A short report on intonation phrase boundaries in German*

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Abstract

This short report presents an experimental exploration of the intonation of German embedded clauses, based on the data of an Austrian speaker of German. The right edge of an intonation phrase is indicated by upstep and by edge tones with this speaker. A right edge of an intonation phrase is regularly found at the right edge of clauses, including embedded clauses, though not preceding medial left edges of clauses. This cannot be captured by the proposal of Downing (1970) to the effect that only root clauses form obligatory intonation phrases, and suggests that clauses affect intonation phrase formation even when they are syntactically more deeply embedded. A brief account in Optimality Theory is presented that relates the present findings to those discussed by Downing and Nespor and Vogel. The account generalizes the interaction of Alignment and Wrapping from phonological phrases to intonation phrases.

1 Introduction

This report is a first systematic exploration of the production of intonation phrase boundaries in relation to clausal configurations in German. Results from recordings with one speaker are reported. They show that, for this speaker at least, the right edge of embedded clauses, though not the left edge, leads to an intonation phrase boundary. These findings are not in line with early suggestions by Downing 1970 and Nespor and Vogel 1986 for English, which do not provide for a primary influence of embedded clauses on intonation phrase formation. A suggestion is made how the present findings and those of Downing and Nespor and Vogel may be reconciled in an account in Optimality Theory.

Section 1 presents relevant background: suggestions for relating intonation phrases to syntax (1.1), intonational analysis and its application to German (1.2.), and the intonational phenomena that are used to diagnose intonation phrases in this report (1.3). Sections 2 and 3 show the experimental results.

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Section 4 contains discussion and the account, and section 5 is the conclusion. Details of the experiment are given in an appendix.

1.1 Intonation phrases

The theory of *prosodic phonology* (Nespor and Vogel 1986, Selkirk 1986) postulates *prosodic words*, which show a systematic relation to morphosyntactic words, without being identical to them; it postulates larger phonological constituents with systematic relations to syntactic phrases (maximal projections, XPs) without being identical to syntactic phrases. (The terminological suggestion of Truckenbrodt 1999 is to subsume these under the label *phonological phrases*, which has been used for some of these cases.) The next higher level in the prosodic hierarchy of Selkirk 1980, Nespor and Vogel 1986 is that of the intonation phrase, which is of interest here. Intonation phrases are known to vary with rate of speech, length of constituents, and other factors. There is nevertheless a theoretically interesting question as to whether and how the formation of intonation phrases is sensitive to syntactic information (Bierwisch 1966, Nespor and Vogel 1986, Selkirk 1984, Taglicht 1998, the latter two concentrating on options of clause-internal divisions): What are the syntactically conditioned cross-linguistic factors that determine reproducible preferences in intonation phrase formation?

In a first approximation, intonation phrases seem to relate to (i) clauses and to (ii) root status of these clauses.[1] Halliday 1967 for example used English clauses and their separation by larger prosodic boundaries as a point of departure. On the other hand, Downing 1970 argued at considerable length that only *root* clauses have their edges coincide with obligatory pauses (larger prosodic boundaries). This latter position is adopted, with different implementations, by Bing 1979 and Nespor and Vogel 1986, and is summed up in (1).

(1) Root clauses (but not embedded clauses) are bounded by obligatory intonation phrases boundaries.

[1] I use the terms *root clause* and *embedded clause* in their standard sense in this article. For completeness I offer this definition (see also Downing 1970:30): Assume that coordination as in *CP and CP* is not represented by a higher conjoined CP node, but instead by either a Boolean Phrase (BP; see Munn 2000) or in a multiplanar representation of coordination without a higher constituent (Goodall 1987, Muadz 1991, Moltmann 1992). Then I call an *embedded clause* any CP that is contained in another CP. I call a *root clause* any CP that is not contained in a higher CP. Thus, in the example *[It's raining] and [you know [that it's raining]]*, the CP nodes are delimited by brackets. There are two root clauses in this example, one being *[It's raining]*, the other one *[you know [that it's raining]]*: both are not contained in a higher CP. The clause *[that it's raining]* is contained in a higher CP, and so it is an embedded clause. I further use the term *matrix clause* in the sense of a root clause 'minus' its embedded clause(s). In the example used here, *[you know __]* is a matrix clause.

Thus coordinated root clauses as in (2a) must form separate intonation phrases, while coordinated embedded clauses as in (2b) are not separated by an obligatory internal division. Downing also points out that the prosodic division in (2c) cannot be omitted without attributing contradictory beliefs to Bill.

(2) a. [Billy thought his father was a merchant]$_I$ [and his father was a secret agent]$_I$
b. [Billy thought his father was a merchant and his mother was a secret agent]$_I$
c. [Bill thought his father was older than his mother]$_I$ [and his mother was older than his father]$_I$

Parentheticals and appositive relative clauses as in (3) are taken to be set off from the rest of a clause by obligatory intonation phrase boundaries. Downing 1970 and Nespor and Vogel 1986 adopt a syntactic analysis by which such elements are (or, for Downing, derive from) root clauses (see also Safir 1986, Espinal 1991).

(3) The girls, I suppose, will make some sandwiches.
Seattle, where George used to live, is an interesting city.

As desired, it can then be derived from (1) that they must form separate intonation phrases.

1.2 German intonation

In the theory of English intonation by Pierrehumbert 1980 and Beckman and Pierrehumbert 1986, tones or tonal combinations called *pitch accents* may associate with stressed syllables. For example, L+H* is a complex pitch accent of which the H part associates with the stressed syllable (marked with a star) and the L tone precedes the H* tone. Further, edge tones associate with the edge of the prosodic constituents. In the account of English in Beckman and Pierrehumbert 1986 these prosodic constituents are the *intermediate phrase* and the intonation phrase. The tones receive phonetic values by a component of phonetic implementation (or tonal scaling), and an actual f0-curve may be thought of as resulting from the phonetic points thus derived, and (linear or sagging) interpolation between them.

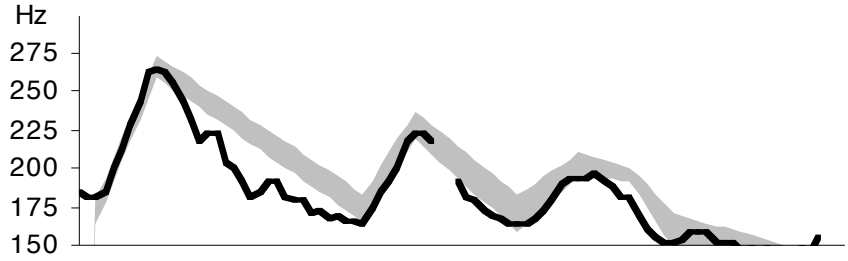
This theory has been applied to German intonation by Wunderlich 1988, Uhmann 1991, Féry 1993, Grabe 1998, Fitzpatrick-Cole 1999, Grice and Baumann 2002, among others. The account below also draws on the studies in this framework in Truckenbrodt 2002, 2004, 2005.

Sentences with no embedded clauses as in (4) and (5) are normally single intonation phrases. Understanding some aspects of their intonation is important for understanding the diagnostics of medial intonation phrase boundaries below.

Following the application of suggestions by Gussenhoven 1983 to German in Uhmann 1991, the intonation phrase (I) is taken to be grouped into a sequence of accentual phrases (A), each with a strongest stress and a pitch accent on the strongest stress. The accentual domains and thus the positions of accent are predictable on the basis of focus and syntactic structure. For the speaker at hand, the pitch accents are L*+H in non-final position, and typically H+L* in utterance-final position (see Truckenbrodt 2002, 2004, 2005, for more details; speaker SW, on whom I draw in the present study, is one of the speakers evaluated there for different recordings). As shown in (4) and (5), this accounts for a sequence of rises that originate with the stressed syllables. The stressed syllables are perceived as low in this intonation pattern. The penultimate accent, L*+H, connects with the final one, H+L* to the shape of a mountain with a high plateau, discernible in (5).

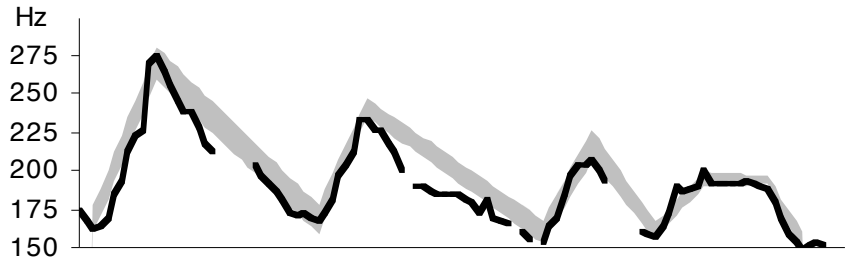
(4) and (5), like later illustrations, show a representative pitch-track (black line) against the background of averaged measurements from a set of sentences with the same syntactic and prosodic structure (grey band). The grey band traces the average values at the low (L) and high (H) turning points of the other recordings with the same structure. The thickness of the gray band at each such measurement point is twice the standard deviation of the values underlying this average. The number of recordings that were made and measured for a given pattern is shown in the top right. The grey band is intended to show that the pitch-track chosen for display is representative of the larger number of recordings that underlie this report. More details on the recordings and measurements, as well as all stimuli, are given in the appendix

(4) n = 6



L*+H L*+H L*+H (H+) L* L_I
[x $]_I$
(x)(x)(x)(x $)_A$
Die Lena will dem Werner im Jänner ein Lama malen.

(5) n = 6



L*+H L*+H L*+H L*+H H+L*L_I
[x $]_I$
(x)(x)(x)(x)(x $)_A$
DerMaurer und sein Lehrling wollen dem Werner in Kamerun ein Lama malen.

In the rendition of the examples accented syllables are underlined, with double underlining highlighting the last (nuclear) accent of an intonation phrase.

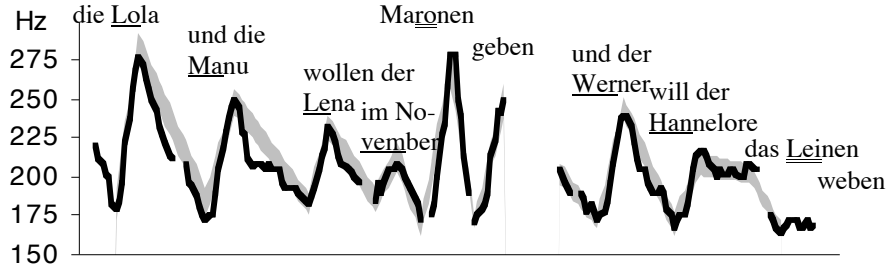
1.3 Evidence for intonation phrases

Crucial for the detection of intonation phrases is the relative height of the L*+H rises. In (4) and (5), the H peaks undergo *downstep* – lowering of each H peak relative to the preceding H peak (Liberman and Pierrehumbert 1984, Prieto, Shih and Nibert 1996, Grabe 1998, Truckenbrodt 2004).

(6) is based on recordings borrowed from Truckenbrodt 2002. They consist of conjoined root clauses, correctly predicted by Downing's and Nespor and Vogel's suggestion in (1) to form two separate intonation phrases, like (2a). The right edge of the first intonation phrase in (6) is marked with a sequence of edge tones L_AH_I that define the final low point and rise before the end of the first intonation phrase.[2] Further, the last (and strongest) nuclear accent of the first intonation phrase is marked with an L*+H rise that is crucially not downstepped, but instead returns to a tonal height comparable to the utterance-initial height. This is the phenomenon of *upstep*, studied and documented in detail in Truckenbrodt 2002, 2005. For speaker SW, upstep and final L_AH_I edge tone combination together provide evidence for the presence of a following medial intonation phrase boundary.

[2] I suggest in Truckenbrodt 2005 in the context of additional material by other speakers of German that the sequence of edge tones L_AH_I for speaker SW is derived from underlying H_AH_I by dissimilation of H_A to L_A before H_I.

(6) ***Upstep in coordinated clauses*** n = 18



[upstep H_I] [$L_I]_I$
(L*+H)(L*+H)(L*+H)(L*+H)(**L*+H L_A**) (L*+H)(L*+H)(H+L*)$_A$

[Die Lola und die Manu wollen der Lena
im November Maronen geben]$_{CP}$ [$_{CP}$ und der Werner will
der Hannelore das
Leinen weben]

This German upstep is cross-linguistically unusual insofar it shares certain properties with the more common clause-initial reset, but is systematically found in clause-final position. See Truckenbrodt 2002, 2005 for discussion and suggestions towards a principled understanding of this phenomenon.

Speaker SW comes from Austria. As argued in Truckenbrodt 2005, another Austrian speaker who was recorded used the nuclear sequence L*+H H_AH_I, and two groups of speakers from the South of Germany used a simpler sequence L*+H H_I preceding a medial intonation phrase boundary, with upstepped H_I and, for one group, also upstepped '+H'. The presence of an upstepped H tone seems to provide evidence for an upcoming medial intonation phrase boundary across these southern speakers; at the same time, the complex tonal configuration L*+H L_AH_I with upstepped +H is a particularly rich way of marking a medial intonation phrase boundary that I have so far found only with speaker SW. (Across speakers, the intonation phrase boundary is also a frequent position for dramatic breath-pauses, of which the pitch-tracks of SW in this paper also give an indication.)

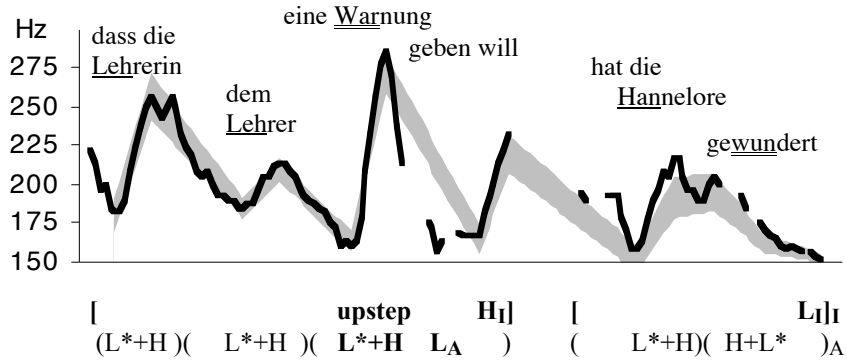
2 Results: Clauses in the Vorfeld, Mittelfeld, and Nachfeld

Do embedded clauses also trigger intonation phrase boundaries at their left or right edges? To test this question, recordings were made with SW with subject clauses in the *Vorfeld* (SPEC,CP), relative clauses in the *Mittelfeld* (between C and the first non-finite verb, if any), and object clauses in the *Nachfeld* (following non-finite verbs, if any). For each case, six different sentences with parallel syntactic structure were recorded twice with SW. The results are shown

in (7), (8), and (9)/(10), with a representative pitch-track for each case. The complete list of stimuli is shown in the appendix.

Subject clauses in the Vorfeld were systematically separated from the matrix clause by an intonation phrase boundary, as shown in (7).

(7) ***Subject clauses in the Vorfeld*** n = 12



[upstep H_I] **[$L_I]_I$**

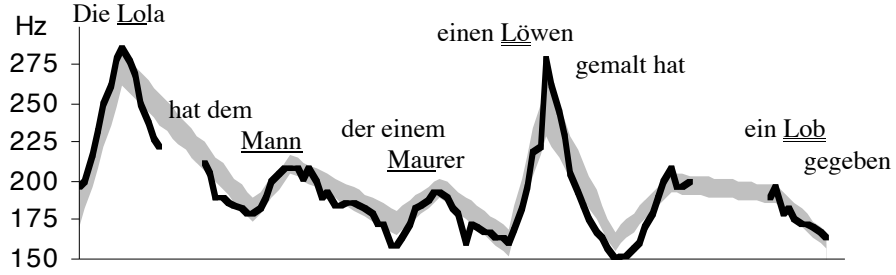
(L*+H)(L*+H)(**L*+H** **L_A**) (L*+H)(H+L*)$_A$

[[Dass die Lehrerin dem Lehrer
eine Warnung geben will]$_{CP}$ hat die Hannelore
gewundert]$_{CP}$

Within the initial clause in (7), there is the expected downstep on the second accent (on *dem Lehrer* in the example used for illustration), but this downstep is not continued on the third accent (on *eine Warnung* in this example), where an upstep is found instead. This upstep, together with the following evidence for the L_AH_I edge tone sequence, provides clear evidence for the intonation phrase boundary following the initial embedded clause

Results for relative clauses in the Mittelfeld are shown in (8). There are two observations of interest here. First, there is clear evidence for an intonation phrase boundary after the relative clause: the last pitch accent of the relative clause (*Löwen*) is upstepped, rather than downstepped in continuation of preceding downstep. It is also followed by the L_AH_I edge tone combination before the right edge of the relative clause. Thus, there is a clear intonation phrase boundary following the relative clause. Notice that the upstep cannot instead be attributed to the utterance-final end of an intonation phrase, which follows at a short distance. Upstep only occurs in these data preceding the end of an intonation phrase when another intonation phrase follows. At the end of the utterance, there is systematically no upstep, as can be seen in (4), (5), (6), and (7) in final position. Thus, the upstep on the peak of the relative clause in (8) clearly shows a medial intonation phrase break, followed by a short intonation phrase that contains the remainder of the matrix clause (*ein Lob gegeben*).

(8) ***Relative clauses in the Mittelfeld*** n = 12



[<no upstep> upstep H_I] [L_I]$_I$
(L*+H)(L*+H)(L*+H)(**L*+H** **L_A**) (H+L*)$_A$

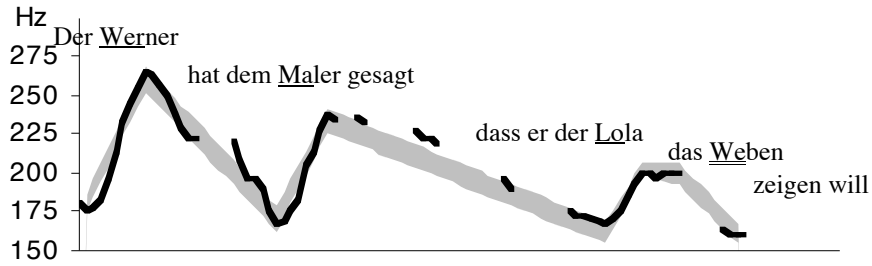
[Die Lola hat dem Mann
[der einem Maurer einen Löwen gemalt hat]$_{CP}$ ein Lob
gegeben]$_{CP}$

The second observation of interest in (8) is that there is no upstep preceding the relative clause. The second peak of the entire sentence (*Mann*) is downstepped relative to the initial peak. If there was an intonation phrase break to the left of the relative clause, this peak (*Mann*) would be expected to show upstep (height as the initial peak) rather than downstep (see Truckenbrodt 2002 for systematic cases of upstep on the second peak). Here, then, the absence of upstep (as well as the absence of a L_AH_I edge tone combination) preceding the relative clause is evidence for the absence of an intonation phrase boundary to the left of the relative clause.

Results for object clauses in the Nachfeld are given in (9) and (10), with two accents in the matrix clause in (9) and three accents in the matrix clause in (10).

Here the interesting result is the absence of upstep and absence of the L_AH_I edge tones preceding the embedded clauses. Thus, there is no evidence of an intonation phrase boundary between matrix clause and object clause. The position in which upstep would be expected if there were such a boundary is on the second peak in (9) and on the third peak in (10). Yet these peaks are instead downstepped, and are also not followed by the L_AH_I edge tone combination. The resulting sentence melody, in both cases, is therefore a continuing sequence of downstepped L*+H accents through the utterance, up to the utterance-final H+L* accent.

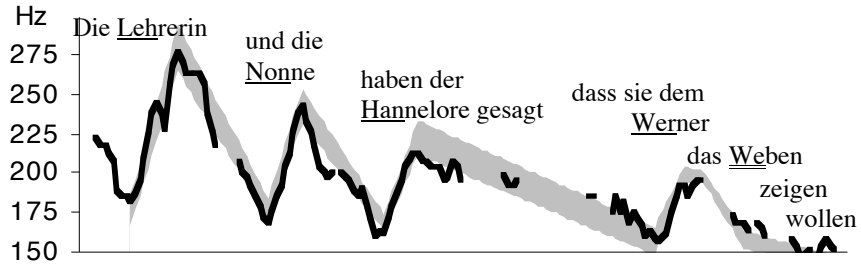
(9) ***Object clauses in the Nachfeld - shorter matrix clause*** n = 6



[<no upstep> $L_I]_I$
(L*+H)(L*+H)(L*+H)(H+L* $)_A$

[Der Werner hat dem Maler gesagt [$_{CP}$ dass er der Lola das Weben zeigen will]]$_{CP}$

(10) ***Object clauses in the Nachfeld - longer matrix clause*** n = 6



[<no upstep> $L_I]_I$
(L*+H)(L*+H)(L*+H)(L*+H)(H+L* $)_A$

[Die Lehrerin und die Nonne
haben der Hannelore gesagt [$_{CP}$ dass sie dem Werner das
Weben zeigen wollen]]$_{CP}$

Taken together, the results of clauses in the Vorfeld, Mittelfeld, and Nachfeld can be subsumed under the following description:

(11) Evidence for the right edge of an intonation phrase (upstep, L_AH_I edge tone combination) is found at the right edge of embedded CPs, but not preceding the left edge of embedded CPs.

Thus, the right edges of clauses in the Vorfeld in (7) and in the Mittelfeld in (8) show evidence of an intonation phrase boundary. On the other hand, there is no evidence of an intonation phrase boundary preceding the left edge of the clause in the Mittelfeld in (8) or the clauses in the Nachfeld in (9) and (10).

These findings, captured in (11), are not predicted by an extension of (1) to German. According to (1), one would not expect intonation phrase breaks at either the left or the right edge of embedded clauses – only root clauses would be expected to trigger intonation phrase boundaries. Thus, the intonation phrase breaks at the end of the clauses in the Vorfeld in (7) and at the end of the relative clause in the Mittelfeld in (8) are not predicted by (1).

3 Results: root coordination vs. embedded coordination

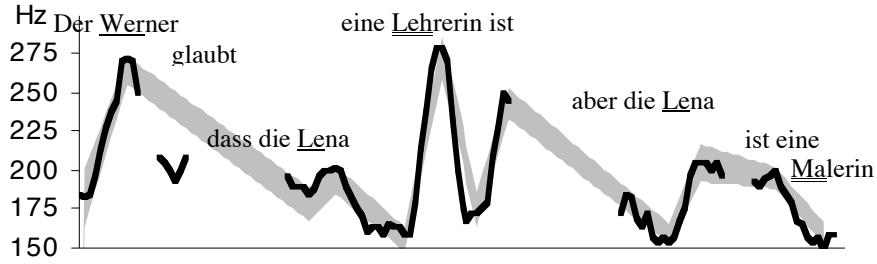
The generalization in (1) and the generalization in (11) also make different predictions for the sentences in (2). This is illustrated here with the German sentence patterns in (12), where (12a) is a construction of root coordination like (2a), and (12b) is a construction of embedded coordination like (2b). The generalization in (1) predicts a prosodic distinction between (2a)/(12a) and (2b)/(12b), which seems to match intuitions about English: Coordination of two root clauses in (2a)/(12a) is predicted to be separated by an intonation phrase boundary by (1), whereas the coordination of two embedded clauses in (2b)/(12b) is part of a single all-embracing root clause, and is therefore predicted not to be thus separated by (1). On the other hand, the generalization in (11), proposed for German, predicts that sentences like (2a)/(12a) and (2b)/(12b) should have identical prosodic structures. The position preceding *aber/und* in (12) is the end of a root CP in (12a) and the end of an embedded CP in (12b). By (11), there should be an intonation phrase break in this position in both cases.

(12) a. [W. glaubt [dass X Lehrerin ist]$_{CP}$]$_{CP}$ [aber X ist Malerin]$_{CP}$
b. [W. glaubt [[dass X Lehrerin ist]$_{CP}$ [und dass Y Malerin ist]$_{CP}$]$_{CP}$]$_{CP}$

(no boundary predicted) **boundary predicted** by (11)

Test sentences for this distinction were part of the recordings. The results for root coordination are shown in (13) and (14). As expected on the basis of either (1) or (11), an intonation phrase boundary separates the two root clauses. Evidence for this boundary is the upstep on the last accent of the embedded clause (*Lehrerin* in (13), *Lama* in (14)), and the following L_AH_I edge tone sequence.

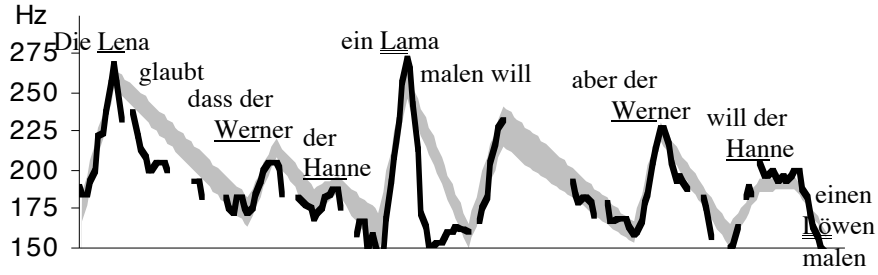
(13) ***Root coordination, shorter embedded clause*** n = 6



[upstep H_I] [$L_I]_I$
(L*+H)(L*+H)(**L*+H L_A**) (L*+H)(H+L*)$_A$

[Der Werner glaubt
[dass die Lena eine Lehrerin ist]$_{CP}$]$_{CP}$ [$_{CP}$ aber die Lena ist
eine Malerin]

(14) ***Root coordination, longer embedded clause*** n = 6

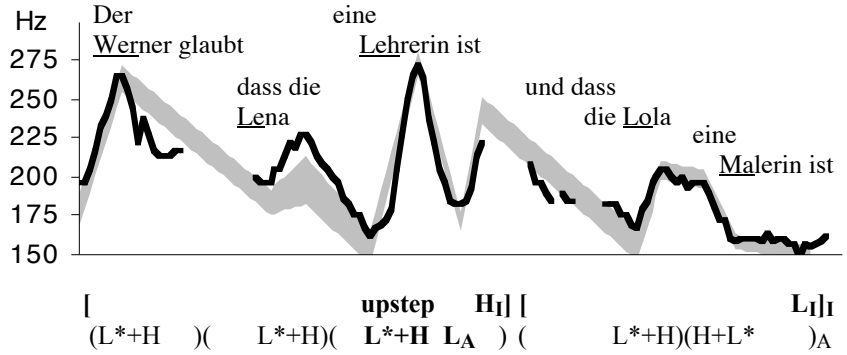


[upstep H_I] [$L_I]_I$
(L*+H)(L*+H)(L*+H)(**L*+H L_A**) (L*+H)(L*+H)(H+L*)$_A$

[Die Lena glaubt [dass der Werner der
Hanne ein Lama malen will]$_{CP}$]$_{CP}$ [$_{CP}$ aber der Werner will
der
Hanne einen Löwen
malen]

Results for the test-case of coordinated embedded clauses are shown in (15) and (16). It can be seen very clearly that an intonation phrase boundary separates the embedded clauses in the same way in which the root clauses in (13) and (14) are separated by an intonation phrase boundary. Evidence for the intonation phrase boundary is the upstep on the last accent of the first embedded clause (*Lehrerin* in (15), *Lama* in (16)) and the following L_AH_I edge tone sequence.

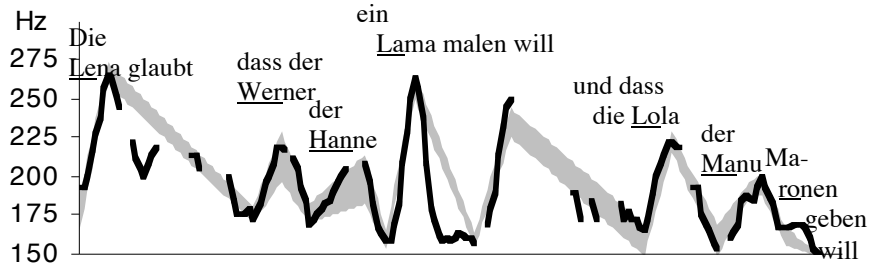
(15) ***Embedded coordination, shorter embedded clauses*** n = 6



[upstep H_I] [$L_I]_I$
(L*+H)(L*+H)(**L*+H L_A**) (L*+H)(H+L*)$_A$

[Der Werner glaubt
[dass die Lena eine Lehrerin ist]$_{CP}$ [$_{CP}$ und dass die Lola eine Malerin ist]]$_{CP}$

(16) ***Embedded coordination, longer embedded clauses*** n = 6



[upstep H_I] [$L_I]_I$
(L*+H) (L*+H)(L*+H)(**L*+H L_A**) (L*+H)(L*+H)(H+L*)$_A$

[Die Lena glaubt [dass der Werner der Hanne ein Lama malen will]$_{CP}$ [$_{CP}$ und dass die Lola der Manu Maronen geben will]]$_{CP}$

This strengthens the formulation in (11) that predicts this internal division in the German data, regardless of whether the clause that ends in this position is a root clause as in (13) and (14), or in an embedded clause as in (15) and (16). It demonstrates the need for a more complex account than by Downing's and Nespor and Vogel's generalization (1), which predicts an intonation phrase boundary in (13) and (14), but not in (15) and (16).

4 Discussion: Formation of intonation phrases

4.1 Why the right edge of CP?

The generalization in (11) in terms of edges of CPs seems to be plausible because of the different positions and types of clauses in the recordings across which it generalizes. Thus, considering (7) on its own, one might wonder whether the subject clauses in the Vorfeld in (7) are followed by an intonation phrase boundary because they are topics (Büring 1999). However, the medial relative clauses in (8) are not suspect of being topics, and yet are also followed by an intonation phrase boundary. Similarly, the first of two embedded clauses in (15) and (16) is not a likely topic, yet it is followed by an intonation phrase boundary. The generalization across these cases seems to be that CPs are followed by intonation phrase boundaries. One might similarly wonder whether the left edge of the relative clauses in (8) fails to trigger an intonation phrase boundary due to the syntactic closeness of the relative clause to the preceding head noun. However, the object clauses in (9) and (10) also lack a preceding intonation phrase boundary, so this seems to be a more general property of the left edge of embedded clauses in this data.

4.2 A tentative account

Not too much can be concluded on the basis of this first exploration. More experimental work is clearly needed before conclusions can be drawn with any confidence. Nevertheless, the picture suggested by the findings reported here, in the context of Downing's account of English, is this: (a) that there is a grammatical factor favoring intonation phrase boundaries at the right edge of clauses (see (11)), which seems to play out unimpeded in the recordings with SW, and that (b) if this tendency is to some extent cross-linguistic, as seems plausible, it is at least optionally suppressed in English for embedded clauses, but not for root clauses, which show the obligatory intonation phrase boundaries described in (1). In the following, I am interested in a first tentative formalization of this impression, which I offer as a possible point of departure for future investigations. The suggestions that follow build on suggestions for phonological phrase formation.

On the level of the phonological phrase, it has been found to be common across languages that one edge of a syntactic XP, right or left, — but not the opposite edge — coincides with a phonological phrase boundary. Selkirk 1986, 1995, 2000 suggested a general theory of edge-alignment between syntactic and prosodic constituents to capture this (Align-XP, on the level of the phonological phrase). Extending these suggestions to the relation between clauses and

intonation phrases, I hypothesize the constraint in (17). It implements (11) by introducing an intonational phrase boundary at the right edge of each CP. (There is an empirical question as to what part of a clause has the triggering effect on intonation phrases, CP, TP, vP, etc. I assume here, for concreteness, that it is CP, though this may need to be revised.)

(17) Align-CP = Align(CP, R; I, R)
'The right edge of a CP must coincide with the right edge of an intonation phrase.'

This constraint implements the description in (11) and directly accounts for the German data presented above. It introduces an intonation phrase boundary after the subject clauses in the Vorfeld in (7), after the relative clauses in the Mittelfeld in (8), after the first of two coordinated root clauses in (6), (13) and (14), and after the first of two coordinated embedded clauses in (15) and (16). Like the Align-XP constraints for phonological phrases, it is asymmetric, introducing a prosodic boundary at one, but not the other edge. Thus, it correctly does *not* introduce intonation phrase boundaries to the *left* of the relative clause in the Mittelfeld in (8) or to the left of the object clauses in (9), (10) and (13) - (16).

To connect to Downing's different observations about English I here explore a parallel to the constraint Wrap-XP. I have argued in earlier work (Truckenbrodt 1995, 1999) that alignment on the level of the phonological phrase is sometimes systematically blocked by a constraint Wrap-XP that demands that XPs may not be split up into two or more phonological phrases. In that suggestion, Align-XP and Wrap-XP are violable universal constraints of Optimality Theory (Prince and Smolensky 1993/2004) with language-specific ranking. Selkirk 2004 suggested that Wrap, like Align, may be a more general constraint format with additional applications. I suggest the constraint Wrap-CP in (18) as such a further application of this format.

(18) Wrap-CP: Each CP is contained in a single intonation phrase.

This constraint blocks the splitting of a CP into two separate intonation phrases. Generally, Align-CP can force intonation phrase boundaries, but never block them, while Wrap-CP can block them, but never introduce them. The two constraints are in conflict in cases of boundaries of embedded clauses (such as (2b)). This is shown in the tableaux in (19) and (20), where CP_2 and CP_3 are coordinated embedded clauses. In both tableaux, candidate a. satisfies Align-CP by right-aligning not only CP_1 and CP_3, but also CP_2 with an intonation phrase break. This comes at the cost of splitting CP_1, the root clause, into two intonation phrases, and thus violating Wrap-CP. The alternative of interest, candidate b., is a single large intonation phrase around the entire sentence. This satisfies Wrap-CP for each of CP_1, CP_2, and CP_3, which are here all contained in a larger intonation phrase. It is not in conflict with Wrap-CP that the same intonation phrase does duty for wrapping all CPs. Candidate b., however,

violates Align-CP, since CP_2 is not aligned with an intonation phrase at its right edge. With the ranking Wrap-CP >> Align-CP as in (19), Wrap-CP makes the decision, and a single large intonation phrase is derived. This ranking will correspond to the suppression of root-clause internal intonation phrase boundaries, i.e. to the non-obligatory nature of root-clause internal intonation phrase boundaries according to (1).

(19) Wrap-CP >> Align-CP

	[X believes CP_2 & CP_3]$_{CP1}$	Wrap-CP	Align-CP
a.	[ ][ ]$_I$	*! (CP_1)	
b. √	[ ]$_I$		* (CP_2)

For the German data of SW, our earlier results are retained Align-CP, which did the correct work without further ado, is undominated. In particular, Align-CP must be ranked above Wrap-CP to account for this data. (20) shows that it will then still introduce a boundary between two embedded clauses.

(20) Align-CP >> Wrap-CP

	[X believes CP_2 & CP_3]$_{CP1}$	Align-CP	Wrap-CP
a. √	[ ][ ]$_I$		* (CP_1)
b.	[ ]$_I$	*! (CP_2)	

This ranking will similarly derive intonation phrase boundaries at the right edges of CPs in the Vorfeld and in the Mittelfeld in German, as desired. As above, undominated Align-CP still directly derives the generalization in (11).

For clauses that are coordinated at the root level, the account inherits a somewhat unclear issue from the notion of root clauses: In what sense are the conjuncts of root coordination root clauses? Why are they not instead embedded, given that at least traditional accounts of coordination postulate a higher node α containing both the conjuncts [CP & CP]$_\alpha$? Why is it that the conjuncts do not count as embedded clauses – embedded in α? I assume here, following up on footnote 1, that the answer to this question lies with the theory of coordination. I assume that α is either not a CP but a Boolean Phrase (BP; see Munn 2000) or that coordination is represented in a multiplanar representation in which there is no such a higher node α (Goodall 1987, Muadz 1991, Moltmann 1992). Either way, I assume that α is not a CP. For the notion of root clauses, this has the effect that one can understand root clauses as CPs not contained in a higher CP (see footnote 1.). For the account at hand it has the similar consequence that the CP conjuncts in the construction *CP & CP* are not contained in a higher CP node that would, by Wrap-CP, require wrapping the entire construction. With this, the separate phrasing of sentences coordinated at the root level follows, as shown in (21). Here no Wrap-CP violation results from splitting the coordinated construction into two intonation phrases. Align-CP therefore leads to the boundary between the two root clauses.

(21) Separate phrasing of CPs coordinated at the root level

	[X believes CP_2]$_{CP1}$ & CP_3	Wrap-CP	Align-CP
a.	[ ] [ ]$_I$		
b. √	[ ]$_I$		*!* (CP_1, CP_2)

Importantly, the boundary between root clauses is inserted in (21) regardless of the ranking between Wrap-CP and Align-CP.

Let me then make a cautious assumption about the ranking of Align-CP and Wrap-CP in English and in German. The cautious assumption I offer is that in both English and German, Align-CP and Wrap-CP are tied in the sense of a free ranking (Itô and Mester 1997). This means that the languages allow structures that result from Wrap-CP >> Align-CP as well as structures that result from Align-CP >> Wrap-CP. From this, the following results are obtained.

First, for the cases considered here, the generalization in (1) can be derived. As seen in (21), coordinated root clauses are separated by intonation phrase boundaries due to Align-CP, regardless of the ranking. Thus, whether this structure is evaluated with Wrap-CP >> Align-CP or with Align-CP >> Wrap-CP, one will always obtain separate phrasing of coordinated root clauses. This correctly derives *obligatory* intonation phrase breaks for this case. Consider then the right edges of embedded clauses. Evaluation with Wrap-CP >> Align-CP as in (19) will lead to suppression of root-clause internal intonation phrase boundaries, due to the application of Wrap-CP to the CP root clause. Evaluation with Align-CP >> Wrap-CP as in (20) leads to an intonation phrase boundary at the right edge of the embedded clause. Since the free ranking allows both the results of (19) and of (20), optional intonation phrase boundaries at the right edge of embedded clauses are predicted. This is compatible with (1) (no *obligatory* intonation phrase boundaries internal to root clauses) and seems generally plausible. For example, Downing's observation concerning (2c) is accounted for: If the internal intonation phrase boundary is omitted, the sentence no longer has a source with coordinated root clauses, but it does have a source with coordinated embedded clauses, whence the latter is the reading forced on it upon omission of the boundary.

Second, it is possible to account for (11), the generalization of SW's renditions. In the cautious account, Wrap-CP and Align-CP are not ranked either for SW or for German as a whole. During the recording session, SW showed a stable preference for Align-CP >> Wrap-CP. As was seen, Align-CP – undominated in this ranking – leads to intonation phrase boundaries after embedded clauses as well as root clauses (see (20), (21)). I leave open here the question how far-reaching this ranking preference is: specific only for SW's style of speaking during the recording session, specific to SW, or specific to a community of speakers. I also leave open the question whether, for one or more speakers, this ranking preference is instead a fixed ranking.

The combination of Align-CP and Wrap-CP presented here is a step in the direction of reconstructing Downing's generalization from the notion of CP and from the geometry of embedding: Boundaries at the edges of embedded clauses (i.e. clauses within CP) are suppressed by Wrap-CP *because* they would occur within CP, and thus in the domain in which Wrap-CP suppresses boundaries. (To be sure, Downing discussed a much wider variety of cases, including parentheticals, appositive relative clauses, and clause-peripheral elements, which are beyond the scope of the present study.)

Another approach, offered recently by Selkirk 2004, is to allow a syntactic notion that parallels Downing's root clauses. Selkirk draws on the feature [+comma] by Potts 2005, for which Potts suggests a semantic/pragmatic interpretation, and uses the Comma Phrase as a point of departure. She proposes a right-edge alignment constraint of the Comma Phrase with intonation phrases.

A further approach to intonation phrase formation, suggested by Gussenhoven 2004, is based on the OO-faithfulness approach to phonological phrasing in Truckenbrodt 2003. Gussenhoven's suggestion integrates the role of the length of syntactic constituents in intonation phrase formation.

The material reported here was recorded before these suggestions were made, and with the purpose of exploring an extension of the suggestions of Downing and Nespor and Vogel to German. Experimental work that also bears on the role of length is currently under way in an ongoing research project, and I plan to return to these recent suggestions in connection with that.

4.3 An indication of the root-embedded asymmetry in German

The study of Schönherr 1997 suggests that the root-embedded asymmetry of (1) that was not found in SW's data may be present elsewhere in German. Schönherr presents a corpus study based on audio and video recordings of a German TV show. The study orients itself with the framework of conversation analysis in Local, Wells and Sebba 1985, Selting 1987 and other works by these authors. It is based on transcriptions that include annotation for cues of intonation phrase boundaries such as pause, slowing down at the end of an intonation phrase and speeding up at the beginning of the next one, and intonational marking at the end of an intonation phrase in four auditory categories (fall, half-fall, rise, and constant height). The latter are marked in addition to transcriptions of the tonal movements on accents. Intonation phrase boundaries are assigned based on an auditory impression and in connection with these transcriptions that are likewise based on auditory impression. The different ways of diagnosing intonation phrase boundaries there and in the present study requires some caution in the comparison. However, six of eight syntactic environments of Schönherr's classification correspond to some extent to the environments investigated here, which invites some tentative comparison. These six categories of Schönherr 1997:93 are listed in (22), along with the

absolute numbers of occurrences of each category, and the percentage of intonation phrase boundaries diagnosed. Schönherr classifies her observations in terms of main/matrix clause ('Hauptsatz'/'Matrixsatz') and embedded clause ('Nebensatz'), cross-classified by parataxis with and without conjunction vs. hypotaxis with different orders of matrix and embedded clause. In (22), a. and b. are parataxis with conjunction (the two categories omitted here are parataxis with no conjunction), c.-f. are hypotaxis. (22c) is embedded clause before main clause, d. and e. are the left and right edge of an embedded clause surrounded by elements of the main clause, and f. is main clause preceding embedded clause.

(22)

	a.	b.	c.	d.	e.	f.
syntax (notation HT)	root [_] & [_]	embedded [_] & [_]	[[_]_] ⇑	[_[_]_] ⇑	[_[_]_] ⇑	[_[_]] ⇑
nr. of occurrences	57	12	26	38	38	106
inton. phrase boundaries	93%	75%	65%	89%	66%	50%

Caution must be applied since the cases counted here may include a much wider variety of constructions than recorded with SW. For example, as best I understand, the cases of hypotaxis in d. - f. may include such elements as parentheticals and appositive relatives, and f. may include occurrences of right-peripheral adjunct clauses. All these are possibilities that could contribute to raising the numbers of internal intonation phrase boundaries. Recall that the cases most closely corresponding to e. and f. in the recordings above were instances of no intonation phrase boundaries in the data of SW, but e. and f. have some sizeable percentages of intonation phrase boundaries in Schönherr's data. I will not conclude anything from the categories d.-f. The categories in a., b., and c., however, are likely to be less affected by these possibilities, since appositives and right-peripheral elements do not occur initially as in c. nor as part of a coordination-like construction.

What I want to highlight here is the comparison of the higher percentage of intonation phrase boundaries in a. in comparison with b. and c. Category (22a.) is comparable to coordinated root clauses, and, in parallel to (1), shows a clear tendency towards regular intonation phrase boundaries. Categories b. and c., on the other hand, are comparable to embedded coordination and initial subject clauses in my data above. The fact that (22b.,c.) do show a sizeable percentage of intonation phrase boundaries is reminiscent of the generalization in (11) and of Align-CP. At the same time, the fact that these percentages are lower than the percentage of a. is reminiscent of (1) and of

Wrap-CP.[3] Here there seems to be an asymmetry between the edges of root clauses (22a) and the edges of embedded clauses (22b.,c.). This asymmetry corresponds to Downing's description of English, and though it was not found with SW, Schönherr's data suggests that one may find it elsewhere in German. This would not be unexpected on the cautious account given above: If Align-CP and Wrap-CP are in free ranking in German (as in English), then obligatory boundaries are expected in (22a.) but optional boundaries in (22b.,c.).

5 Summary

In this short report, I have presented an intonational pattern of a speaker of German, SW, in which the right edge (but not the left edge) of embedded clauses regularly shows an intonation phrase break in the environments that were tested (Vorfeld, Mittelfeld, Nachfeld, root coordination, embedded coordination).

I have outlined an account in terms of two constraints, Align-CP, which demands intonation phrase breaks following clauses, and Wrap-CP, which punishes intonation phrase breaks internal to clauses. Align-CP (assuming dominance at least during the recordings) allows for an understanding of the data of SW, in which all clauses were regularly right-aligned with intonation phrase boundaries. Wrap-CP establishes a connection to Downing's description of English: Wrap-CP can suppress intonation phrase boundaries at the right edge of embedded clauses, though not intonation phrase boundaries at the right edge of root clauses. Free ranking of the two constraints correctly predicts the location of obligatory intonation phrase boundaries of Downing's assessment of English, and (allowing for a ranking preference) is compatible with SW's German renditions.

6 Appendix: Details of the experiment

Two lists of pseudo-randomized sentences were read by SW during one recording session. The first list, read three times in succession, contained coordinated sentences of different length. These are evaluated, together with data of a number of other speakers, for upstep in Truckenbrodt 2002, 2005, and for final lowering in Truckenbrodt 2004. The data of SW in (6) are from recordings from this first list. The sentences underlying the measured tokens in (6) are given in (6'). Accented syllables are underlined throughout. Double underlining highlights the last (nuclear) accents of the intonation phrases as

[3] Notice also that the possibility of there being initial parentheticals in category c. or, say, left-peripheral clauses preceding the Vorfeld, does not weaken this point: these possibilities could contribute to larger percentages of intonation phrase boundaries. In the case at hand, however, what is telling is that there are smaller percentages of intonation phrase boundaries in b. and c. than in a.

diagnosed by upstep and edge tones, and in utterance-final position. (There was no underling in the stimuli when they were presented to SW.)

(6') ***Upstep in coordinated clauses*** n = 18

a. Die Nonne und der Lehrer wollen der Lola in Murnau eine Warnung geben, und die Hannelore will im November ein Lama malen.
b. Der Maler und der Lehrer wollen der Lena in Malmö einen Marabu geben, und die Lola will sich im Jänner eine Wohnung nehmen.
c. Der Maurer und sein Lehrling wollen dem Werner in Kamerun ein Lama malen, und der Maler will im Jänner in Murnau wohnen.
d. Die Lola und die Manu wollen der Lena im November Maronen geben, und der Werner will der Hannelore das Leinen weben.
e. Die Lena und die Lola wollen dem Werner im Jänner ein Lama malen, und die Manu soll im November Bananen essen.
f. Die Manu und die Hanne sollen der Lena im Jänner das Leinen weben, und der Werner soll in Murnau Maronen kaufen.

The remaining data presented in this report are from the second part of the recording session, with a pseudo-randomized list read two times by SW. The stimuli are given here, with numbers corresponding to the numbers in the text above.

(4') ***Downstep in shorter single clauses*** n = 6

a. Die Nonne will der Lola in Murnau eine Warnung geben.
b. Der Werner will der Lena in Malmö einen Marabu geben.
d. Die Lena will dem Werner im Jänner ein Lama malen.

(5') ***Downstep in longer single clauses*** n = 6

a. Der Maurer und sein Lehrling wollen dem Werner in Kamerun ein Lama malen.
b. Die Lola und die Manu wollen der Lena im November Maronen geben.
c. Die Manu und die Hanne sollen der Lena im Jänner das Leinen weben.

(7') ***Subject clauses in the Vorfeld*** n = 12

a. Dass die Manu der Hanne ein Lama malen will, hat den Werner gewundert.
b. Dass der Lehrer der Nonne Maronen holen will, hat die Lehrerin gewundert.
c. Dass der Maurer der Lola eine Mole mauern will, hat den Maler gewundert.
d. Dass die Lehrerin dem Lehrer eine Warnung geben will, hat die Hannelore gewundert.
e. Dass der Friedemann der Lehrerin Bananen mitbringt, hat den Lehrer gewundert.
f. Dass die Lola dem Maurer das Weben beibringen will, hat die Maurerkollegen gewundert.

(8') ***Relative clauses in the Mittelfeld*** n = 12

a. Die Lola hat dem Mann, der einem Maurer einen Löwen gemalt hat, ein Lob gegeben.
b. Die Lena hat dem Mann, der einem Maurer das Weben beibegracht hat, ein Lob gegeben.
c. Der Werner hat dem Mann, der einer Nonne einen Roman gegeben hat, ein Lob gegeben.
d. Die Hanne hat dem Mann, der einem Löwen eine Banane gegeben hat, ein Lob gegeben.
e. Die Manu hat dem Mann, der einer Nonne das Malen beigebracht hat, ein Lob gegeben.
f. Der Werner hat dem Mann, der einer Lehrerin eine Leinenbluse genäht hat, ein Lob ausgesprochen.

(9') ***Object clause in the Nachfeld - shorter matrix clause*** n = 6

a. Die Lena hat der Manu gesagt, dass sie dem Werner ein Lama malen will.
b. Die Lola hat der Hannelore gesagt, dass sie der Lena Maronen mitbringen wird.
c. Der Werner hat dem Maler gesagt, dass er der Lola das Weben zeigen will.

(10') ***Object clause in the Nachfeld - longer matrix clause*** n = 6

a. Der Maler und sein Lehrling haben dem Werner gesagt, dass sie der Lola einen Wal fangen wollen.
b. Die Lehrerin und die Nonne haben der Hannelore gesagt, dass sie dem Werner das Weben zeigen wollen.
c. Die Lena und die Hanne haben der Manu gesagt, dass sie dem Maurer ein Lama malen wollen.

(13') ***Root coordination, shorter embedded clauses*** n = 6

a. Die Lena glaubt, dass die Lola eine Nonne ist, aber die Lola ist eine Lehrerin.
b. Die Manu glaubt, dass der Werner ein Maler ist, aber der Werner ist ein Maurer.
c. Der Werner glaubt, dass die Lena eine Lehrerin ist, aber die Lena ist eine Malerin.

(14') ***Root coordination, longer embedded clauses*** n = 6

a. Die Lena glaubt, dass der Werner der Hanne ein Lama malen will, aber der Werner will der Hanne einen Löwen malen.
b. Die Manu glaubt, dass der Maler der Nonne eine Warnung geben will, aber der Maler will der Nonne Maronen geben.
c. Der Werner glaubt, dass der Lehrer der Lola Mengenlehre beibringen will, aber der Lehrer will der Lola das Weben zeigen.

(15') ***Embedded coordination, shorter embedded clauses*** n = 6

a. Die Lena glaubt, dass die Lola eine Nonne ist, und dass die Manu eine Lehrerin ist.
b. Die Manu glaubt, dass der Werner ein Maler ist, und dass der Manuel ein Maurer ist.
c. Der Werner glaubt, dass die Lena eine Lehrerin ist, und dass die Lola eine Malerin ist.

(16') ***Embedded coordination, longer embedded clauses*** n = 6

a. Die Lena glaubt, dass der Werner der Hanne ein Lama malen will, und dass die Lola der Manu Maronen geben will.
b. Die Manu glaubt, dass der Maler der Nonne eine Warnung geben will, und dass der Lehrer der Lola Maronen geben will.
c. Der Werner glaubt, dass der Lehrer der Lola Mengenlehre beibringen will, und dass die Malerin der Lena das Weben zeigen will.

The assignment of narrow focus was minimized by having each sentence read as an answer to the question 'Was gibt's Neues?', *What's new?*. In addition, instructions were given that the sentences were to be read on the assumption that each sentence part is equally important. The instructions also included the interest in a normal, narrative sentence melody.

The measurements reported in this article were made with the speech analysis software Computer Speech Lab from Kay Elemetrics. See Truckenbrodt 2002, 2004 for criteria for measurements and criteria for skipping measurements. In the data reported here, there were no skipped measurements in any of the H values of L*+H pitch accents (non-utterance-final rises), the ones crucial for assessing downstep and upstep. (The missing values are: frequent utterance-final L_I and final L* of H+L*, seven utterance-final H of H+L*, distributed across (6), (14), and (16), and one L* each in non-final position in (6) and in (7) due to segmental interferences on the f0-track.)

The results reported above concerning upstep and L_AH_I were most consistent in the recordings with SW. Where upstep is reported above, it is found in all recordings of a set. Likewise with the following L_AH_I sequence. Where *absence* of upstep is reported above, no upstep is found in any token in the set of recordings. In (10), for example, the third rise was lower in height than the second rise in all tokens.

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