Prosodic Phrasing in Three German Standard Varieties

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1 Introduction

While the investigation of segmental features has been in the center of phonetic research concerned with regional variation for the last century, prosodic features have only recently been addressed in the German-speaking area (Auer et al. 2000). However, the German language as a pluricentric language (Clyne 1995; Ammon 1995) requires comparison and description not only with respect to different dialects but also to different standard varieties (Ulbrich 2005).

The phrasing of continuous speech into meaningful linguistic units is one of the most fundamental functions of prosody and is assumed to be characterized by distinctive functions and phonetic forms. The paper presents a comparative analysis of rhythmic features of the three German standard varieties (henceforth SVs) spoken in Germany, Austria and Switzerland. The underlying hypothesis that there are crosslinguistic differences in the prosodic structuring of utterances between speakers of the German, Austrian, and Swiss German SV is based on rather tentative impressions gathered during several perception tests (see Ulbrich 2003, 2005).

Section 2 provides a brief overview of the situation in the German SVs from a sociolinguistic perspective. In section 3 I will summarize the theoretical background for research in the temporal prosodic domain and previous findings on crosslinguistic prosodic differences found in utterances produced by speakers of the three German SVs. In section 4 I will introduce the speech data of the present study and subsequently turn to the methods for the auditory and acoustic analysis. Section 5 reports findings of the statistical analysis of inter- and intra-sentential phrase boundaries and their crosslinguistic variation in the German SVs.

2 Sociolinguistic Background: German Standard Varieties

Although debated in the sociolinguistic field, most authors agree that there are three standard varieties of German, spoken in Germany, Austria and Switzerland. Specific variants for the respective SVs have been described on all linguistic levels (Ammon 1995). These variants allow speakers from Germany, Switzerland and Austria to identify themselves and to make them

identifiable to others on a national level. This has been supported by a perception test carried out with different groups of listeners, where speakers were recognized as Swiss, Germans, or Austrians rather than based on their regional origin. However, that does not exclude the occurrence of specific features and variants across national borders, but is shows that these features can have a more regional status in one German center, while functioning as a national variant in another.[1]

The three German centers are characterized by fundamentally differing linguistic situations. While German is the only official language in Austria and Germany, which makes them unilingual centers, German is one of four national languages in Switzerland, which makes it a multilingual center (Clyne 1992, 1995).[2] Additionally, there are differences in the polarization of standard and dialect between the three German SVs.

In Switzerland a 'medial diglossia' exists (Hove 1999:3). Dialect and SV are strictly separated with respect to the formality of the situation in which verbal communication takes place. The SV is used in formal communication situations, whereas dialect is spoken in everyday communication. The dialect is not understood as a social marker.

The separation between dialect and SV is less strict in Austria. The polarization smoothly transits in a dialect-standard continuum. The use of the dialect in everyday interaction is equally not regarded as a social demarcation.

Language use in Germany—even though much more sophisticatedly codified—allows no comparable clear cut definition of the linguistic situation. While in the northern Low German region of Germany dialect is only spoken by older people in rural areas and clearly understood as social marker, the central and eastern Bavarian parts of South Germany are characterized by a dialect-standard continuum comparable to the one in Austria. In the Upper German Alemannic region, dialect and SV are used in parallel. However, dialectal speech is less acceptable in formal communication situations than in Switzerland. Nonetheless, language use including the level of pronunciation is homogeneously standardized in Germany. Switzerland and Austria do not possess a comparable codex and therefore in controversial situations Austrians and Swiss speakers are forced to consult the German language codex, which is generally based on the Northern German SV.

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[1]The southeastern region of Germany shares the Bavarian dialect with Austria; the southwestern region of Germany shares the Alemannic dialect with the Swiss German region of Switzerland.

[2]French, Italian and Rhaetoromanic are the other national languages in Switzerland.

The lack of a comprehensive language codex in Austria and Switzerland leads to sociolinguistic conflicts among individuals and a lack of presence in the international linguistic context. The respective language description according to the respective language use would allow for appropriate language investments and politics. Additionally, it leads to a symmetric three-sided comparison of the German SVs. Recent investigations have already succeeded (e.g. Ammon et al. 2005 lexical level, Ulbrich 2005 prosodic level).

3 Theoretical Background and Previous Findings on Prosodic Phrasing in German

The prosodic level of the German standard variety has been described in different frameworks (e.g. Adriaens 1991, Möbius 1993, Féry 1993, and Benzmüller et al. 1997). The Swiss and the Austrian SVs lack any adequate descriptive framework. Additionally, a great deal of research on prosody concentrates on aspects of intonation. Phrasing and timing are often considered only peripherally. This preference seems questionable since relative modifications of fundamental frequency (f_0), overall intensity and spectral intensity are time-dependent. This approach finds support in former investigations of timing which show less inter- and intraspeaker variation than f_0-modifications (Keller 1994, Mixdorff 2002a, Zellner-Keller 2002). Most research on prosodic phrasing focuses on the relationship between syntax and prosodic phrasing, which seems reasonable in the study of discourse. Although prosodic boundaries do mirror syntactic boundaries to a certain extent, they are also influenced by rhythmic and stylistic constraints. Among the most common criteria for prosodic unit boundaries facilitating segmentation are pauses, f_0 features and temporal cues of segments. However, a theory explaining the hierarchy and interaction of these features has not been forthcoming. Researchers have investigated phonetic cues of segmentation and phrasing in different languages (for Hebrew, see Amir et al.; for Swedish, see Hansson 2002; for Greek, see Botinis 2004; for English, see Bachenko/Fitzpatrick 1990; for French, see Keller/Zellner 1995; for Norwegian, see Heggtveit/Natvig 2004) or crosslinguistic comparisons (e.g. German and English Batliner et al. 2001). Applications are found mostly in the area of speech recognition (e.g. for two German varieties Baum et al. 2004, for two Swiss German varieties Siebenhaar 2004).

For the SV spoken in Germany, the following features (with descending degree of importance) have been described to be among the most important prosodic features for phrasing: pauses, f_0 and durational cues (Mixdorff 2002b:282). Also of importance are glottalization, assimilation and reduction

at phrase boundaries in German. Even though it has been stated in the literature that the higher a boundary is placed, the more strongly it is marked for prosodic cues (e.g. Campell 1993, Mertens 1987), the type of boundary has been shown to be critical for the prosodic means employed for dividing a continuous utterance into meaningful entities. The occurrence as well as the combination (bundling) of prosodic features has been shown to differ in standard German with respect to the location of the boundary in the utterance. Mixdorff (2002b:287) found differences in the employment of prosodic features between intra- and inter-sentential boundaries. He found that 31% of intra-sentential boundaries showed phrase-final syllable lengthening. 83% were realized with a rising boundary tone. For one third, a readjustment of the f_0 declination has also been found. The combination of phrase final lengthening and readjustment of the f_0 declination has been observed in 38% of the intra-sentential phrase boundaries. The combination of phrase-final lengthening, readjustment of the f_0 declination and pause has been the most frequent feature bundle for inter-sentential boundaries (80%). It was only found in 31% of the intra-sentential boundaries.

Peters et al. (2004) found turn-internal and turn-final phrase boundaries to differ in their demarcation by prosodic features. They were able to show interactions between specific cues, e.g. final lengthening was found in >93% of the turn-internal cases. However, when only one feature was present, it was f_0-reset rather than syllable lengthening. The most dominant feature bundle for turn-final phrase boundaries found in the Kiel corpus is final lengthening and pause.

Both studies were based on the German SV. However, phonological and phonetic conventions as observed for a SV do not always apply equally to all varieties of a language. Previously described differences between the German SVs at the prosodic level are mostly based on auditory intuitive impressions (Meyer 1989, Ammon 1995, Panizzolo 1982). Only recently a comprehensive crosslinguistic study focusing on tonal features of accentuation and segmentation revealed significant differences between the three German SVs (Ulbrich 2005). Some observations suggested that there are – among others – differences in phrasing of utterances between Swiss, Austrian and German standard speakers. So far, only the number and duration of pauses has been shown to differ significantly between 10 Swiss, 10 Austrian and 10 German speakers reading 11 directly comparable news messages. The German speakers produced on average a significantly smaller number of pauses compared to the other two groups of speakers ($F_{(2,21)}$=9,418; $p<.05$). Also, German speakers produced on average significantly shorter pauses than Swiss and Austrian speakers ($F_{(2,21)}$=4,829; $p<.05$).

Speakers	Number of pauses	Duration of pauses
D	0.327	0.102s
CH	0.769	0.238s
A	0.858	0.280s

Table 1: Comparison of number and duration of pauses in news messages produced by German, Swiss and Austrian news readers

The goals of the present study are (1) to explore the occurrence of prosodic cues signaling different types of phrase boundary in German and (2) to gather auditory and acoustic evidence for crosslinguistic differences in these three German SVs.

4 Comparison of Prosodic Phrasing in German, Austrian and Swiss SVs

The present study is part of a larger investigation of prosodic features of the German standard varieties in Austria, Switzerland and Germany and deals with their rhythmic features. In the following sections the speech material and the methods of the analysis are described.

4.1 Material

The collected corpus contains recordings of eleven news broadcasts read by five Swiss, five Austrian and five German male speakers (~5min/speaker = ~75min). The speakers were news readers in German, Austrian, and Swiss public broadcasting corporations (Germany: ARD, ZDF; Austria: ORF, Switzerland: DRS II). The recordings were taken using a DAT-recorder and they took place in the studios of the broadcasting agencies. The speakers read a text containing eleven news messages which was provided in normal orthography. They were instructed to read the text in the most neutral way, disregarding agency-specific modes.[3]

4.2 Methods

The speech data were digitized at a sampling rate of 16 kHz, 16-bit mono format. The material was analyzed in two steps:

[3]The author is aware that the conscious control of specifically trained patterns in broadcasting is often impossible.

1. Auditory annotation of the speech material carried out by German (5), Swiss (4), and Austrian (5) trained control listeners.
2. Acoustic measurements of selected prosodic features known to contribute to the segmentation of spoken utterances.

Auditory Notation

Due to the influence of the communication biography on language production and perception the auditory notation was carried out by control listeners of all three SVs. Included were a notation of phrase boundaries and the prosodic features signaling them, such as pauses, virtual pauses, modifications in speech or articulation rate (faster/slower), and boundary tones (High H%, Low L%).

Acoustic Measurements

The following data were collected during the acoustic analysis of the speech corpus using PRAAT:

- Number of intra-sentential boundaries
- Number and duration of intra-sentential pauses
- f_0-reset in the beginning of intonational phrases (IP), sentences and paragraphs
- Syllable duration in the beginning of prosodic phrases, sentences and paragraphs (Fast Speech Rate = FSR)
- Syllable duration at the end of prosodic phrases, sentences and paragraphs (Slow Speech Rate = SSR)

FSR and SSR where calculated as a result of a comparison of syllables in phrase medial position to either the syllable duration in the anacrusis onset or the post-nuclear unstressed syllables at the end of a prosodic phrase, sentence or paragraph. FSR was indicated if the ratio was less than 0.9 (syllables in anacrusis onset are more than 10% shorter than syllables in medial position). SSR was indicated at a ratio of more than 1.1 (post-nuclear syllables are 10% longer than in medial position).

To exclude or limit the influence of stress pattern or accentuation on the f_0 measurements, f_0-reset has been restricted to unaccented and unstressed phrase-initial syllables. Following an auditory notation of phrase-initial pitch-reset, f_0-measurments were taken at each point of the periodic portion of the phrase-initial syllable and the reset was assumed to be confirmed if f_0 did not differ more than $\pm 10\%$ from the speaker specific average f_0. The statistical analysis was carried out using SPSS and is based on the GLM (General Linear Model; Repeated Measurement design).

5 Results

In the following sections the results of the auditory and the acoustic analysis of prosodic phrasing in three German SVs are presented separately. Four types of prosodic boundaries were distinguished in the present study, separating different kinds of prosodic units: paragraphs, sentences, intra-sentential IPs with punctuation marker and intra-sentential IPs without punctuation marker.

5.1 Results of the Auditory Notation

The results of the auditory notation of prosodic phrase boundaries showed differences between the three groups of speakers. These results confirm previous findings where recorded speech was exclusively annotated by German control listeners. The statistical analysis proved the differences to be significant ($F_{(2;12)}=3.65$; $p<.05$). For the German speakers, a significantly smaller number of sentence-internal phrase boundaries has been annotated in comparison to both Swiss and Austrian speakers (see table 2). Note that the comparison of the auditory notation with respect to the groups of German, Swiss and Austrian control listeners shows differences also. As the number of produced pauses increases from German to Austrian speakers (D<CH<A), the results for the annotation of the control listeners shows the same pattern. For all groups of speakers, German control listeners annotated the smallest number of pauses, while Austrian control listeners annotated the highest number of pauses (D<CH<A). These findings confirm a generally assumed interaction between communication biography and perception.

Speaker	Control listeners		
	D	CH	A
D	1.42	1,51	1,60
CH	1.64	1,76	1,75
A	1.76	1,72	1,81

Table 2: Average number of sentence-internal phrase boundaries annotated by groups of Swiss (CH), German (D), Austrian (A) control listeners

Differences between the three groups of speakers were only observed in sentence-internal positions. All three groups of speakers produced silent pauses at paragraph and sentence boundaries. Only the German speakers connected paragraph medial sentences without a silent pause, however, only in 2% of sentence boundaries. A comparison of intra-sentential pauses

showed that German speakers realized silent pauses significantly more often at IP boundaries with a punctuation marker ($F_{(2;12)}$=4.65; p<.05). While Swiss and Austrian speakers produce sentence-internal pauses only in ~70% at IP boundaries marked by a punctuation marker but ~30% at IP boundaries without punctuation marker, German speakers produce intra-sentential silent pauses in nearly 90% in syntactically marked position.

The realization of pauses depending on the specific boundary type also showed significant differences ($F_{(3;36)}$=2,12 ;p<.05). No interaction between the origin of the speakers and the realization of pauses was found.

The auditory notion also included boundary tones. Boundaries between paragraphs and sentences were realized in ~100% with a low boundary tone (L%) by all three groups of speakers. At intra-sentential boundaries all three groups of speakers produced mostly a high boundary tone (H%). The occurrence of an H% has been found to increase with the absence of intra-sentential punctuation demarcation. IP boundaries without a punctuation marker are more often realized with an H% than IP's with punctuation. Differences have also been found between the three groups of speakers. Swiss speakers produced significantly more often L% at both punctuation marked and unmarked IP boundaries. Austrian speakers produced the smallest amount of L% in intra-sentential boundary position. These differences have been analyzed to be significant ($F_{(2;12)}$=3,24; p<.05).

Text-specific differences between the four boundary types have also shown a significant main effect ($F_{(3;36)}$=6,45 ;p<.05). No interaction has been found for the realization of boundary tones and the origin of the speakers. The findings for the realization of pauses and boundary tones at four different boundary types by German, Swiss and Austrian speakers are summarized in table 3.

5.2 Results of the Acoustic Analysis

As described in section 3, temporal and tonal modifications have been shown to contribute to the demarcation of prosodic phrase boundaries in different languages and dialects. The present study takes into consideration a speeding up of phrase-initial syllables (fast speech rate = FSR) and a slowing down of phrase-final syllables (slow speech rate = SSR) as temporal features and the f_0-reset (f_0_R) as a tonal feature. Comparable to the auditory analysis, four boundary types have been distinguished in the analysis of acoustic measurements (paragraph, sentence, IP with and IP without punctuation marker).

Unit	Speakers	Pauses (unit)	Pauses (speakers)	BT (unit) L%/H%	BT (speakers) L%/H%
I	D	100%	100%	100%/0%	100%/0%
	CH		100%		100%/0%
	A		100%		100%/0%
II	D	100%	98%	100%/0%	100%/0%
	CH		100%		100%/0%
	A		100%		100%/0%
III	D	71%	89%	32%/68%	32%/68%
	CH		73%		39%/61%
	A		70%		25%/75%
IV	D	29%	11%	25%/75%	22%/78%
	CH		27%		31%/69%
	A		30%		21%/79%

Table 3: Comparison of pauses and boundary tones in paragraphs (I), sentences (II), IPs with punctuation marker (III) and IPs without punctuation (IV) listed for German (D), Swiss (CH), and Austrian (A) speakers

As for the f_0-reset, a significant main effect was observed in the prosodic units ($F_{(3;36)}$=28,024; $p<.05$), but not with respect to the origin of the speakers. An interaction of f_0-reset and the origin of the speakers was also found (f_0_R*origin: $F_{(6;36)}$=2.619; $p<.05$) Even though in all three groups the data showed a decreasing tendency of f_0-reset from paragraph to IP without punctuation, significant results were only found between all four units within the German group of speakers. Swiss speakers showed significant differences between sentences and paragraphs on the one and IPs on the other hand. No significant differences at all were found in the Austrian group.

Significant main effects were found for the acoustic measurements of FSR in the beginning of prosodic units with respect to both origin and feature. The statistical analysis did not show an interaction effect. Considering differences between the prosodic units, the data showed that FSR is weakest in prosodic units of higher order; the smaller the prosodic unit the stronger the FSR effect (I<II<III<IV; $F_{(3;36)}$=5.018; $p<.05$).

The statistical analysis of the acoustic measurements of phrase final lengthening (SSR) did not show significant differences with respect to the prosodic unit. However, note that the data show a similar correlation between prosodic strength and occurrence of the feature as already seen for the initial speed up (FSR). The temporal effect increases with the decrease in unit size (I<II<III<IV).

The statistical analysis of differences between the three groups showed that in the German group temporal effects have the smallest impact independent of the phrase boundary strength. This counts equally for temporal modification of syllable duration in phrase initial and final position. The differences are significant for both, FSR ($F_{(2;12)}$=3,931; p<.05) and SSR ($F_{(2;12)}$=34,786; p<.05).

unit	speakers	f_0_R (unit)	f_0_R speakers	FSR <0.9 (unit)	FSR<0.9 (speakers)	SSR >1.1 (unit)	SSR>1.1 (speakers)
I	D	81.6%	86%	0.77	0.83	1.51	1.26
	CH		79%		0.71		1.59
	A		80%		0.77		1.68
II	D	78.7%	81%	0.69	0.81	1.553	1.28
	CH		77%		0.61		1.69
	A		79%		0.65		1.69
III	D	75%	72%	0.673	0.79	1.603	1.39
	CH		74%		0.56		1.72
	A		79%		0.67		1.70
IV	D	73%	71%	0.61	0.74	1.627	1.43
	CH		70%		0.52		1.73
	A		78%		0.57		1.72

Table 4: Results for f_0-reset (f_0_R), FSR, and SSR in the prosodic units: paragraph (I), sentences (II), IP's with punctuation marker (III) and IP's without punctuation (IV) listed for German (D), Swiss (CH), and Austrian (A) speakers

6 Summary

The present study was intended (1) to further explore the occurrence of prosodic cues employed for signaling distinct phrase boundary types in German and (2) to find auditory and acoustic evidence for cross linguistic differences in three German SVs. We found evidence supporting earlier findings that prosodic cues differ between intra- and inter-sentential phrase boundaries. While f_0-reset and pauses show the most frequent occurrence at inter-sentential boundary, a cross boundary change of articulation rate appears to be strongest between prosodic units which lack any syntactic demarcation. Also, confirming a general (most likely universal) feature, high boundary tones (H%) do not occur paragraph or sentence final if the

utterance is declarative. The likelihood for H% increases with the lack of other linguistic markers.

With respect to crosslinguistic variation, significant differences were found between the three German SVs. Although all three groups of speakers show the text-specific characteristics described above, they differ in quantitative extent of the specific features. No differences were found in the distribution of pauses, which were found to be realized mostly between sentences and paragraphs. Since the corpus only contained declaratives, paragraph and sentence final nearly exclusively low boundary tones were produced.

Cross-boundary change of articulation rate (FSR and SSR) was found significantly less in German utterances compared to both Swiss and Austrians. Intra-sentential phrase boundaries were significantly more often realized with an L% by Swiss speakers, in comparison to Germans and Austrians.

Follow-up studies are intended to deal with the specific bundling of prosodic features signaling phrase boundaries, and with possible crosslinguistic differences.

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