REVIEWS

Silbenschnitt in deutschen Dialekten. By Helmut Spiekermann. (Linguistische Arbeiten, 425.) Tübingen: Max Niemeyer, 2000. Pp. viii, 239. Paper. DM 124,00.

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The notion of SYLLABLE CUT (*Silbenschnitt*), which was introduced and motivated in classical works by Sievers, Jespersen, Trubetzkoy, and others, has been discussed and developed recently in Germanic linguistics, including by Vennemann (1991), Maas and Tophinke (1991), Becker (1996, 1998), and Murray (2000). Along with the issue of tonal accents, syllable cut is also featured in a volume edited by Auer, Gilles, and Spiekermann (forthcoming).

In paradigmatic terms, the central idea of syllable cut—or syllable cut prosody—is to provide a prosodic account of oppositions in words such as German *Miete* 'rent' with [i:] versus *Mitte* 'center' with [I]. According to this account, these oppositions are based not on a quality or quantity distinction that is limited to the domain of the vowel (using features such as [tense] or [ATR], or a representation with one versus two entries on the timing tier in an autosegmental approach); instead they are based on a prosodic distinction that spans both the vowel and the following consonant, if one is present within the same sylable. It is assumed that in *Mitte* the vowel is in some sense cut off or interrupted by the following consonant, whereas in *Miete* the vowel can complete its full cycle without interruption from any following consonant. Syntagmatically, the syllable cut account can serve in the analysis and explanation of certain phonotactic and lexical stress patterns of Modern Standard German (see Becker 1998 for a collection of facts and arguments). The value of syllable cut prosody in historical linguistics has been demonstrated with respect to Early Middle English by Murray (2000). One further advantage of syllable cut prosody lies in the domain of linguistic typology. According to Vennemann (1991), Becker (1998), and others, syllable cut systems as found in German or English need to be distinguished carefully from quantity systems as found in Finnish or Czech, and in some languages, like Hopi, both syllable cut and quantity are claimed to be distinctive.

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Although there are many phonological arguments in favor of syllable cut prosody, it is not clear what its phonetic correlates are and whether the metaphor of "cutting" the vowel by the following consonant finds any support in phonetic reality. It is this question of the phonetic grounding of syllable cut prosody on which Spiekermann focuses in his book. Along with a discussion of the previous literature on the phonetics of syllable cut prosody, Spiekermann provides a large empirical study of its acoustic correlates and perception in German. For the first time dialectal variation in the phonetics of syllable cut is systematically addressed. It is also the first time that systematic empirical evidence has been provided that quantity systems lack the phonetic correlates of syllable cut systems, hence supporting this typological distinction.

In the first chapter (1–3) Spiekermann provides an introduction to his work. A syllable cut interpretation of oppositions such as in *Miete* versus *Mitte* is distinguished from a vowel quality and a vowel quantity interpretation and the problem of the lack of sufficient phonetic motivation of syllable cut is stated. The central hypotheses that guide his work are, first, that there exists a phonetic correlate of syllable cut which can be shown experimentally, and second, that there is a pattern of regional variation whereby northern dialects of German show evidence of syllable cut whereas southern dialects show little or no such evidence.

In his second chapter (4–14) Spiekermann presents an overview of the sounds and the phoneme system of German and some prosodic entities such as juncture, word stress, and the syllable. (In his table 2.1.1-2 "R" needs to appear in the slot "uvular trill," and the word *dunkel* 'dark' in footnote 1 needs to be transcribed with a velar nasal.) In this chapter Spiekermann also provides a summary of existing literature about the phonology and phonetics (including experimental) of German dialects, with special emphasis on the vocalic and prosodic patterns that are relevant to his study.

Chapter 3 contains an overview of the phonetics and phonology of syllable cut prosody, covering theories about its role in the historical development of German (15–19), the history of the concept, including ideas about the phonetic manifestation of syllable cut (20–24), previous experimental results on the articulation, acoustics, and perception of syllable cut (24–28), and the phonological representation of syllable cut prosody as proposed by different authors (28–35). As part of the final section Spiekermann also shows how syllable cut prosody can be captured within optimality theory.

In the fourth and fifth chapters, which constitute the main body of his text, Spiekermann describes the methods and results of his phonetic study of syllable cut in Standard German (chapter 4; 36–90) and in German dialects (chapter 5; 91–226). A summary and suggestions for further research (chapter 6; 227–228) conclude the book. For the remainder of this review we take a closer look at Spiekermann's experimental work, laid out in chapters 4 and 5.

Standard German (chapter 4), as produced by northern German speakers, is investigated on the basis of a "nonsense corpus" and a "standard corpus." The former is a set of 225 sentences spoken by a single speaker, each containing a nonsense word of the structure [gəC_iVC_iə], where V is the vowel target of the measurements (bearing main word and sentence stress) and both instances of C are phonemically identical. V and C run through most of the existing vowels and consonants of German (36). The standard corpus consists of eight one-minute sections from TV programs (news, talk shows, documentaries) with speech from five male and three female speakers. This corpus was taken from a research project at Halle University aimed at creating a German pronouncing dictionary on CD-ROM. The selected target words have the same prosodic pattern as the nonsense words (38).

For each of the target vowels in the two corpora Spiekermann measured first and second formant frequency (F1, F2), duration, the dynamics of fundamental frequency (F0) over time, and the duration of the following consonant. Furthermore, extensive attention was spent on the dynamic patterns of the energy curve (smoothed and rectified representation of overall signal amplitude over time) during the course of the vowel. According to classical ideas about the phonetic manifestation of syllable cut, the maximum of the energy curve should occur late during the vowel in the case of abruptly cut vowels (as in *Mitte*), whereas it should occur roughly at the center of the vowel in the case of the smoothly cut vowels (as in *Miete*). This would reflect the idea that abruptly cut vowels are interrupted by the following consonant roughly when the sonority maximum has been reached, whereas in the case of the smoothly cut vowels there is a decline in sonority between vowel center, where maximum sonority occurs, and the beginning of the following consonant. Spiekermann's parameter "E-Pos" (temporal location of energy maximum in relation to the entire duration of the vowel) is able to test this classical notion. Spiekermann (39–41) also introduces the parameters "E-Zahl" (number of energy peaks within the limits of the vowel) and “E-Halt” (degree of amplitude reduction between maximum and minimum energy within the vowel span). (In the course of the discussion of E-Halt on page 41, “80 Hz” needs to be replaced by “80 dB.”)

With respect to the three energy distribution parameters it turned out that, first, in smoothly cut vowels the number of energy peaks is higher than in abruptly cut vowels. Second, the degree of amplitude reduction is lower in smoothly cut vowels than it is in abruptly cut vowels, which means that a relatively high energy level is maintained throughout the vowel in the former case, whereas in the latter case there is a stronger difference between energy maximum and energy minimum. With respect to E-Pos it is surprising that the energy maximum occurs later, not earlier, in smoothly cut vowels than it does in abruptly cut vowels (48). Although these are the general patterns, Spiekermann found a high degree of variability across factors such as the particular vowels involved, the surrounding consonants, and the two different corpora. Among the three energy parameters it is E-Halt that turned out to be the most stable syllable cut correlate (58).

Turning to the remaining acoustic correlates, there is a robust and salient difference in terms of vowel duration. Consistent with the literature on German vowels in main stressed position, smoothly cut (tense) vowels turned out to be clearly longer than abruptly cut (lax) vowels (see Antoniadis and Strube 1984, among others). This result is consistent with the idea that abrupt vowels are cut short by the following consonant whereas smooth vowels are not. However, a vowel duration difference is also expected in a quantity system; hence a vowel duration difference alone does not demonstrate that a syllable cut system and not a quantity system is at work—a circumstance Spiekermann is well aware of.

Vowel quality differences between smoothly and abruptly cut vowels were measured by Spiekermann in terms of the difference between F2 and F1. This makes more sense for front vowels than it does for back vowels. Going from abruptly cut (lax) to smoothly cut (tense) vowels, F2 rises and F1 falls for front vowels, hence the difference between F2 and F1 shows an enhanced effect relative to changes in F1 or F2 alone. However, for back vowels both F1 and F2 fall (see the German vowel formant data in, e.g., Jørgensen 1969). In any case, Spiekermann is able to confirm earlier results in the literature showing that for all but the low vowels (and the distinction between long and short epsilon) there is a clear and robust quality difference between smoothly and abruptly cut vowels in German, as measured in terms of formant frequencies. Spiekermann also found that in going from the nonsense corpus to the standard corpus there was a stronger reduction of duration differences than of formant frequency differences between smoothly and abruptly cut vowels (62). This shows that vowel reduction in the more natural speech of the standard corpus relative to the more explicit "lab speech" in the nonsense corpus affects vowel quantity more than vowel quality. An analogous pattern was found by Jessen (1994), who showed that in going from stressed to unstressed position in the word there is a stronger reduction of duration differences than of F1 and F2 differences among the (nonlow) vowel pairs.

Duration measurements of the consonants that follow the vowels in question reveal that consonants following smoothly cut and abruptly cut vowels are about equally long. This is consistent with the results of Fischer-Jørgensen 1969. However, Spiekermann reports as a tendency that consonants following smoothly cut vowels are slightly longer than those following abruptly cut vowels (66), which contradicts the tendency found by Fischer-Jørgensen.

Measurements of F0 at four equally spaced locations in the vowel again do not reveal any clear difference between smooth and abrupt cut. There was at best a slight tendency for F0 to undergo a falling-rising movement in abruptly cut vowels and a falling-rising-falling pattern in smoothly cut vowels (70). This might be a side effect of the duration difference and the overall intonation contour rather than a genuine smooth/abrupt difference. (In discussing his figures 4.2.3-4 and 4.2.3-5, Spiekermann could have mentioned the generalization that F0 is higher after voiceless [tense] than voiced [lax] obstruents; cf. Jessen 1998 for consistent F0 results.)

The set of measurements discussed so far were also applied to speech from Finnish, Czech, and French. Spiekermann was able to show that the parameter E-Halt, which turned out to be the most stable syllable cut correlate of German, did not distinguish the long and short vowels of these languages. This is evidence for the assumption that these languages do not have a syllable cut system.

In the final section of chapter 4 Spiekermann reports an experiment on the perception of syllable cut and its correlates. Minimal pairs with smooth versus abrupt syllable cut (such as in the words *Miete* vs. *Mitte*, mentioned above) were recorded. Using a re-synthesis program

Spiekermann carried out systematic manipulations of the duration and the shape of the energy curve of the target vowel, while holding other acoustic factors (most importantly formant structure) constant. The perceptual effect of the duration manipulations is consistent with results in the literature. For example, reducing the duration of the smoothly cut *a*-vowel in *raten* 'guess' to the duration of the abruptly cut *a*-vowel in *Ratten* 'rats' leads to a categorical shift in perception from smooth to abrupt cut, whereas in the nonlow vowel pairs duration manipulations do not have such an effect because vowel quality factors (formant frequencies) are perceptually more important for the distinction than vowel duration (see Sendlmeier 1981). Spiekermann shows that there are exceptions: for some listeners—mostly from the southwest of Germany—vowel duration has a strong perceptual effect even for some (but not all) of the investigated pairs of nonlow vowels. Most importantly for the purpose of his study, Spiekermann shows that manipulations of the energy curve (comprising the parameters E-Halt, E-Pos, and E-Zahl) have almost no effect on the perception of the minimal pairs.

Given the near absence of a perceptual effect, one may doubt that the observed acoustic energy patterns (including the relatively robust parameter E-Halt) are actively controlled by the speaker. It is implausible from a goal-oriented point of view (Perkell et al. 1995) to invest articulatory effort without a corresponding perceptual effect. Alternatively, it is possible that these energy patterns are a side effect of other acoustic differences. As far as the parameter E-Zahl is concerned, Spiekermann does in fact point out that the number of energy peaks is positively correlated with vowel duration (76). For E-Halt an explanation might be found in the first formant transition patterns reported by Strange and Bohn (1998). Measuring German vowels in the context /dVt/, Strange and Bohn found that in smoothly cut (tense) vowels the F1 transition from /d/ into the following vowel has an average duration of 16 ms, and that the F1 transition from the vowel into the following /t/ is on average 11 ms long (their table VII). For abruptly cut (lax) vowels the F1 transition into the vowel is 38 and the F1 transition out of the vowel is 18 ms in duration. This means that in smoothly cut vowels the F1 vowel target is reached quickly and maintained for as long as possible. Taking into account the fact that in stressed position smoothly cut vowels are about twice as long as abruptly cut vowels, this means that F1 is at maximum for a very high percentage of total vowel duration. In abruptly cut vowels, on the other hand, it takes about twice as long until the F1 vowel target is reached; the offglide is also longer than in smoothly cut vowels. Again taking into account that abruptly cut vowels are usually much shorter than smoothly cut vowels, this means that the proportion of the vowel with maximum F1 is much smaller than it is in smoothly cut vowels. According to this F1 pattern smoothly cut vowels are more stable and abruptly cut vowels more dynamic. This difference is further enhanced by the fact that abruptly cut vowels have a higher F1 target than smoothly cut vowels, hence the spectral distance between consonant and vowel is greater. In order to draw the connection between F1 and energy it is necessary to know that an increase in first formant *frequency* also leads to an increase of the *amplitude* of the first formant plus the energy of higher formants (see Allen et al. 1987:146–147). Such an increase in amplitude of the first and higher formants will lead to an increase of overall energy. Therefore it is expected that first formant frequency changes over time are positively correlated with energy changes. It is possible that higher stability of the energy curve (high "E-Halt" = high degree of energy hold) in smoothly cut vowels as opposed to abruptly cut vowels is at least partially caused by the higher stability of the first formant frequency values over time and the lower first formant frequency target under smooth cut as opposed to abrupt cut.

In chapter 5 Spiekermann applies the same set of measurements (except F0 and consonant duration) used for the Standard German data to speech produced in thirty-two different German-speaking regions, most of them in Germany. Some of these samples were taken from dialect corpora compiled and transcribed between 1957 and 1964 and published as "Lautbibliothek der deutschen Mundarten"; others are published in the PHONAI series or are stored in unpublished form by the Deutsches Spracharchiv at the Institut für Deutsche Sprache in Mannheim, Germany (see Haas and Wagener 1992). The selection of speech samples is representative of the major dialects in and around Germany. Separate reports and discussions are presented for the results of each of the thirty-two speech samples, amounting to around half the size of the book. The amount of material processed in this manner is impressive and the results are without any doubt of great value for German dialectology. For readers more generally interested in German vowel systems the value of the study would have been even greater if results for F1 and F2 had been reported separately rather than presenting formant frequencies only in the condensed form of subtracting F1 from F2. Maybe Spiekermann can supply this in another publication or make these data available through the internet.

Towards the end of chapter 5 Spiekermann provides a summary of the dialect differences, including a set of maps in which the major patterns for each of the acoustic parameters are presented. It turned out that the energy parameter E-Halt generally has a north-south distribution, whereby the greatest differences between smoothly and abruptly cut vowels are found in the north and center and the lowest in the south of Germany. Spiekermann concludes that as a tendency the north and central, but not the southern dialects have a syllable cut opposition (216–217). (There are more details, which cannot be discussed here.) Vowel duration shows roughly an east-west distribution; the greatest duration differences are found in the west and smallest duration differences are found in the east. The formant frequencies again show more of a north-south pattern with the greatest differences in the north and center, and the smallest in the south. There are no strict associations between any of the different parameters. However, Spiekermann points out that not only is there a certain positive correlation between vowel duration and E-Zahl (mentioned earlier), but also between the formant differences and E-Halt (226). The latter result is consistent with the idea, proposed above, that the energy parameter E-Halt might be partially caused by the values and dynamics of first formant frequency.

In the course of this discussion, Spiekermann cites Claßen et al. (1998) for further support of the correlation between syllable cut and vowel quality. Claßen et al. (1998) have shown for German that abruptly cut (lax) vowels tend to have more energy in the mid-to-high domain of the vowel spectrum (= less spectral tilt) than smoothly cut (tense) vowels. This was again found, based on a larger set of data, in research by Jessen (forthcoming). This result on the spectral balance of tense versus lax vowels had already been predicted for English by Halle and Stevens (1969). Raising F1 can lead to a certain amount of mid-to-high spectral energy increase, but laryngeal differences are probably at work as well, some or all of them caused indirectly by the influence of tongue root position and other supralaryngeal effects on the voice source (for further discussion see Halle and Stevens 1969, Jessen forthcoming). What this shows, again, is that differences in vowel quality, most importantly vowel closeness and as a result F1, can have an influence on the energy level and energy dynamics of the vowel. The connection between vowel quality and syllable cut can be further tested by examining the asymmetry between low and nonlow vowels. Recall that in terms of formant structure there is little or no difference between *a*-vowels, only between nonlow vowel pairs. How do *a*-vowels behave in terms of the three energy parameters E-Pos, E-Zahl, and E-Halt? Looking at table 4.2.1-2 and 4.2.1-3 one can see that for E-Pos and E-Zahl smoothly and abruptly cut *a*-vowels have among the highest differences as compared to other vowel pairs. On the other hand, for E-Halt, the primary syllable cut correlate, *a*-vowels have among the lowest difference. This latter fact could be interpreted as further support for the connection between vowel quality and syllable cut. However, the asymmetry between *a*-vowels and other vowel pairs in terms of E-Halt is not as clear-cut as the one usually found in terms of F1 and F2.

In conclusion, Spiekermann has succeeded in providing the most comprehensive, innovative, and systematic study of the acoustic correlates of syllable cut ever. (For a large recent study of its articulatory correlates see Mooshammer 1998.) It was thoughtful of him to include a well-designed perception study, since this helps the reader to place the acoustic results into perspective. The results of Spiekermann's study are not only interesting and thought provoking for the linguist and phonetician, but also of great value for the kind of modern dialectology that cares about (as it should!) results from experimental phonetics.

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