may be made prominent by a prosodic change on its final syllable ("intéresSANT"), with the realization of a final continuation rise (for which the corresponding ToBI symbol would be LH% or H-), of a final question rise (H%), of a focus (H*), or the expression of admiration. Prominence on the penultimate syllable ("intéRESsant") could be perceived as an expression of doubt (Fonagy and Bérard, 1973) or a tinge of regional accent (Carton & al, 1983). In typical cases of focus, one of the initial syllables is made more prominent. It may be the first syllable ("INtéressant") because of **initial jump** (see a description further down), which is generally anchored on the word-initial syllable in long words. Then again, it may

be the second syllable ("inTEressant"), because emphatic stress is realized with increased subglottal air pressure, which is easier to build up during obstruents. Interestingly, the realization of one type of "stress" does not preclude other "stresses". If the word is long enough, it can be the site of coexisting stresses (focalization + doubt + continuation rise + final lengthening, for example). In short words, confusion in the interpretation may ensue. Focus can be realized by stressing the first syllable, the second syllable, or both. The term "fixed" and the term "stress" in the expression "fixed stress" should therefore be used very cautiously. The location of the syllable perceived as prominent in a French word is much more variable than in English. Several syllables have a potential for prominence.

b) French as an intonation language

As in English or Russian, the Fo pattern of a word is specified by the overall intonation pattern. As nicely illustrated by Delattre (1953), intonation in French is considered of the *rising* type, because of the frequency of major and minor continuation rises. The perceptual impression of a dominantly rising type, however, is affected by the style of speech. Professional speakers, who tend to emphasize word onset, will frequently produce falling contours. Purists have been known to complain that radio announcers were emphasizing every word in an unstylish manner (perhaps imitating English radio speakers?). Stressing the word-initial syllable(s) has by now become so common that French people do not perceive it as the expression of emphasis anymore (see Vaissière, 1991, for an account of the consequences of the co-existence of two rhythms in French, one based on final lengthening and the other on onset strengthening).

Roughly speaking, there is at least an H (High) associated with every lexical word, realized either at its onset or offset or both (more frequently at is end). As for function words, there is a low target (L) anchored at the very end of the last of a series of function words. Note that function words are more numerous in French than in English; Peter**'s** book = **le** livre **de** Pierre. As a first approximation, it may be said that French contrasts between lexical words, associated with an H, and function words, associated with an L.

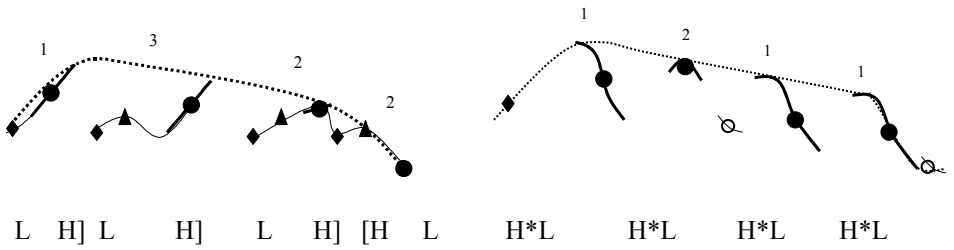


Figure 1: A typical declarative pattern in French (left) and in English (right). Plain circles correspond to word-final syllables in French and to stressed syllables in English; triangles to lexical word-initial syllables, and lozenges to the function words of French. Unfilled circles correspond to unstressed final English syllables. The numbers indicate the number of syllables in the lexical word.

c) "Accent de groupe", "groupe de sens" and "groupe rythmique"

To a Frenchman, the notion of "groupe de sens" makes much more sense than the notion of word stress. A sense-group is composed of one or more lexical words which are closely related semantically. It corresponds loosely to the syntactic notion of "phrase", but it is conceived as a semantic rather than syntactic unit. Two or more words may be more or less grouped depending on

their estimated semantic distance. Because continuation rises (minor or major) and final lengthening are simultaneous, French rhythm is dominated by the perception of final left boundaries. The word seems to lose much of its perceptual identity inside a sense-group, but desaccentuation is often incomplete (Delattre, 1938). The integration of the words into a single acoustic unit is increased by the realization of linking and liaison (*petit* + *ami* = *petit ami*, pronounced [pə.ti.**t**a.mi] or pti**t**ami, whereas the [t] is not pronounced when the word *petit* stands in isolation). From an acoustic point of view, a slight difference in the Fo contour, in the duration profiles and in the segments often points to the presence of an underlying word boundary.

Figure 2 (left) illustrates the melodic grouping of two lexical words into a single Fo pattern. The end of the first word is optionally marked by final lengthening (Vaissière, 1971). Rhythmic grouping is partly independent from melodic grouping: in French, final rhyme lengthening or initial consonantal lengthening may contrast some otherwise strictly identical Fo patterns.

It is useful to distinguish six types of syllables in French: (i) word-final syllables, the so-called "stressed" syllables, which are the site of continuation rises, and rhyme-final lengthening, (ii) word-initial syllables, the site of initial Fo jump, and word-initial consonantal strengthening, (iii) the first syllable in the word that starts with a consonant (the site of emphasis and expiratory stress), (iv) syllables in function words, which are the anchor points of a low target, (v) the penultimate, which has a special status for the expression of attitudes and regional accents, and (vi) unstressed, transitional syllables. The size of the "groupe de sens" and of the intonational phrase (terminated by a major continuation rise) is by no means fixed. It depends in part on the speaker's habits. See also Monnin and Grosjean 1993, who point out the role of performance constraints). Under certain circumstances, some speakers take the care to speak "mot après mot" (word by word), while others use larger units. For the same sentence, a major boundary may be replaced by a minor boundary (without pause and anticipatory lowering) when speech rate increases.

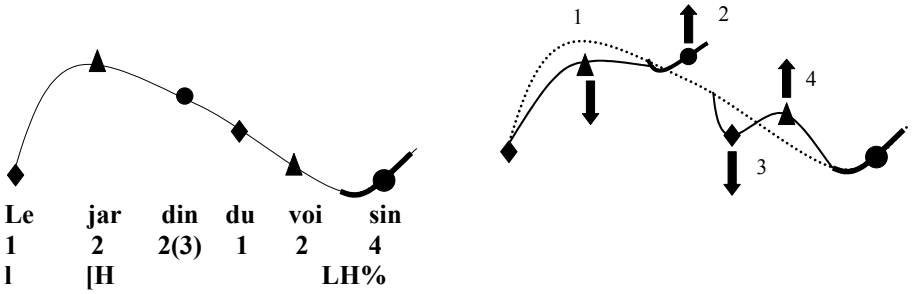


Figure 2: Melodic grouping of two words into a single "groupe rythmique" (left). There is only a transitional fall between the initial jump ([H) and the final continuation rise (LH%). Final lengthening may further mark the end of the first word (*Le jardin du voisin*, the neighbor's garden). The second line indicates the relative duration of the syllable in not-too-rapid speech. The four options available to increase the distance between two words in an intonation phrase are represented on the right: displacement of the first peak to the end of the first word; a local peak or a rise movement (mid-rising) on the end of the first word, and/or a low target on the intermediate function word, and/or an Fo jump at the beginning of the last word.

Pierre Delattre's famous article "Les dix intonations du français" (Delattre, 1966) has attained international fame. Three of the ten intonations directly concern the intonation of simple neutral sentences: "continuation majeure", "continuation mineure", and "finalité". The existence of a contrast between "continuation majeure" and "mineure" was verified by Delattre on spontaneous

interviews, and was never put into question again. Since then, however, there has been some amount of divergence concerning the acoustic realization, and the perception, of the minor continuation. The number of relevant degrees has also been the subject of some discussions. Martin (1981, 1982) and myself insist that there are more than two degrees of continuation, as well as syntagmatic contrasts between successive word-final tunes. Figure 3 illustrates different tunes marking the end of the first word. The general principle is the following: all other things being equal, the greater the rise, the more independent the word is. Some speakers use more rising contours than others (Vaissière, 1974), but the general principle holds. Contours *a* and *b* do not give rise to two different interpretations: the only difference is that the semantic distance between the two words is felt to be a little larger in the second case. But subtle differences may become distinctive in the realization of sentences. Let us take a look at : **[sɛtɔmɛtenɔrmemãbɛt].**
It may mean "this man is enormous and bothers me" (Cet homme est énorme et m'embête"), or "this man is enormously silly" (Cet homme est énormément bête), or even a highly unlikely "Seven men and Tenor like me as a beast" (Sept hommes et Ténor m'aiment en bête): there is ample room for variation.

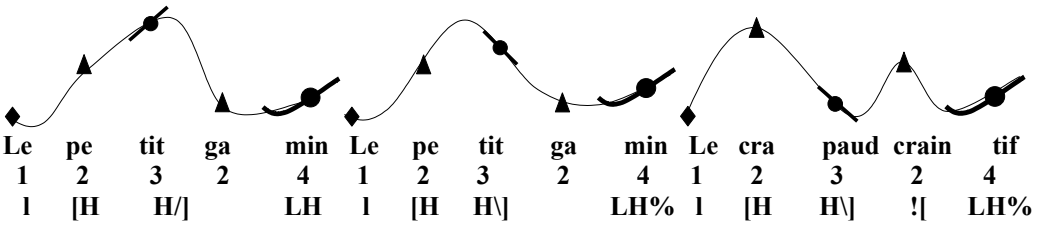


Figure 3: A high-rising tune (late peak) at the end of the first contour (le petit gamin) indicates a degree of semantic independence (right). A high-falling tune (early peak) at the end of the first word indicates a certain degree of semantic dependency (middle figure). A falling pattern indicates semantic dependency (Le crapaud craintif) of the first word relative to the second (left figure). An initial jump ([H) may or may not be realized on the second word. If it is realized, it increases the perceptual distance between the two words.

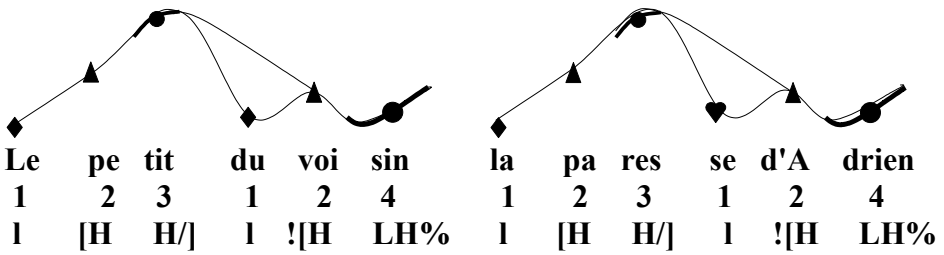


Figure 4: Local trough-shape "l"; may be associated to the presence of a function word (left) or to a final mute *e*.

d) A double-accentuation system

The syncretism between accentuation and intonation may cause confusion, since both are mainly anchored on the final word-stressed syllable in French: see Rossi (1979). For the same reason, it is impossible, in French, to dissever accentuation and intonation. In history, this convergence led to the refinement of the degree of boundary tones in French: see Vaissière (2001)

for a description of the consequences on the segments of the confusion between accentuation and intonation in the transition from Latin to Modern French.

Which ways are there to make a word more prominent in French, remembering that the prominence of the final syllable is cognitively linked to the notion of boundary? First, there are syntactic means. To the question "*Qui a vu Henri?*", a French speaker will tend to answer "*Pierre*", or "***C'est** Pierre **qui** a vu Henri*". Secondly, focus may also be marked prosodically, like in English (this is especially frequent in casual speech). In the case of long words, prominence spreads (phonetically) over the whole of word onset. In such words, there is the possibility that a pragmatic "stress" will fall on the beginning of the word and a boundary tone on the final syllable. In short words, any syllable can be made prominent. The intoneme [Focus] is therefore bound to the word as a whole and not anchored to a particular syllable in the word, whereas in English it seems to be bound to the word-stressed syllable.

As a first approximation, the left boundary is connected more frequently to the informational content of a word, and the phenomena that take place on the right edge carry indications about its semantic distance with the following word. But an extra-high initial jump also marks the beginning of a syntactic unit of higher rank. The degree of semantic distance is marked by preboundary and postboundary phenomena. As a consequence, extra height at the beginning of the word could mean either emphasis or the onset of a new topic. Emphasis in French generally corresponds to an expiratory stress accompanied by an increase in subglottal air pressure (Benguerel, 1970; for English, see Ladefoged, 1958), an increase in the duration of the consonant, more intensity in the release of the consonant and the following vowel, and an extra-high Fo value. The two extra-highs are therefore quite distinct from an acoustic point of view. The following table (adapted from Vaissière 2001) summarizes my interpretation of the facts.

Word onset	**Word-final rhyme**
1) LEXICAL ACCENTUATION	
Tension stress (increase in glottal and supraglottal tension)	*Quantitative stress* (lengthening of final rhyme)
2) SUPRALEXICAL LEVEL	
a) *Syntactic intonation*	
	Melodic stress (length and tension of the vocal folds)
b) Pragmatic intonation	
expiratory stress Indicates emphasis (subglottic air pressure increases)	

Table 1: The four types of stresses in French: quantitative, melodic, expiratory and "intensive" (increased tension). Adapted from Vaissière 2001.

Coherence among words within a "groupe de sens" is signaled by a systematic decrease of the onset jump relative to preceding peaks. This decrease can be interpreted as a manifestation of the downstep observed in a large number of languages, or as the result of a local declination line superimposed on the Fo curve. I personally interpret it as the phonologization of a natural tendency (Vaissière, 1995). The onset of the word-initial jump is synchronized very neatly with the onset of the word or of the word-initial consonant. (From a prosodic point of view, the linking consonant, *consonne de liaison*, behaves like a word-initial consonant.) The slope of the initial rise

(if visible) and its duration tend to be constant (Vaissière, 1975). The timing and height of the following turning point are not precise, and that point should not be described as a "target" corresponding to a well-defined segment. It is known to be influenced by the voicing characteristics of the first consonant: the target is earlier for unvoiced consonant and after obstruents, and delayed in longer words. Other relevant parameters include specific characteristics such as the duration of the underlying phonemes, speaker habits, and speech style. As a consequence, the term "target" is not adequate for the initial jump. The high H should be considered as an indirect consequence of a general strengthening of the articulators (vocal folds included) which occurs at the onset of the word. For want of a better term, I call this a "tension stress". This extra tension has played a major role in the transition from Latin to Modern French, that of protecting the initial vowel from deletion and major sound changes. It does not seem to be peculiar to French.

3) French prosody in contrast to English prosody

a) A French phrasing intonation *versus* an English pragmatic-attitudinal intonation ?

Prosodic grouping and phrasing in French have been the subject of much study, whereas relations of prominence were left largely uninvestigated. This tendency may reflect the characteristics of the language. In French, focusing, topicalisation and the theme-rheme distinction are all related to word order and phrasing (there is morpho-syntactically marked focus), not to differences in prominence. Major and minor continuation rises, and "finality fall", prevail in the Fo curves (see Delattre's detailed study of an interview given by Simone de Beauvoir: Delattre 1961).

At least, this is how things happen in formal French. There is a blatant lack of statistics on the everyday use of intonation patterns. From available studies, it may however be suggested that boundary tones (as related to the thematic division of the utterance and to syntactic phrasing) prevail in Standard French, in opposition to English, where the pragmatically determined pitch accents associated to the most strongly stressed syllables in words are particularly salient (Beckman, 1993), tone boundaries playing a lesser role. The dominance of intonational phenomena related to the right boundary (rising intonation and final lengthening) may be the cause of the dominantly "temporal", right-headed rhythm of French, as opposed to the left-headed "intensive rhythm" of English (Fraisse, 1974; see Vaissière, 1991, for discussions). Note that word-initial syllable-onset lengthening and polysyllabic shortening are also tendencies of French; for alternation tendencies, see Duez and Nishinuma, 1985. The presence of word stress in English thus seems to allow for more intonational variety in terms of pitch accents than would be possible in French (Blum, 1999). Further studies are needed, because attitudinal intonation contours (as investigated in the pioneer studies by Fonagy, the Grenoble team, and Léon) bring out a greater intonational variety in French than one would imagine from previous studies. Conversely, in English, not all of the many possible pitch accents actually come up very often.

	P1	P2	P3, P4, P0	PE
	Low-rising	Mid-rising or Peak	flat, falling, or Baseline	Emphatic
	Rising contour	Peak contour	Flat, falling contour	Emphatic contour
	([H) LH%	([H H]-	[H H], [H L], [H\]	H*
	end of intonational phrase	end of groupe de sens	end of word	focus
demarcative	+	+	-	-
prominent	+	+	-	+

Table 2: Word pattern and results of perceptual experiments (Vaissière, 1976, Delgutte, 1978).

b) Anticipatory phenomena in French versus no anticipatory phenomena in English.

Janet Pierrehumbert observed no strong anticipatory phenomena in English (but findings contradicting this point of view can be found in Grosjean, 1983). A previous tone may influence the one that follows (i.e., a downstep after a bitonal pitch accent), but not the other way round.

1) Anticipatory pre-rise downstepping before major continuation rises

Figure 5 illustrates a typical way of regrouping two (or more) successive lexical words into a single Hat Pattern in English, by keeping the rise associated with the first stressed syllable (in the first word), the fall in the last word, and suppressing the intermediate fluctuation of the Fo contours. The realization of a boundary tone (H% or L%) on the Hat Pattern's final syllable does not influence the preceding Fo movements.

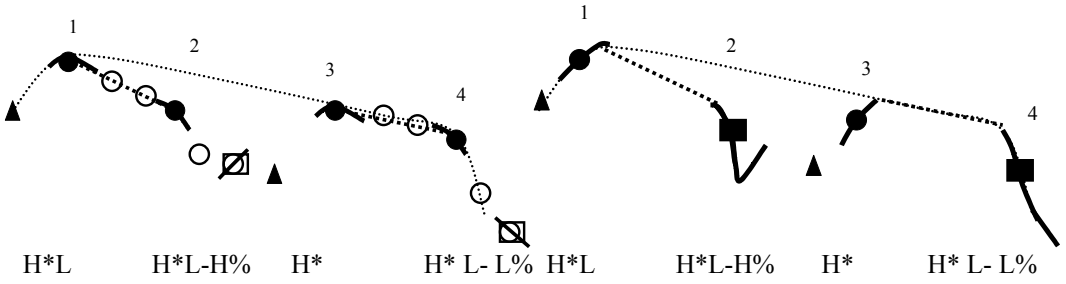


Figure 5: Hat-pattern grouping of lexical words in English: two successive words go to make a single Hat-pattern ({1 2} {3 4}). Each Hat-pattern in the figure constitutes an intonational phrase, the first one ending with H%, and the second one with L%. The figure on the left pertains to monosyllabic words, and the one on the right to disyllabic words with a stress on their first syllable. Filled squares represent stressed final syllables. Unfilled squares refer to unstressed final syllables. (An L has been introduced after the first H* to account for the downstepped second H*, according to Janet Pierrehumbert's theory).

French contrasts strongly with this state of affairs: it features strong anticipatory phenomena. French listeners, unlike English subjects, could identify the +0 word ending earlier than the potentially last word: as early as the preceding word (Grosjean *et al*, 1996). First, the penultimate syllable tends to be lower in anticipation of the following major continuation rise: LH%. Word-

initial jump, too, may affect its context. If the last word has more than two syllables, there is no conflict with a word-initial jump (Figure 6, left, down-pointing arrow). But if the last word is disyllabic (Figure 6, right), a conflict occurs: the word-initial jump may be suppressed (1) or decreased (2); [H LH% may be compressed, L being realized during the consonant (3) or L may be suppressed (3) (Vaissière, 1974, 1975). In the latter case, Low-rising becomes Mid-rising, blurring the distinction between major and minor continuation rises. Anticipation may also affect the penultimate word, a function word or a lexical word, which gets lowered. When the final syllable of the penultimate word is lowered, a contrast is built between a falling penultimate word and a final rising word.

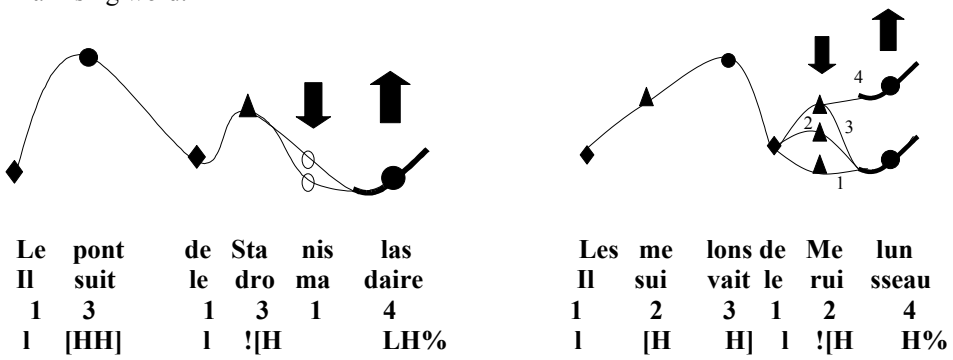
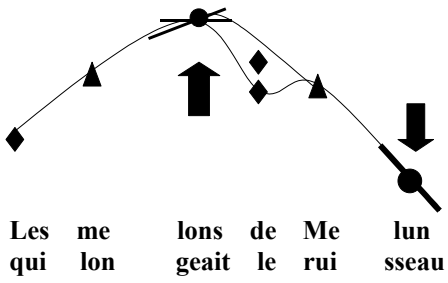


Figure 6: Pre-rise anticipatory lowering. When the intonational phrase ends with a long word (left), both the initial jump and low-rising final movements can be realized on the word. When the word is disyllabic, various strategies are adopted by individual speakers (right). To sum up: there is an *intonation contrast* between the two last words.

2) Anticipatory pre-fall rise before finality

Finality in French is not indicated solely by a local fall on the final syllable, as is the case in English. Finality involves at least the two last words in the sentence. It is realized by a contrast between a high or high-rising tone at the end of the penultimate word and a falling tone on the very last word (Vaissière, 1974; Martin, 1982). The final fall begins from the end of the penultimate word.

The choice of a *high* vs. *high rising* tone depends on the degree of semantic cohesion between the two last words. High-rising (H/]) indicates relative independence (such as the boundary between two NPs) and a simple High (H]) indicates dependence (such as Adjective + Noun, or Noun + Adjective). The penultimate word as a whole may also be raised relative to the top line. As a consequence of anticipation, there is a reduction in the number of possible patterns for the word in penultimate position.



l [H H] (l) ![H L]L% (dependence)
l [H H/] (l) ![H L]L% (more independent)

Figure 7: The realization of the final fall in French constrains the Fo contour of the penultimate word, which ends on a high Fo value. The lowering corresponding to the intermediate function word is not compulsory.

c) Gradient acoustic degrees of continuation and their categorical interpretation

Pitch interacts with duration to mark continuation. Syllables at the edge of intonational phrases (major boundary) are longer than syllables at the edge of a minor phrase. The final syllable at the end of a minor phrase (or a word) may even be suppressed. In both of those cases, the interaction of pitch and duration can be summed up quite neatly: increasing final lengthening and raising pitch at the end of the word both go to augment the strength of the boundary.

Such continuity is reminiscent of the BI part of the ToBI system: indeed, "break indices" are related to the perceived strength of phrase boundaries (Price *et al*, 1991; Wightman *et al*, 1992). As a matter of fact, the BI part of the ToBI system is quite suited to the description of French.

<table>
<tr><td colspan="9">SENTENCE-INTERNAL PATTERNS
<i><Independence</i> <i>Dependency></i></td></tr>
<tr><td colspan="2">P1+
followed by
pause</td><td>P1
non
followed
by pause</td><td colspan="2">P2/
(last H target)
rising peak</td><td>P2^
(mid H
target)
mid peak</td><td>P2\
(early H target)
falling peak</td><td>P3-

flat</td><td>P3\ (or (P3-P4)

flat-falling</td><td>P4

falling</td></tr>
<tr><td colspan="2">obligatory
final leng.
++++</td><td>obligatory
final leng.
+++</td><td colspan="2">obligatory
final leng.
++</td><td colspan="2">frequent
final lengthening.
+</td><td colspan="3">Optional
final lengthening.</td></tr>
<tr><td colspan="3">Rising pattern P1</td><td colspan="4">Peak pattern P2</td><td colspan="2">Flat pattern P3</td><td>Falling patternP4</td></tr>
<tr><td colspan="3">major phrase
continuation majeure
Intonational Phrase IP</td><td colspan="4">minor phrase
continuation mineure
intermediate phrase (ip)</td><td colspan="3">prosodic word</td></tr>
<tr><td colspan="3">H%</td><td colspan="4">H|-</td><td colspan="2">H|</td><td>L|</td></tr>
<tr><td colspan="3">([H) ... +H%</td><td colspan="2">([H) ... H/|-</td><td>([H) ... H|-</td><td>([H) ... \|-</td><td>([H) ...H]</td><td>([H) ..H+L].</td><td>[H ... L]</td></tr>
<tr><td colspan="3">internal clause,
major phrase</td><td colspan="4">minor phrase
Subject or Verbal Phrase</td><td colspan="2">Noun + Noun</td><td>A + N
N+ A</td></tr>
</table>

Table 3: Sentence-internal patterns. (See text.)

Phrase tones in English are freestanding tones, H or L, which occur between the last pitch accent and the boundary tone (see the symbols "L-" in Figure 5). The association with a pitch accent, bound to a lexically stressed syllable, defines phrase stress. In contrast with the strong discontinuity in the acoustic realization of boundary tones (H% and L%) and phrase tones in English (H and L), in French both of these types of tones are precisely timed with the final syllable. They form a continuum. Furthermore, as the temporal distance between the initial jump and the final syllable increases, there is an increase in the effect of the Fo decline on the intermediate syllable during the transitional Fo contour. The final minor rise H/ starts from a lower value as a direct consequence of the distance from the initial jump, and tends to resemble LH%. A long word tends to constitute a single intonation group, due to performance effects. What surfaces as a high-rising tone at the end of a short word tends to surface as a low-rising continuation in the

case of a long word. To sum up, the continuity in the way major and minor continuations are actually realized is quite obvious.

Within a sentence, the contrast between successive pattern words (see Vaissière, 1975) allows for the construction of a (discrete) structural representation of the sentences, at least in de-contextualized, de-emotionalized sentences. If a tone at the end of a word is more rising than the final tone at the end of the preceding word, the two words are integrated into a single unit. Otherwise, a boundary is inserted and a new sense group starts. A *continuous* estimation of boundary strength and an interpretation in terms of *discrete* structure are therefore compatible. I would like to stress the fact that perception in continuous speech does not function in the same way as perception in isolation. In continuous speech, comparison between successive word-final tunes is performed all along. It is therefore perfectly normal for two contours to be perceived categorically in one given context even though they would not be perceived categorically if given outside context.

d) Target tone bounded to non-metrically strong syllables

Table 3 summarizes the alignment of tonal events.

In English, pitch accents are anchored onto the lexically stressed syllable. Function words can therefore be left out of the description. In the description, one should keep in mind that some Fo events may be better described in terms of *targets*, others as *movements*; then again, some may be indirect consequences of another phenomenon.

In French, the low targets "l" on function words play quite an important role. Perceptual experiments on a single, non-final IP *"Il a contribué à la majorité des progrès technologiques"* (Vaissière, 1976) have shown that listeners are highly sensitive to the low Fo values on function words. The underlying low target is on the offset of the function word. (The superimposition of a higher-level initial rise, however, results in an apparently rising contour during the first syllables, a contour in which function words are included).

As was mentioned briefly above, one syllable may be associated with conflicting tones, a conflict leading to variability in the realizations. The definite article "la" is associated with a low target (Figure 8, left: *la parution*). When the articles "le" and "la" are placed before a word starting with a vowel (or a mute h), they are reduced to [l] (written as *l'*). In the case of "l'apparition" (Figure 8, right), the consonant in the syllable /la/ actually corresponds to the function word "la", the vowel /a/ being the first phoneme of the lexical word. The syllable is associated both with a Low target (corresponding to the article) and with a high target (corresponding to [H). In the latter case, there is inter-speaker variation: the first vowel can be phonetically low, mid, rising or high (right).

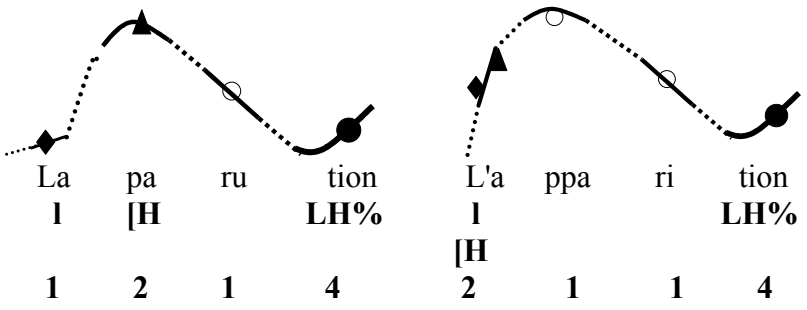


Figure 8: Left: "la parution" (the coming out of a book), right: "l'apparition" (the appearance). See Vaissière, 1989.

ALIGNMENT OF TONAL EVENTS		
l	function word(s)	l target at the very end of the word
L%	end of utterance	L target at the very end of the utterance
LH%	major phrase boundary	rising contour during the vowel
H\], H], H/]	minor phrase boundary	early, mid or late peak in the final syllable
H], L]	word boundary	level or falling contour
[H	initial jump	rise starting at the onset of the word (sometimes delayed to the word's first consonant)
H*	focus	variable position in the word
H**	emphasis	word-initial consonant

Table 4: Some of the symbols used in the text and their typical associations. Superpositional events cannot be represented using discrete symbols. They are better represented graphically; for the sake of comparison with English, such representations are avoided in the present paper.

Conclusion

As mentioned by Hirst and Di Cristo (1998), it is still difficult to find in the literature a succinct and precise statement of the specific characteristics which make one language sound prosodically different from another. This is true even for the languages which have been the object of a considerable amount of research.

ToBI-like symbols can be used for a description of Fo curves in many non-tonal languages. This is because pitch movements are generally linked to stressed syllables and boundary syllables. But an uncritical application of ToBI transcriptions may conceal the deep differences between prosodic systems.

The differences between French and English include:

- anticipatory phenomena (which play a great role in French, whereas they are not salient in English)
- the linking of tones with metrically weak syllables in French, such as function words, and with whole words : emphasis may be realized on one or several syllables in the word, or on the whole word
- the inadequacy of the notion of "target" (at least in the case of the French initial jump and major continuation rise)
- the collision between French accentuation and intonation, so that several ToBI symbols apply to the same syllable, namely *, -, and %
- the gradual change from one prosodic word to the next, and between minor and major boundary in French: there is a continuity in the realization of the tones attached to *, -, and %)
- the primary role of durational phenomena in French (for which no notation is proposed in ToBI)
- the syntagmatic contrast between successive word-final tones
- the double accentuation system in French
- the physiological and therefore segmental difference between four types of stresses (quantitative, melodic, expiratory, and "tension stress").

The list here is by no means exhaustive. Looking back at this array of data, I want to state firmly my belief that French prosody is not an exception. The present paper is an illustration of the fact that existing notations are not complete yet. To take an example: Janet Pierrehumbert has been really successful in describing the phonology of American English intonation. Such was the scope of her research. Her groundbreaking work should be read as an invitation to engage in a basically concrete, phonetic approach to prosody. Then, the phonetic approach has to be supplemented by careful consideration of morphology before one may build well-grounded, useful phonological models, whose ultimate aim should be to bridge between substance and form.

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