Correlates of phrasing in French and German from an experiment with semi-spontaneous speech*

Caroline Féry, Robin Hörnig and Serge Pahaut
Goethe University of Frankfurt, Germany

Correlates of prosodic phrasing are examined in a comparative study between two languages, German and French. The material was elicited in a production experiment with 30 speakers of German and 20 speakers of French, who were asked to describe orally the spatial arrangement of toy animals on a table. Prosodic phrasing clearly correlates to syntactic structure in both languages, but tonal excursions correspond to pitch accents plus boundaries in German, and have a demarcative function in French. This difference is explained by the presence vs. absence of lexical stresses in the two languages. It is reflected in the position of tones, which are peripheral in the French prosodic phrases, but are associated with metrical heads in German, and also with final lengthening, which is systematic in French, but not in German. A final difference between the two languages is deaccenting, used in German, but not in French.

Keywords: French intonation, German intonation, spontaneous speech, localizations, word order, givenness, focus

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1. Introduction

In this paper, we examine prosodic phrasing in two languages, French and German, from the perspective of the phonetic and phonological correlates without neglecting theoretical aspects. The material consists of pseudo-spontaneous speech, elicited in an experiment conducted in the same way in both languages. In this experiment, native speakers of French and native speakers of German localized contextually new or given toy animals relative to each other.

Prosodic phrasing is approached empirically by examining the phonetic correlates from a language-specific perspective: scaling of pitch accents, like downstep or reset, height of boundary tones, but also duration and deaccenting were used as correlates. We propose that despite superficial similarities, French and German differ in their prosodic grammar. German has pitch accents, whereas French uses tones for demarcative purposes. Duration, as final lengthening, is also used differently in the two languages. It is more systematic in French than in German. We assume that the differences in the prosodic grammar correlate with the presence (in German) vs. absence (in French) of lexical stress.

A perspective on prosodic phrasing is tackled by the formal theory of the syntax-prosody interface, as elaborated by Chomsky & Halle (1968), Nespor & Vogel (1986), Selkirk (1984, 1995), etc. The syntactic structure serves as input for an abstract prosodic phrasing, and rules or constraints are formulated that predict the mapping between the two. Some studies have combined the two approaches and have used experimental data to confirm or falsify existing models of phrasing (see for instance Frascarelli 2000 and Feldhausen 2010). Prosodic phrasing in its relationship to syntax and information structure has been often examined (see for example D'Imperio, Elordieta, Frota, Prieto & Vigário 2005; Frota 2000; Gabriel 2007; Prieto 2006; as well as other articles in this volume, and many others for Romance languages). The present work is part of this tradition, and uses experimental material as a basis for the elaboration of a theoretical proposal.

When speakers localize two objects relative to each other, they often use a two-place linguistic expression in which the predicate assigns the localizer role to one argument and a localizing role to the remaining one. Henceforth the object to be localized will be called the 'locatum', and the object relative to which it is localized will be called the 'relatum'. Typically, the locatum (Loc) is a simple expression, like a nominal phrase. The relatum (Rel) is part of a more complex constituent, an adverbial phrase or a prepositional phrase, called a 'locative expression' (Lx), as illustrated in (1).

(1) $[\text{The dog}]_{\text{Loc}}$ is $[\text{to the right of } [\text{the lion}]_{\text{Rel}}]_{\text{Lx}}$

In a situation in which both the dog and the lion are given, and the position of the lion is already known, but the position of the dog is not, that is, when the speaker assumes that the hearer knows where the lion is, but assumes that the hearer does not know where to find the dog, a sentence like (1) is a straightforward way to communicate the unknown position of the dog relative to the familiar position of the lion. If you ask your neighbor at a dinner table where the salt is, you expect an answer like 'It is behind the bottle' rather than 'The bottle is in front of it' in a situation in which the salt is hidden by an obvious bottle. Of course there may be pragmatic effects changing this preference. The second answer may be better if the speaker is explaining why the salt is invisible from your perspective, for instance. But in the absence of such influences, the second sentence is odd. It is thus reasonable to expect that the locatum and relatum roles in a localization sentence like (1) are assigned in a predictable way: the place of the locatum is assumed to be unknown or new to the listener whereas the place of the relatum is assumed to be known or given.

The same kind of asymmetry between locatum and relatum is found in a situation in which one of the objects is (discourse) new and the other one is known or (discourse) given, in addition to the familiarity of their positions. The new object preferably plays the role of the locatum, and the one which is known or visible plays the role of the relatum. A number of researchers, as for instance Huttenlocher (1968), Huttenlocher & Strauss (1968), Harris (1975), and Hörnig, Oberauer & Weidenfeld (2005), have shown with experimental studies that it is indeed the case that a linguistic expression in which the new object is the locatum is easier to comprehend than when it is the relatum; see also Herskovits (1986), Landau & Jackendoff (1993), Levelt (1984), Levinson (1996), Miller & Johnson-Laird (1976) and Talmy (1983). Based on some of these results, as well as on the insights of Chafe (1970) on the expression of new and given information, Miller & Johnson-Laird (1976) proposed an influential account for the perception and expression of spatially localized objects.

A large number of experiments, based on these ideas, have been conducted since then on general strategies used when linearizing into speech spatial configurations of different kinds; see for instance Levelt (1984), Ullmer-Ehrich (1982), Ehrich & Koster (1983), Klein (1991), and many others for descriptions of static localizations or path descriptions.

According to the 'given-new contract' of Clark & Haviland (1977), given referents should be mentioned first, and new referents afterwards. In the sentences under consideration, this means that locative expressions containing a given relatum should be placed sentence-initially, and new locata should be placed after them, as in (2) for French and German. This word order, in which a more complex expression, an adverbial or prepositional phrase, is produced before a simple

noun phrase, a subject or an object, is then a marked one from the point of view of the syntax. In other words, we have a conflict between the unmarked word order, which calls for locatum before relatum, and the given-new contract, which calls for relatum before locatum. In the examples, the first number stands for the speaker, and the second one for the layout, namely 12.5 is speaker 12 in the experiment, and layout 5 of the toy animals.

(2) a. [A la gauche [de l'ours]$_{\text{REL}}$]$_{\text{LX}}$, on met [*un chien*]$_{\text{LOC}}$
'[To the left [of the bear]$_{\text{REL}}$]$_{\text{LX}}$, one puts [*a dog*]$_{\text{LOC}}$' (12.5)

b. [Links [vom Pferd]$_{\text{REL}}$]$_{\text{LX}}$ steht jetzt [*ein Zebra*]$_{\text{LOC}}$
'[To-the-left [of-the horse]$_{\text{REL}}$]$_{\text{LX}}$ stands now [*a zebra*]$_{\text{LOC}}$' (28.4)

Because of the large amount of work done on linguistic expressions used for localizations, we will refrain from entering into the details of their set up and quickly turn to the phrasing issues. We refer the readers to Hörnig & Féry (submitted) for more detailed results about word order and definiteness for German, and to Féry, Skopeteas & Hörnig (2010) for a comparison with further languages. In the next section, we introduce the experiments. After that, Section 3 looks at the results of prosodic phrasing in German, and Section 4 examines the prosodic phrasing in French. An overview of the theoretical issues is provided in Section 5.

2. Experiment

2.1 Materials and procedure

Ten plastic toy animals, of approximately 8 cm in length, were used as stimuli. Twenty French and thirty German participants, individually tested, served as informants. During the experiment, they were seated at a table with the instructor. They were informed of the task with carefully prepared instructions, which were presented to them orally. They were told to describe the spatial layouts of the animals such that a listener who was seated behind them, back to back, could understand them and reproduce the spatial arrangements himself. In the German experiment, the participants were asked to talk to an imaginary listener, but in the French experiment, the listener was physically present. The instructor started the session by putting two toys, a crocodile and a gorilla, side by side on the table (layout 0 or L0). The participant described this layout. Then the instructor added a horse as a third animal. This layout L1 of three toys was described orally by the participants. In a second step, the instructor took away the crocodile, and added a tiger. This procedure was repeated until the participants had described eleven different layouts. The participants' task consisted of giving a brief oral description

of all layouts, one after the other. All layouts were identical for all participants for each language. See the overview of the layouts in Figures 1 and 2. Animals which were currently not on the table were hidden in a bag, and thus not visible to participants, hence the new toy was unfamiliar to the participants in the current setting. There were slight differences between the French and the German layouts, but only the animals differed, not the arrangements.[1]

L1	Crocodile		Gorilla		**Horse**			
L2	Gorilla		Horse		**Tiger**			
L3	Gorilla		Horse		**Bear**			
L4	**Zebra**		Horse		Bear			
L5			Horse		Bear	**Dog**		
L6	Horse	L7	Horse				L8	Horse
	Bear		Bear					Bear
			Gorilla					**Cow**
L9	*Tiger*			L10	**Pig**			
	Horse				Tiger			
	Bear				Horse			
L11	Tiger		Horse					

Figure 1. Layouts for the French experiment

L1	Crocodile		Gorilla		**Horse**			
L2	Gorilla		Horse		**Lion**			
L3	Gorilla		Horse		**Bear**			
L4	**Zebra**		Horse		Bear			
L5			Horse		Bear	**Dog**		
L6	Bear	L7	Bear				L8	Bear
	Dog		Dog					Dog
			Gorilla					**Cow**
L9	**Tiger**			L10	**Pig**			
	Dog				Tiger			
	Cow				Dog			
L11	Tiger		Pig					

Figure 2. Layouts for the German experiment

1. Nooteboom & Terken (1982) and Terken & Hirschberg (1994) conducted similar experiments with Dutch and English informants who localized letters or objects relatively to each others. These authors were exclusively interested in the accented vs unaccented status of the new or given referents.

In L1 to L5, as well as in L11, the animals were arranged horizontally whereas in L6 to L10, the alignment was front to back, thus sagittal. Moreover, there were different classes of experimental settings. First, some of the layouts, L1 to L5, L8 and L10, were altered by adding a new animal to a layout of two given ones, either by putting the new animal at the place of the removed one (L3, L4, L8), or by adding the new animal at the end opposite to the place of the removed one (L2, L5, L10). In L1, the new animal was just added to the initial layout, which contained only two animals, thus no animal was removed prior to the location of the new animal. In two cases, L6 and L11, one of two given animals was displaced or relocated. And in L7 and L9, the added "new" animal had already been part of previous layouts. It was thus reintroduced. For German, this happened only once in L7. In L9 in German, a new animal was put at the same place as the animal just removed, and this layout is then of the same kind as L3, L4 and L8. When the animal was reintroduced or displaced, it was always put at a new place.

As a result, there were four categories of animals, which are called **new** (bold), displaced (underlined), *reintroduced* (italic) and given (no marking) in Figures 1 and 2.

2.2 Participants, recordings and analysis

All participants were students at the University of Paris 7 for French (20 speakers) and at the University of Potsdam for German (30 speakers). The recordings took place in a quiet room. The material was recorded on a DAT recorder (Sony T100) with the help of a headworn microphone (Shure). First, the recordings were transcribed into written files and subdivided according to the layouts L1 to L11 for each speaker, altogether 220 descriptions in French (20 speakers x 11 layouts) and 329 descriptions in German (30 speakers x 11 layouts, minus one because the instructor skipped one layout). For the prosodic analysis, we used the acoustic speech analysis software Praat© (Boersma & Weenink 1994–2010). All utterances were analyzed according to several criteria: syntactic structure, roles of the given and new animals, word order of the locatum and relatum, definite vs. indefinite article, and prosodic and tonal structure.

The sentences produced by the participants can be classified in three categories, both in French and in German.

First, the majority of sentences are relational. Relational descriptions have been illustrated in (1) and (2). They contain a locatum and a relatum included in a locative expression.

Second, non-relational descriptions, as illustrated in (3). Non-relational expressions lack an overt relatum expression. Non-relational localizations are

interpreted with respect to the layout as a whole rather than relative to a particular object as a relatum.

(3) a. On enlève le crocodile et on ajoute [**un tigre**]$_{\text{Loc}}$ [*à droite*]$_{\text{Lx}}$ qui nous regarde aussi. (10.2)
The crocodile has been removed and [**a tiger**]$_{\text{Loc}}$ has been added [*to the right*]$_{\text{Lx}}$ which is also looking at us.
b. Jetzt ist [links außen]$_{\text{Lx}}$ [*das Zebra*]$_{\text{Loc}}$ (29.4)
'Now [*the zebra*]$_{\text{Loc}}$ is [on the far left]$_{\text{Lx}}$'

The third category of expressions which are commonly used to localize objects in the experiments is called 'replacement' sentences. In such sentences, illustrated in (4), the new animal occupies the place of an animal which has been taken away. This kind of sentence implies a dynamic situation, in which objects are replaced by each other, rather than a static arrangement that is described at once.

(4) a. Alors j'ai toujours trois animaux devant moi, cette fois-ci *c'est le gorille qui a cédé* [[*sa*]$_{\text{Rel}}$ *place*]$_{\text{Lx}}$ *à* [**un zèbre**]$_{\text{Loc}}$ (2.4)
So I still have three animals in front of me, this time *it is the gorilla that has given up* [[*its*]$_{\text{Rel}}$ *place*]$_{\text{Lx}}$ *to* [**a zebra**]$_{\text{Loc}}$
b. [Anstelle des [*Löwen*]$_{\text{Rel}}$]$_{\text{Lx}}$ ist jetzt [*ein Bär*]$_{\text{Loc}}$ getreten (30.3)
'[*A bear*]$_{\text{Loc}}$ has now taken [the place of [the lion]$_{\text{Rel}}$]$_{\text{Lx}}$'

Of the 220 sentences in French, 160 were relational (73%), 10 non-relational (5%) and 50 were replacement sentences (23%). The 329 sentences in German were distributed into 223 relational (68%), 39 non-relational (12%) and 62 replacement sentences (19%). There were also 5 non-classifiable utterances in which the animals were mentioned as a list.[2]

In French, there was a clear preference for the unmarked word order, in which the locatum was introduced before the locative expression: 63% of all utterances had the unmarked word order Loc-Lx, and 37% had the marked word order Lx-Loc. In German, the reverse pattern was found: 66% of the sentences had the marked word order Lx-Loc, and 34% had the unmarked word order Loc-Lx. The marked word order, in which the simple locatum comes after the more complex locative expression, has been illustrated in (2). The word order results are in agreement with the view that French has a rather strict word order, whereas German

2. An example of an unclassifiable utterance: *Jetzt ist die Kuh verschwunden und wir haben die Reihenfolge: Hund, Tiger, und* ein Schwein 'Now the cow has disappeared and we have the order: dog, tiger, and *a pig*.' We suspect that in such lists, the new element is preferably mentioned last, but we did not control this.

is more flexible. Nevertheless, the order between locatum and locative expression can be reversed in French as well, due to the influence of discourse structure.

In the next sections, we focus on the correlates of prosodic phrasing in the two languages. We will see that there are many similarities between phrasing in French and in German. First of all, phrasing is sensitive to syntax in the same way in both languages. Phonetic correlates of phrasing are also similar to each other, due to the fact that both German and French are intonation languages, and thus express pragmatic meanings and information structure by means of varying tonal excursions and boundary tones. But the two languages differ in crucial ways, the most important one being the presence vs. absence of lexical stress. German has pitch accents obligatorily associated with lexical stress, whereas French varies the place of tonal excursions more freely, a freedom which comes from the absence of lexical stress. We assume that this distinction brings essential differences as to how phrasing is implemented in pitch and duration. In German, phrases are organized around pitch accents, the last one being the nuclear one. After the nuclear accent, other lexical stresses are not assigned any pitch accent, and are thus 'deaccented.' In French, there is no deaccentuation, but also no true accentuation. Important prosodic phrases, as for instance those containing new or focused referents, are more clearly phrased than others, with small breaks separating them from neighboring phrases, and larger boundary tones. Important words are often realized at places where they get tonal excursions, but this is not always met. Examples will be discussed below.

Only two levels of prosodic phrasing are considered here. The highest level is the intonation phrase (i-phrase), which roughly corresponds to a sentence. And the lower one is the prosodic phrase (p-phrase). Both levels are recursive, in the sense that a larger domain of level n can contain a lower domain of the same level n. We do not try to motivate recursion of prosodic domains here, but refer the readers to Ito & Mester (2009, forthcoming), Wagner (2005), Féry (2010) and Féry & Schubö (2010), among others.

Let us start with a survey of prosodic phrasing in German.

3. Correlates of phrasing in German

Correlates of phrasing are pitch accents and boundaries (3.1) and deaccenting (3.2). Duration may play a role, but not in a systematic fashion (3.3).

3.1 Tones and scaling of register

Following the tradition initiated by Bruce (1977) and Pierrehumbert (1980), H stands for a high tone, and L for a low tone. Subscripted P stands for p-phrase. It identifies the tone it is associated with as the boundary tone of a p-phrase. In declarative sentences, the final p-phrases generally end with a fall, written HL_I. The subscripted I stands for i-phrase. Both the p-phrase and the i-phrase bitonal contours are associated with pitch accents. In German, the first part of the bitonal contour is provided with a star, indicating in this way that this tone is associated with a lexical accent. If it is falling, it is thus H^*L_I or H^*L_P.

The utterance in (5) and Figure 3a consists of three prosodic phrases and illustrates the typical F0 correlates of German phrasing. The first two p-phrases end in a high boundary tone, which is at the same time part of the bitonal pitch

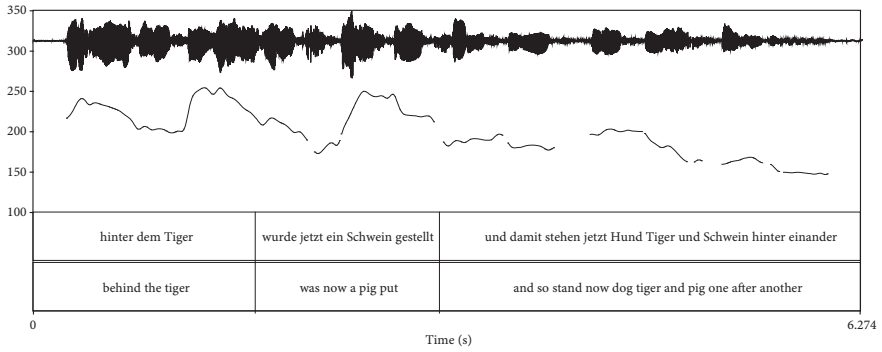


Figure 3a. Highest level of phrasing (1.10)

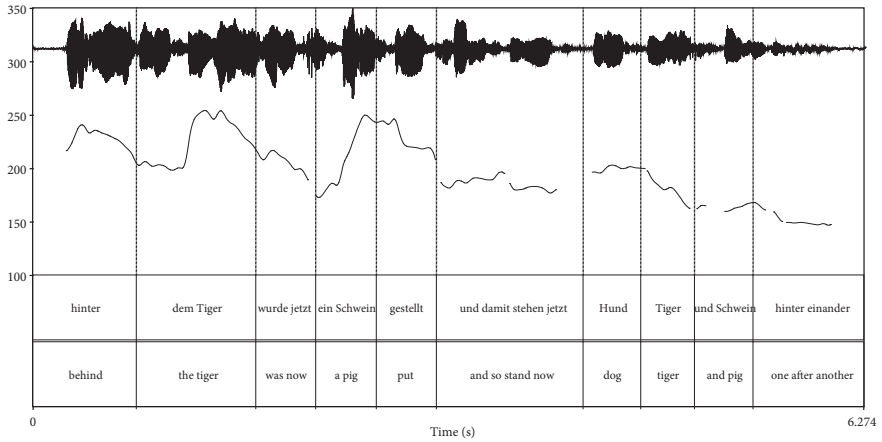


Figure 3b. Detailed embedded phrasing (1.10)

accent, thus L^*H_P. The accents are associated with the head of a p-phrase, typically the lexical stress of the most prominent word. The last word, *hintereinander* 'one after the other', carries the low boundary tone L_I of the entire i-phrase, which comprises the three p-phrases. All sound files can be heard at http://web.uni-frankfurt.de/Fb10/fery/publications.html.

The second boundary tone H_P is located directly after L*, since these two tones form a rising melodic contour. The arrow from *Schwein* to *gestellt* indicates that the level reached by H_P is maintained until the end of the phrase (see Gussenhoven 2004 for this representation).

(5) H^* L^*H_P $L^*H_P \rightarrow$
$[[[$HINTER$]_P$ dem TIGER$]_P$ [wurde jetzt ein SCHWEIN gestellt$]_P$
behind the tiger was now a pig put
L^*H_P H^*L_P L^*H_P
[und damit stehen jetzt [HUND$]_P$ [TIGER$]_P$ [und SCHWEIN$]_P$
and so stand now dog tiger and pig
L_I
hintereinander$]_P]_I$ (1.10)
after-one-another
'Now a pig has been put behind the tiger, so that dog, tiger and pig are now in a row.'

The first prosodic phrase contains an additional accent on the preposition *hinter* 'behind'. We assume that the presence of a pitch accent is indicative of a prosodic phrase, and, as a result, this expression forms a p-phrase. This p-phrase is, however, completely contained inside of the larger p-phrase, which consists of the prepositional phrase. Embedded p-phrases can have a higher or a lower pitch accent than that of the containing p-phrase. In this case, the accent on *hinter* is lower than the one on *Tiger* 'tiger', a rising bitonal tone L^*H_P.

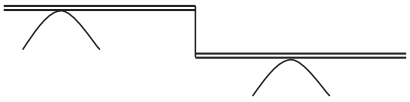
The second p-phrase has only one accent on *Schwein* 'pig', which is also a rising bitonal accent. The high part of this pitch accent is again at the same time a boundary tone. The following unaccented verb *gestellt* 'put' in the same p-phrase stays perceptively at a high level until the end of the p-phrase. There is interpolation between the level of *gestellt* and the beginning of the third p-phrase, and, since the third p-phrase starts much lower than the second one, the pitch level of *gestellt* is acoustically lower than the high tone on *Schwein*.

The third p-phrase is again complex. It contains three embedded p-phrases in a row, thus an iteration structure of the three animal names *Hund* 'dog', *Tiger* and *Schwein*. The remainder of the p-phrase is unaccented. The third p-phrase is altogether on a lower register than the preceding ones, but the three accents are in a downstep relationship to each other. We thus assume a difference between the

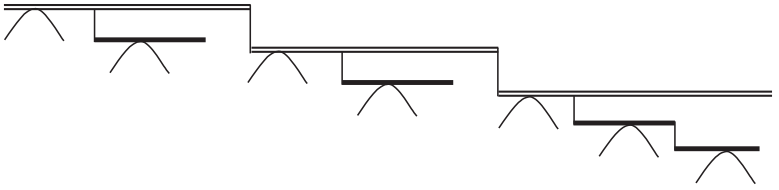
lower prosodic domain PW (for prosodic word) and the p-phrase. The PW does not need to carry a pitch accent, whereas a p-phrase does.

Downstep between sequences of high tones happens at two different levels of phrasing: at the higher p-phrase level, as the schematic representation in (6) illustrates, and also at the lower level of the embedded p-phrases, as in (7). The double lines stand for the 'reference lines' of prosodic domains, or 'top lines', which are calculated from the highest peak of the domain (see Note 3 for the detection of highest peaks).

(6) Downstep



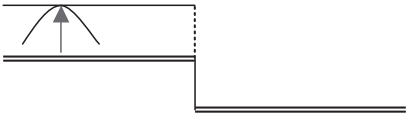
(7) Embedded downstep



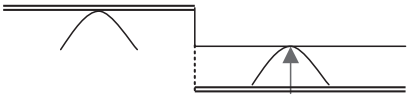
However, in Figure 3, downstep is cancelled at the higher level between the first two phrases, because the second p-phrase contains the focus of the sentence, and focus triggers a boosting of F0, as illustrated schematically in (8).

(8) Raising due to narrow focus

a.

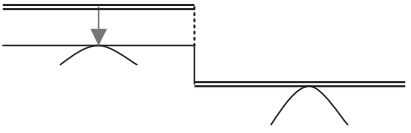


b.



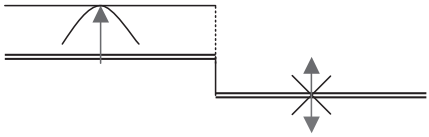
This model of pitch scaling can account for fine differences in the pitch scaling of bitonal tones in sentences, both for wide and narrow focus, especially if the effect of givenness is translated into register reduction, as illustrated in (9).

(9) Register compression due to givenness



The last aspect of the model concerns postnuclear deaccenting. The absence of pitch accent after the largest pitch accent of the sentence is due to the total compression of the range of the prosodic phrase, as illustrated in (10). We return to deaccenting below.

(10) Postnuclear deaccenting after nuclear raising



The model of tonal scaling sketched here was elaborated on the basis of laboratory speech. It was first sketched in Féry & Ishihara (2009a, b) and Féry (2010), and was inspired by van den Berg, Gussenhoven & Rietveld (1992). In the present paper, pseudo-spontaneous speech is used, rendering some of the values more difficult to verify. In particular, there is no baseline relative to which focus or givenness can be calculated, and only few minimal pairs (see Section 3.3 for some). Altogether 50 speakers were recorded, rendering systematic comparisons across them nearly impossible, because each speaker used her or his own syntactic constructions and word orders. Instead, every sentence is taken by itself and we speculate that the model of downstep, boosting and lowering due to information structure is valid in spontaneous speech as well.

A second example of embedded phrasing appears in (11) and Figure 4, in which several contrasts, all expressed by pitch scaling, are realized. In this utterance, the lion is the new animal. There are three locata, *gorilla*, *horse* and *lion*.

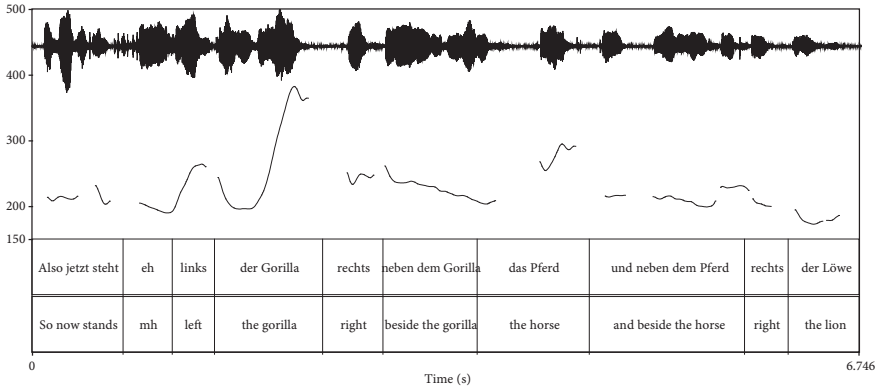
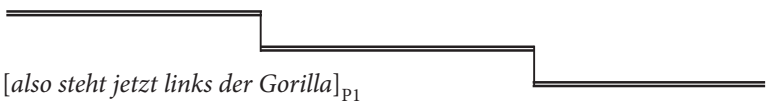


Figure 4. More complex embedded phrasing (21.2)

(11) L*H$_P$ L* H$_P$ H*
[[Also jetzt steht]$_P$ [[links]$_P$ [der Gorilla]$_P$]$_P$ [[rechts]$_P$
so now stands left the gorilla right
H*L$_P$ L*H$_P$ L*H$_P$
[neben dem Gorilla]$_P$]$_P$ [das Pferd]$_P$]$_P$]$_P$ [[[und neben dem Pferd]$_P$
beside the gorilla the horse and beside the horse
H*L$_P$ H*L$_I$
[rechts]$_P$ [der Löwe]$_P$]$_P$]$_I$ (21.2)
right the lion
'So now the gorilla is standing to the left, the horse is standing to the right beside the gorilla, and the lion is standing beside the horse to the right.'

Each of the sentences is a p-phrase. As a result, there are three p-phrases at the highest level of p-phrasing, in a clear downstep relationship to each other. Together, they are organized in an i-phrase.

(12)



[*also steht jetzt links der Gorilla*]$_{P1}$
[*rechts neben dem Gorilla das Pferd*]$_{P2}$
[*und neben dem Pferd rechts der Löwe*]$_{P3}$

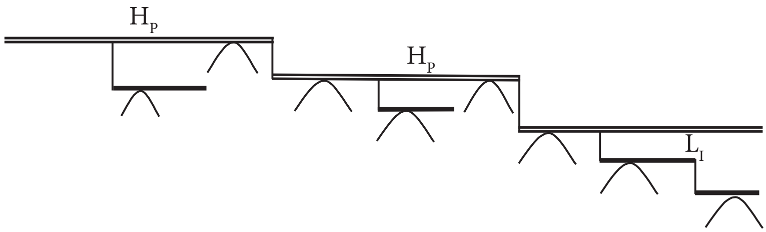
Each of these p-phrases contains embedded phrases. First, the locata *der Gorilla*$_{Loc1}$, *das Pferd*$_{Loc2}$ and *der Löwe*$_{Loc3}$, which are in a downstep relationship to each other, the highest pitch values being 388, 303 and 178 Hz, respectively. Second, the locative expressions: *links*$_{Lx1}$, *rechts neben dem Gorilla*$_{Lx2}$ and *und neben dem Pferd rechts*$_{Lx3}$ (highest pitch values 269, 253, and 230 Hz, respectively).[3] Inside the second complex locative expression, we have another downstep, *rechts* being slightly higher than *neben dem Gorilla* (253, 235). In the third one, *neben dem Pferd* is slightly higher than *rechts* (230, 204).

The first two highest-level p-phrases end at a high level. The reason is that the animals are strongly contrasted with each other and cause a focus boost in their respective domains. We assume that the last high tone in a p-phrase is scaled at the level of the reference line of its own p-phrase, as illustrated for *Gorilla* and *Pferd* in (13). However, this is it is not the case for *Löwe*, which is final and attracted by the final low tone. For this reason, this word is only subject to downstep.

Figure (13) shows the scaling relationship between the registers of phrases and the individual tones in a schematic fashion.

3. The highest peaks were detected with the help of the 'get maximum pitch' function of Praat (before smoothing the pitch track).

(13)



The metrical grid for the sentence (12) is given in (14). Every pitch accent is the head of its p-phrase. At the highest level of phrasing, the heads are strongest, and they become weaker when the p-phrases they head are embedded. A deeper embedding goes together with a weaker metrical position.

		x			x			x
	x	x		x	x		x	x
	[[[x]	[x]]	[[[x]	[x]]	[x]]	[[[x]	[x]]	[x]]
	269	*388*	**253**	235	*303*	**230**	204	*178*
(14)	links	Gorilla	rechts	Gorilla	Pferd	Pferd	rechts	Löwe

3.2 Postnuclear deaccenting

Some sentences contain deaccented postnuclear material (see (9) and (10)). As has been repeatedly observed in the literature, a locational or directional adverbial or prepositional expression preceding a predicate is often deaccented (see for instance Kratzer & Selkirk 2007; Zubizarreta 1998; Féry to appear). Without going into the details of syntax-based phrasing in German, in (15) the subject *eine Kuh* is the only pitch accent of the entire phrase, which is formed by a subject, directional PP and verb. In any case, the lack of pitch accents keeps the number of p-phrases small, as in Figure 5, where *an seine Stelle gestellt* is unaccented.

(15)
H^*L_P L^*H_P
[[Der GORILLA]$_P$ [wird ENTFERNT]$_P$]$_I$
H^*L_P ⟶ L_I
[[und eine KUH an seine Stelle gestellt]$_P$]$_I$
'The gorilla is removed and [*a cow*]$_{Loc}$ is [at its place]$_{Lx}$ put.' (39.8)

Deaccenting can also take place when the entire VP is considered as given, as illustrated in (16) and in Figure 6. The entire VP *wird hinter dem Tiger hingestellt* is deaccented. It must be noticed, however, that this kind of deaccentuation was exceptional in our corpus. In most utterances, both locatum and relatum received

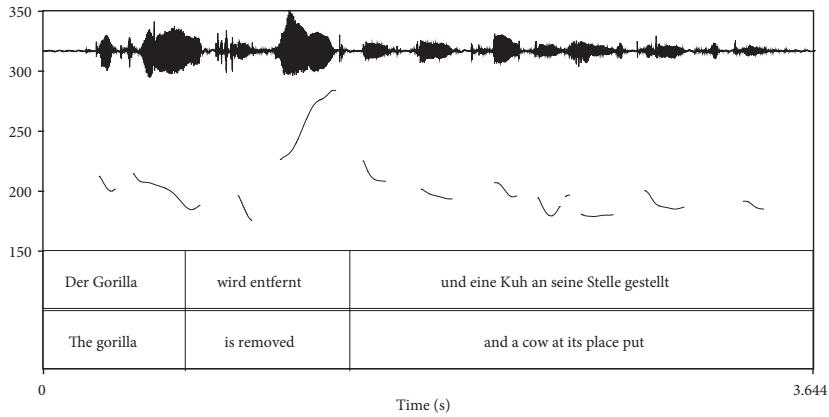


Figure 5. Deaccenting and dephrasing (39.8)

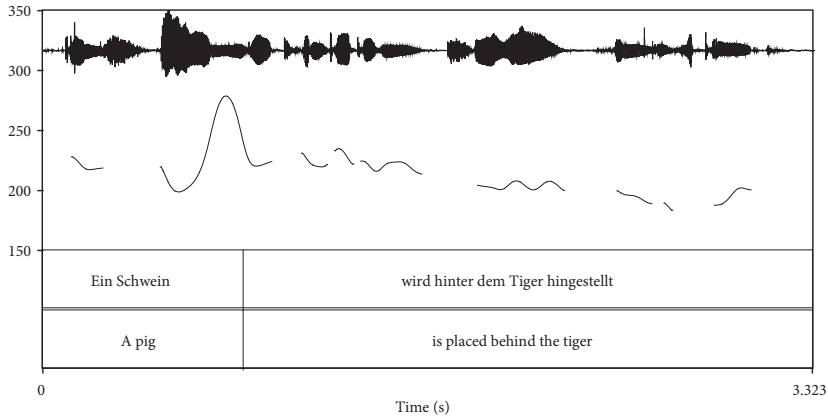


Figure 6. Deaccenting (48.10)

a pitch accent, and the difference between new and given animals was expressed by word order and the concomitant direction of accents as rising and falling.[4]

4. We were interested in whether givenness affects the height of pitch accents in our data, as well. As mentioned above, a correlation between givenness and word order could be established. In 66% of the German sentences, the locative expression, containing a given relatum, was uttered before the new locatum. The word order affected the direction of the pitch accents since non-final pitch accents are usually rising in German, and final ones are usually falling. However, a correlation between height of accents and givenness could not be established. In order to check this, we compared the maximal and minimal values of pitch accents in Loc-Lx and Lx-Loc for those speakers who realized both orders with a new Loc, altogether 10

L*H$_P$ H*L L$_I$
(16) [[Ein SCHWEIN]$_P$ [wird hinter dem TIGER hingestellt]$_P$]$_I$ (48.10)
'[*A pig*]$_{LOC}$ is placed [behind [the tiger]$_{REL}$]$_{LX}$.'

3.3 Duration

The last correlate of prosodic phrasing discussed for German is duration, which can replace or complement pitch scaling, as illustrated in (17) and Figure 7. The rising accent on *Zebra* is only slightly downstepped relative to the accent on *Pferd*, but the length of *Zebra* is increased. This particular realization was 0.920 ms long. There were 4 other realizations of *Zebra* by the same speaker (in other experiments, recorded later but on the same day), twice as a focused referent (0.566 and 0.590 ms), and twice as a given referent (0.417 and 0.574 ms).

L*H$_P$ L*H$_P$ L*H$_I$ H*L$_P$
(17) [[LINKS]$_P$ [vom PFERD]$_P$ [steht jetzt ein ZEBRA]$_P$]$_I$, [[RECHTS]$_P$
H*L$_P$ H*L$_I$
[vom PFERD]$_P$ [der BÄR]$_P$]$_I$ (28.4)
[*a zebra*]$_{LOC}$ is now standing [to-the-left of-the horse]$_{LX}$, the bear is standing to the right of the horse

Both strategies (high boundary tone and lengthening) can also be combined, as illustrated in (18) and Figure 8 where both animal names are concerned: *Krokodil* is

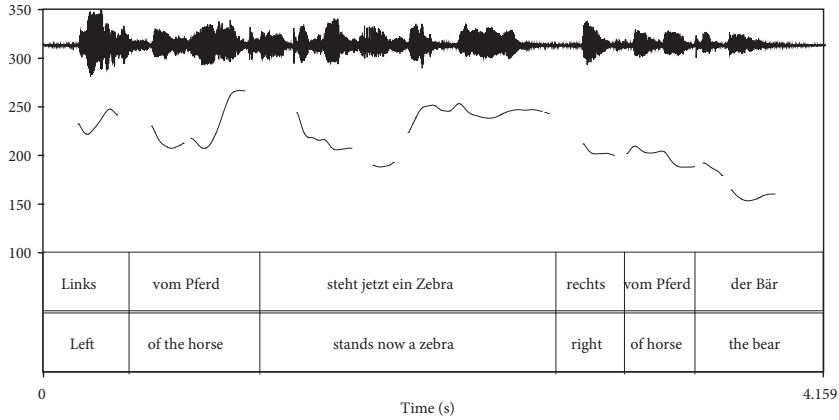


Figure 7. Duration as a correlate of phrasing (28.4)

speakers. The data are highly variable, not only because of speaker-dependent pitch registers, but also because each speaker used different constructions (see Appendix for the results).

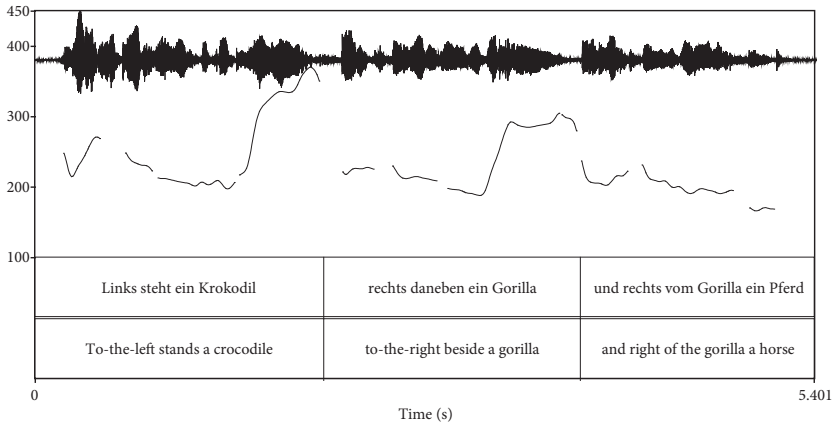


Figure 8. Combination of pitch scaling and duration (28.1)

0.887 ms (as compared to other non-lengthened occurrences: 538 and 530 when focused, and 580 ms when given). *Gorilla* is 0.741 ms in Figure 7 (as compared to 608 and 584 as focus and 380 ms when given and not lengthened).

(18) L^*H_P L^*H_P L^*H_P
[[[LINKS]$_P$ [steht ein KROKODIL]$_P$]$_P$ [[rechts daneben]$_P$ [ein GORILLA]$_P$]$_P$
to-the-left stands a crocodile to-the-right beside a gorilla
L^*H_P H^*L_I
[[und RECHTS]$_P$ vom Gorilla]$_P$ [ein PFERD]$_P$]$_I$ (28.1)
and to-the-right of-the gorilla a horse
'On the left there is a crocodile, to its right a gorilla, and to the right of the gorilla a horse.'

However, duration remains a secondary prosodic means in German. In Section 4.3, duration is systematically compared in French and German with the word *Gorilla*, classified in phrase-internal, phrase-final and sentence-final occurrences. It will be shown there that German uses length as a correlate of phrasing, but to a lesser extent than French.

To sum up this section, prosodic phrasing, corresponding to syntactic and pragmatic structure, is expressed in German through scaling of accents and boundary tones, and complex (embedded) phrasing is accompanied by complex relationships in F0. Pitch accents, which are associated with lexical stresses, act as pivots for the intonation. They are assigned to the phrasal heads and stand in a scaling relationship to each other, modulo the level of embedding and information structural status. There is postnuclear deaccenting. Final lengthening is only sporadic and is not systematically used to signal the end of prosodic domains,

although we find a systematic lengthening in phrase-final position as compared to phrase-internal position (see below).

4. Correlates of phrasing in French

Three properties of phrasing in French will be discussed in some detail: first, scaling of tones in Section 4.1, second the demarcative function of tones in Section 4.2 and third the role of duration in 4.3.

4.1 Scaling of tones

Syntax is decisive for prosodic phrasing in French, in the same way as it is for German, and p-phrases largely correspond to syntactic phrases (see Delais-Roussarie 1995, 2005 and Hamlaoui 2008 among others). As in German, p-phrases can be completely included inside larger ones, speaking for recursion of p-phrases. However, there is a crucial difference between the two languages. Tones are not assigned to lexical stresses, which do not exist in French, but are distributed at the beginnings and ends of p-phrases; see Section 4.2. In the following, final tones are provided with subscripted P and I, but initial ones are not. Like in German, pitch scaling is important, as can be seen from the pitch tracks of the French examples.

In Figure 9, which illustrates (19), the top lines of a sequence of p-phrases at the highest level of phrasing are in a downstep relationship, like in German. All three are contained in a larger constituent, an i-phrase. The downstep relation

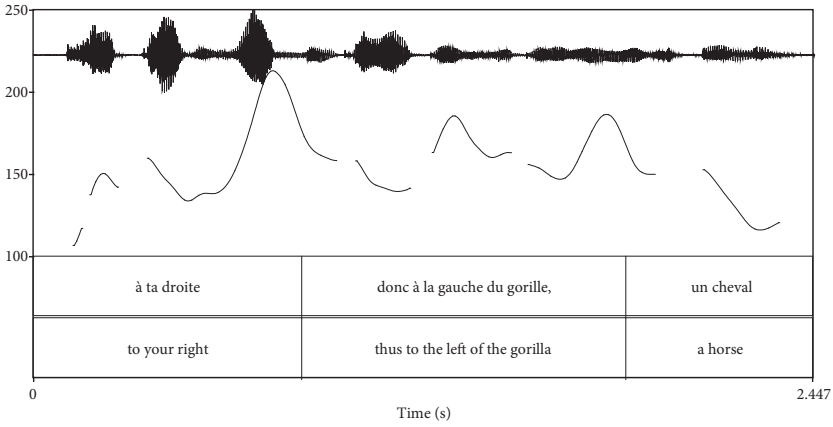


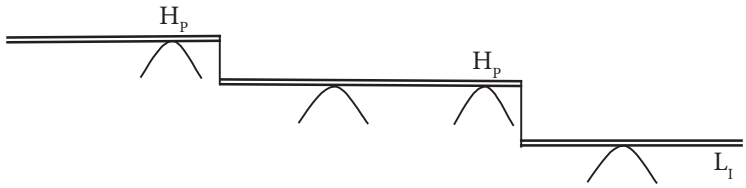
Figure 9. Pitch scaling in French (16.01)

between the top lines of constituents expresses the cohesion between the constituents; see (20).

(19) H L H_P L H_P L H_P H L_I
[[A ta droite]$_P$ [donc [à la gauche]$_P$ [du gorille]$_P$]$_P$ [un cheval]$_P$]$_I$ (16.01)
To your right, thus to the left of the gorilla$_{Lx}$, a horse$_{Loc}$

There is however a crucial difference between pitch scaling in German and in French. We saw that in German, every p-phrase defines its own level of downstep, and that this property can lead to an intricate downstep pattern. By contrast, in Figure 9, the medial p-phrase contains an embedded p-phrase *à la gauche* 'to the left', but the pitch level of this part is not lower than the level of the one in which it is contained. This is because both tonal excursions of this p-phrase are adjusted to the top line of the domain, as shown in (20).

(20)



When p-phrases are embedded into each other, downstep is often cancelled or even reversed.

The pitch track for (21) in Figure 10 illustrates pitch scaling of tonal excursions across two successive i-phrases, as well as inside of them.

(21) a. H L H_P H L H_P L H_I
[[On enlève le chien]$_P$ [[on met l'ours]$_P$ [devant le cheval]$_P$]$_P$]$_I$ (1.6)
One takes-away the dog, one puts the bear$_{Loc}$ in front of the horse

b. H L H_P H L_I
[[et devant l'ours]$_P$ [un gorille]$_P$]$_I$ (1.7)
and in front of the bear a gorilla$_{Loc}$.
'The dog is taken away, the bear is placed in front of the horse, and a gorilla is placed in front of the bear.'

The single i-phrases each stand for one layout, but they are tonally organized in a common i-phrase, showing that, as in German, i-phrases may be embedded into each other. They are in a downstep relationship to each other; see (22). The top line of the first i-phrase is visible at its final boundary, thus on the word *cheval*. The word *chien* delimits the first p-phrase, embedded into the larger one. *Chien* carries a high boundary tone, which is lower than *cheval* (265 vs 291 Hz). And the first mention of *ours* (237 Hz) is much lower than *cheval*. In fact, it does not

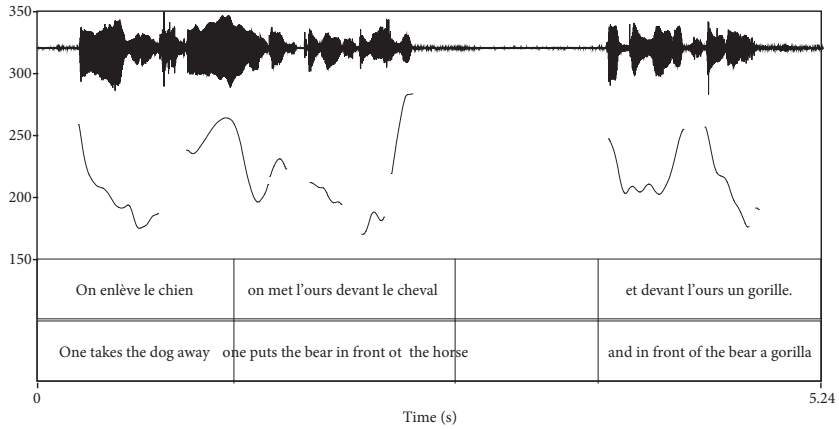
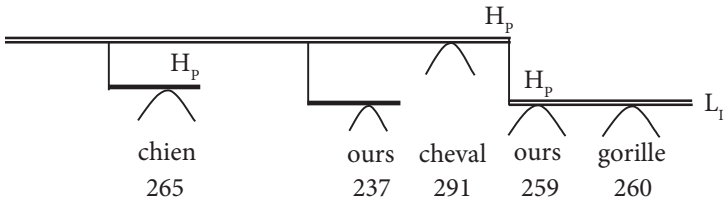


Figure 10. No downstep in embedded p-phrases in French (1.6), (1.7)

carry any tonal prominence, even though the referent is introduced for the first time. The high tone on the second occurrence of *ours*, which is the head of the first p-phrase of the second i-phrase, indicates the height of the top line of this i-phrase (259 Hz). It is downstepped relative to the high tone of *cheval*, but not relative to *chien*. It is much higher than the first occurrence of *ours* because it is at the boundary of a non-embedded p-phrase. The second high tone of the second i-phrase, *un gorille*, is not downstepped relative to the first one of the same phrase (260 Hz).

(22)



The symmetric and regular downstep relations observed in (14) for German is thus absent in French. The relationship between the highest peaks is dependent on the place of the bearers of high tones in the prosodic phrases, and not on the pitch accents as in German. Furthermore, as mentioned above, embedded phrasing does not necessarily correlate with downstep. This different pitch scaling relationship seems to be a recurrent property of phrasing in French, though more research is needed in order to establish it as a reliable property.

4.2 Demarcative function of tones

Prosodic p-phrases are characterized by their tonal melody. Non-final p-phrases generally end with a rising contour, the *continuation mineure* 'minor continuation' of Delattre (1966), *intonème continuatif mineur* 'minor continuation intoneme' of Rossi (1985) or *contour montant* 'rising contour' of Delais-Roussarie (2005). We analyze the tonal pattern of a non-final p-phrase as the tone sequence LH_P. A frequent realization of a p-phrase involves an early high tone, often preceded by a low tone, thus a rise, which has been analyzed as a secondary accent by a number of authors (see the overview in Di Cristo 1998). In the last p-phrase of an i-phrase, the initial rise and the final fall often form a hat contour: there is no dip in-between (see Figure 10).

In the p- and i-phrase final position, a fall, written as HL_I, is generally found, as in Figure 11, example (23), which shows a final downstepped fall on the locatum *chien* in the Lx-Loc order.[5]

(23) L H_P (L) H_P L H_P L H_P H L_I
[[et [de l'autre]$_P$ [côté]$_P$ des animaux]$_P$ [[on met]$_P$ un chien$_{Loc}$]$_P$]$_I$ (1.5)
and on the other side of the animals, one puts a dog
'And a dog is placed on the other side of the animals.'

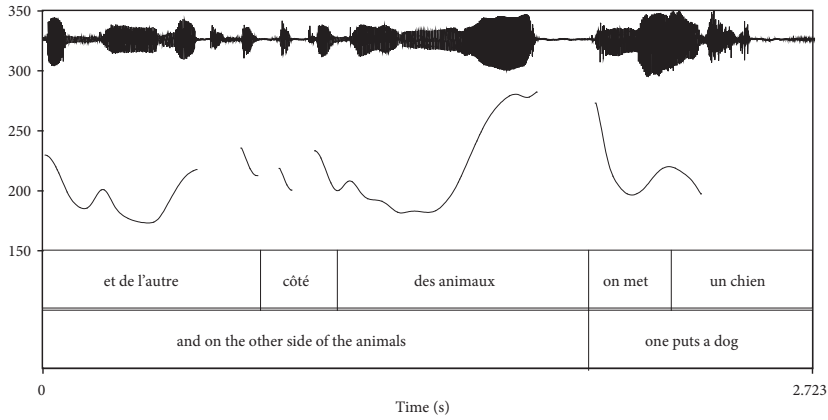


Figure 11. Falling contour on the final locatum (1.5)

5. Alternatively, a steep rise followed by a short truncated fall, analyzed as LH_PL_I, appears very often in the corpus. In this kind of contour, a final schwa emerges, which is typical for the speech of young Parisians (Martin 2007).

Consider next the lexical material on which tonal excursions are realized. Since tonal excursions are preferably located at the edges of p-phrases in French, tones can associate with functional or content words, given or new. The fact that major tonal excursions coincide with the beginning or end of the domains has been widely commented upon (see for instance Delais-Roussarie 1995, 2005; Di Cristo 1998; Féry 2001; Garde 1968; Ladd 1996; Post 2000; Vaissière 1983 and many others). Some researchers associate these tonal excursions with 'demarcative' or postlexical accents, a terminology that suggests that the tonal excursions found at the beginning or end of prosodic domains are pitch accents. The final excursion is then the primary accent, sometimes called 'logical' or 'grammatical,' and the initial one is either a secondary accent or an emphatic accent. For other authors, it is the grouping of lexical items in syntactic units which gives French its characteristic intonational pattern (see Martin 1975 and Dell 1984 among others). It is conspicuous that nearly all authors studying the intonation of French have concentrated on a domain comprising a few words or about 3.5 syllables on average, called the *arc accentuel* 'accentual arc' by Fonagy (1979), the *mot rythmique* 'rhythmic word' by Pasdeloup (1990), or the 'Accentual Phrase' by Jun & Fougeron (2002), rather than, as is usual in German and in English, on pitch accents and their alignment with stressed syllables.[6] We think that this shift in the object under study corresponds to a deep difference in the prosodic organization of the two languages. In the same way, when studying the meaning of intonational patterns in French, Delais-Roussarie (2005), Delattre (1966) and Marandin (2006) use contours rather than tones.

The following sentence, in (24) and Figure 12, is another utterance in which the new animal is neither phrase initial nor phrase final, and, as a result, has no rise or fall. If tonal excursions do not appear p-phrase medially, but rather fall together with beginnings or ends of phrases, this is what is expected.

	LH	L H_P	L $H_P(L_I)$
(24)	[[Le gorille s'en va]$_P$ [un zèbre à la place]$_P$]$_I$		(16.4)
	The gorilla goes away, a zebra$_{Loc}$ at the place		
	'The gorilla has gone away; there is a zebra instead.'		

The fact that function words are often the bearers of initial high tones strongly speaks against a systematic interpretation of the initial rises as accents or stresses. For this reason, we refrain from establishing a strict association between final excursions and 'accents' in French, and prefer an interpretation of the final and initial excursions as delimiting prosodic domains.

6. Exceptions are Post (2000), followed by Gussenhoven (2004), and Delais-Roussarie (1995, 2005), who consider French to have pitch accents resembling those of Germanic languages.

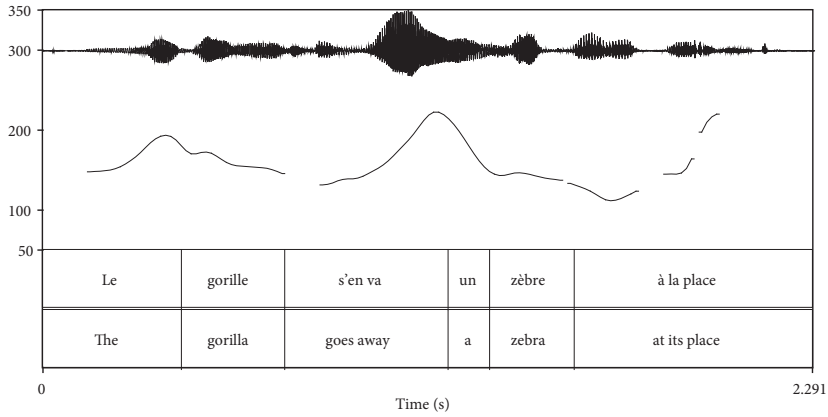


Figure 12. No tonal excursion on a new locatum (16.04)

In (24), the article *le* 'the' is the high-pitched syllable in the first p-phrase, and it is *par* 'by' in the second one.[7] As a result, this kind of intonation, which is very frequent in French, does not serve to emphasize the function words. Rather the initial rises are to be interpreted as purely delimitative tones.[8]

The asymmetric pitch scaling in French finds a natural explanation. If tonal excursions have a demarcative function, it may be the case that the p-phrase initial one is lower than the final one. This would coincide with a weaker initial boundary and a stronger final one. In German, tonal excursions may be demarcative as well, but pitch accents are more prominent, and overwrite the demarcative function of a tonal contour in a large number of cases. As a result, excursions are interpreted as prominences.

4.3 Duration

The third and last component of phrasing is duration. It is sometimes claimed that French systematically lengthens p-phrase final syllables (see for instance Crompton 1980; Pasdeloup 1990 and Vaissière 1983 for lengthening in French). Delais-Roussarie (2005) finds that final syllables have an increase of duration varying between 25% and 100% as compared to non-final ones. Di Cristo (1998)

7. Contrary to Jun & Fougeron (2002), who claim that 3 or 4 or more clitic syllables are necessary in order for a clitic to be able to carry the first high tone, we find that a unique function word can be the bearer of this high tone.

8. The same intonation on the definite article in German can only be used in a contrastive situation: "This gorilla is going away, but that one…"

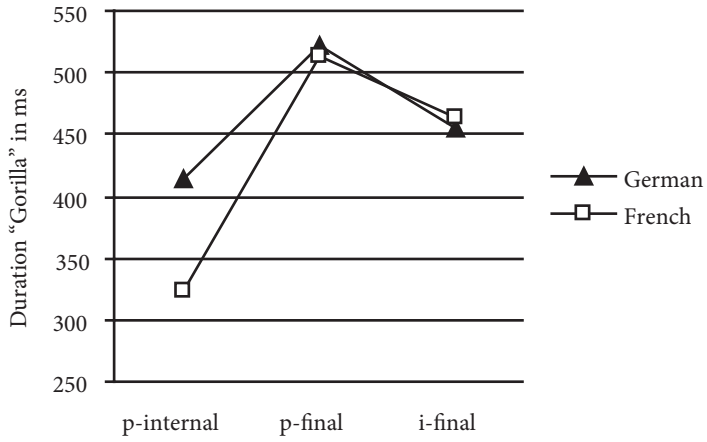


Figure 13. Mean durations of *Gorilla* (German, 23 speakers) and *gorille* (French, 20 speakers) as a function of position: p-internal, p-final, and i-final

also insists on the longer duration of final words, which he correlates with stress. Post (2000) distinguishes primary accent, a tonal phenomenon, from longer duration, due to final lengthening. All authors agree in finding an increase of duration at the end of larger prosodic domains. In our own data, final lengthening is the rule rather than the exception.

In order to find out how final lengthening is implemented in French and whether lengthening differs from German, we measured the duration of all occurrences of *Gorilla* in German (156 tokens provided by 23 speakers; seven speakers used the word *Affe* 'monkey') and *gorille* in French (112 tokens provided by 20 speakers). Layout 0 (L0) with a crocodile next to a gorilla was included, since this introductory layout also elicited occurrences of *gorilla*. The data were subjected to a linear mixed effect model (LME) with speakers and language as random and fixed factors, respectively.[9] The second fixed factor was phrase position with the three levels: internal in p-phrase (p-internal), final in p-phrase (p-final: not final in i-phrase), and final in i-phrase (i-final). We specified repeated contrasts for the three-level factor position, that is, we compared p-initial with p-final and p-final with i-final occurrences. Mean word durations are plotted in Figure 13.

Averaged across both languages, p-phrase-final occurrences are longest, that is, they are much longer than p-phrase-internal occurrences [estimated difference: 161, $SE = 13.6$, $t = 11.85$] and they are also significantly longer than i-phrase-final occurrences [estimated difference: 58, $SE = 16.9$, $t = 3.46$]. This may be due to the

9. The LME was computed with the *lmer* program of the *lme4* package (Bates, Maechler & Dai 2008), supplied in the *R* system for statistical computing (R Development Core Team 2008).

fact that p-phrase-final words sometimes went together with a moment of hesitation of how to continue the sentence, and that this moment of hesitation often had a considerable effect on duration. By contrast, i-phrase-final words showed a less strong lengthening effect, falsifying the claim that final lengthening is larger in higher prosodic domains.

Moreover, the lengthening of p-final compared to p-internal occurrences was stronger in French than in German as revealed by the significant interaction [estimated difference: –52, *SE* = 13.6, *t* = 3.85]. It thus appears that French uses length differences to a larger extent than German for the expression of prosodic phrasing.[10]

Additionally to final lengthening, a common lengthening strategy is illustrated in (25) and Figure 14. There, *ours* 'bear', a word ending on a consonant, is pronounced with an additional schwa. In Figure 13, it is the last word of the sentence, but the same phenomenon also regularly appears in the middle of an i-phrase in our data.

(25) L H_P L H_P H L_P
[Et y a un chien]$_P$ [[à la droite]$_P$ [de l'ours[ə]]$_P$]$_I$ (2.5)
and there is a dog to the right of the bear
'And there is a dog to the right of the bear.'

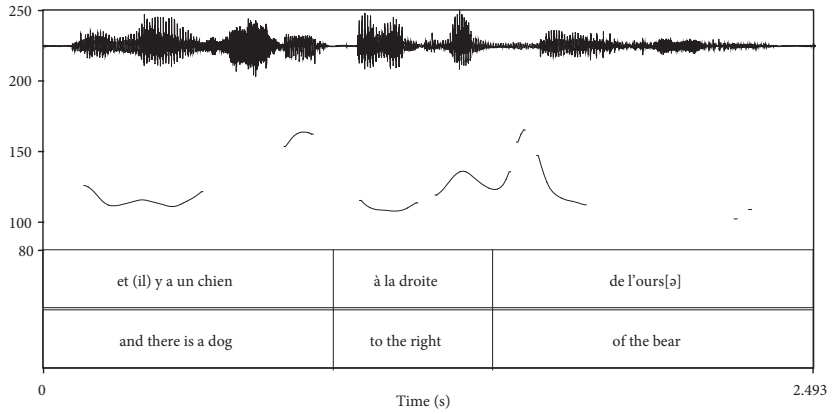


Figure 14. Final lengthening on *ours* (2.5)

10. Especially since the word *gorille* in French has two syllables, but the word *Gorilla* in German has three.

In sum, final lengthening is an important correlate of prosodic phrasing in French, but less so in German. This may be related to the fact that tones are demarcative in French but primarily indicators of prominence in German.

5. Discussion and conclusion

Results of a production experiment with pseudo-spontaneous utterances conducted in the same way in French and German have been used to explore the differences in prosodic phrasing between the two languages. The participants had to describe layouts of new and given toy animals. We started the paper by sketching some issues having to do with syntax and information structure (but see Hörnig & Féry submitted, for a more detailed account). In particular, we assume that in both languages, the unmarked or canonical word order favors the order locatum < locative expression. In many cases, however, the locatum was the new referent, whereas the locative expression contained a given referent, called the relatum. According to the 'given-new contract' of Clark & Haviland (1977), the locative expression should precede the locatum. The conflict between word order and information structure was resolved differently in the two languages. German has a flexible word order and inverted the order of the constituents more easily than French, which has a rigid word order.

The correlates of prosodic phrasing were investigated and compared in the remainder of the paper. In both languages, prosodic phrasing is primarily motivated by syntax, which is itself influenced by pragmatic needs. The syntactic structure is mapped to prosodic phrases, modulo some mismatches not addressed in the paper. Larger syntactic phrases correspond to larger prosodic phrases, and smaller syntactic phrases to smaller prosodic phrases. Prosodic structure is recursive.

The crucial claim made in the paper is that superficially similar tonal contours arise from different tonal entities, namely pitch accents in German and boundary tones in French. This crucial difference between German and French comes from the fact that German has lexical stress whereas French does not, and many differences between the two languages are related to this distinction. In German, pitch accents are obligatorily assigned to lexically stressed syllables, which carry the starred tones in an autosegmental representation. The excursions as rises or falls are perceived as off-glides from the starred tones, or as boundary tones. Pitch accents are at the same time heads of prosodic phrases and thus indicators of scaling of registers. Postnuclear material is deaccented. In a neutral kind of prosody, when the sentence is all-new, all prosodic phrases are downstepped relative to each other, and downstep is realized and perceived by the bitonal tones. When focus or givenness increases or reduces the register of a prosodic phrase, it is again

the bitonal tones which are concerned. Duration, by contrast, plays a subordinate role. In sum, most prosodic effects are organized around prominent pitch accents related to lexical stresses.

French has no lexical stress and no correlating pitch accent. Instead, tonal excursions correspond to edges of prosodic domains and have a demarcative function. French may also have more freedom in the way bitonal contour tones are realized. Since no syllable obligatorily carries a prominence, tones can be assigned to any of them. Tones are prominent by nature, since they involve changes in the melody of sentences, and they are often associated with prominent words, in our data preferably with animal names or location adverbs. Conversely, a prominent word in the middle of a p-phrase can be realized without any melodic contour. Downstep of p-phrases is also constitutive of the intonation of French, however it is not the second part of bitonal pitch accents which implement it, but rather the boundary tones of each p-phrase. Duration as a correlate of prosodic phrasing is more important in French than in German. It could be shown with the measurement of all occurrences of the word *Gorilla* in German and *gorille* in French that duration differs more phrase-internally and phrase-finally in French than in German. This result is important since it provides more evidence for analyzing French as a phrase-based language and German as prominence-based.

In sum, German and French have deep structural differences in their prosodic structure related to the presence versus absence of lexical stress. A comparative study such as presented in this paper can reveal the differences in an efficient way.

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Appendix 1

Table i. F0 minima and maxima of rising and falling accents on the German locata and relata for the 10 speakers who produced both word orders Loc-Lx and Lx-Loc. The values are averaged on n sentences for each case (n is in parentheses).

Speaker	Rel-Loc (Loc falling)				Loc-Rel (Loc rising)			
	Rel (min)	Rel (max)	Loc (max)	Loc (min)	Loc (min)	Loc (max)	Rel (max)	Rel (min)
1	183	223 (7)	188	153 (4)	190	255 (1)	–	–
18	177	206 (4)	182	144 (4)	151	173 (2)	–	–
26	176	217 (1)	187	156 (1)	190	208 (7)	183	166 (4)
32	194	229 (1)	197	175 (1)	139	222 (2)	187	173 (1)
34	170	225 (2)	200	160 (2)	199	207 (2)	193	177 (1)
35	117	166 (4)	114	100 (4)	107	132 (1)	–	–
39	201	209 (1)	182	179 (1)	179	241 (4)	200	178 (3)
42	190	293 (2)	237	177 (2)	188	324 (1)	257	175 (1)
44	192	288 (5)	216	163 (5)	202	329 (1)	215	164 (1)
48	180	261 (4)	203	176 (4)	197	282 (1)	226	198 (1)