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Reset on a Boundary Tone

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This paper presents the phenomenon of the intonational reset of Southern German, and an analysis of it as an upstep phenomenon affecting a phrase-final high boundary tone. The material is discussed in more detail in Truckenbrodt 2001.

1. Background and the phenomenon

I here use the standard analysis of intonational contours in terms of H and L tones following Pierrehumbert (1980), Beckman and Pierrehumbert (1986), Pierrehumbert and Beckman (1988), and much related literature (see Ladd 1996 for a recent overview, see Uhmann 1991 and Féry 1992, 1993, Grice et al. 2000 for applications to German). *Pitch-accents* are associating with prominent syllables. They are notated as L*, H*, H*+L, L*+H etc. where the tone associating with the prominent syllable is marked with an asterisk. *Boundary tones* are associating with prosodic edges. Where the kind of edge they associate with is not relevant, these are here marked with the % diacritic of Pierrehumbert 1980, Pierrehumbert and Beckman 1988, as in L% or H%.

H (and L) tones are not always of constant phonetic height. A frequent phenomenon, subject to language-specific phonological conditions, is that of *downstep*, lowering the height of a H tone in relation to a preceding H tone. Since Clements 1979, downstep is usually analyzed in terms of an abstract phonetic register: H and L tones receive their phonetic value at the top and bottom of the register, and downstep is analyzed as lowering of the register. This is illustrated in (1), where the gray area is the register. The register analysis captures a crucial aspect of downstep—its effects carry over to later tones. When downstep applies to an already downstepped register,

[1] I want to thank Carlos Gussenhoven and Bob Ladd for their recent feedback on my material. All errors are of course my own. Since the presentation at the conference, I have revised my analysis of the phenomenon at hand. Here I present the revised analysis. I have changed the title of the paper accordingly.

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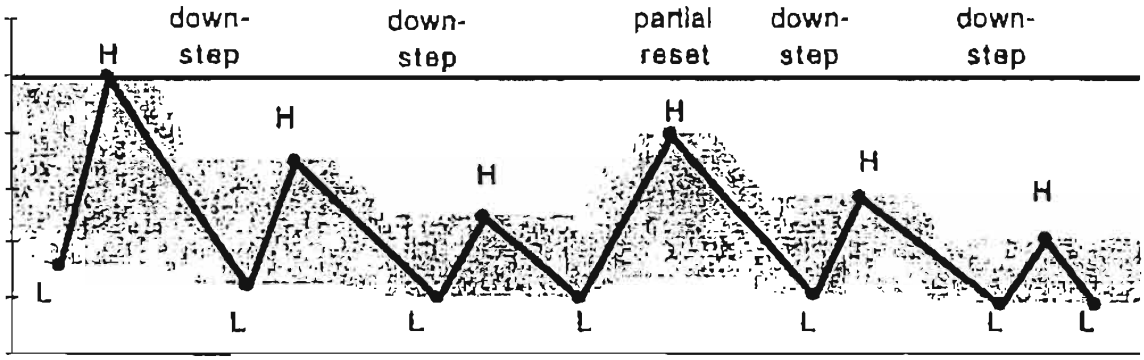
the register is further lowered. In certain positions, the chain of lowering may be terminated and the register shows a renewed height, which is sometimes referred to as a reset. A partial reset is illustrated in (1). A complete reset would set the register back to its initial height.

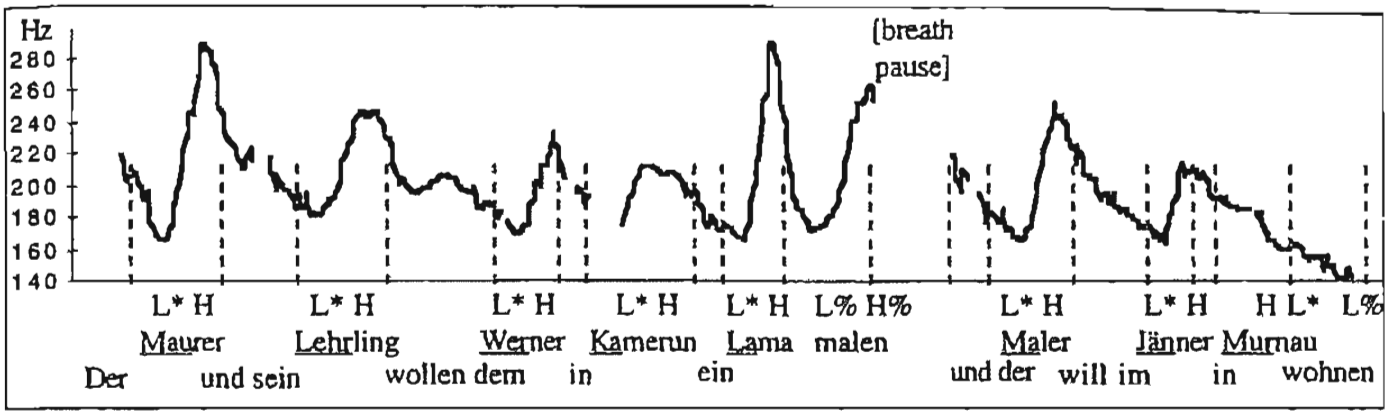
(1) *The concept of register*



In a number of languages in which resets have been reported in the literature, the reset occurs in position *initial in a prosodic domain*. Such languages include Japanese (Pierrehumbert and Beckman 1988, Selkirk and Tateishi 1991), English (Beckman and Pierrehumbert 1986, Ladd 1988), Yoruba (Laniran 1992), Hausa (Inkelas, Leben, and Cobler 1987), and Dutch (van den Berg, Gussenhoven, and Rietveld 1992). The unmarked case here seems to be the *partial reset* (rather than the complete reset). It is found in Yoruba, Hausa, Ladd's (1988) English data, and van den Berg, Gussenhoven and Rietveld's (1992) experiment in Dutch. In Japanese, the situation seems to be more complex, though the partial reset is found at least for some speakers by Selkirk and Tateishi (1991).

Against the background of these earlier findings, the Southern German reset is interesting because it occurs in the *final position of a prosodic domain* if there is continuation. It is also typologically unusual in being a *complete reset*, as will be seen in more detail below. An f0-track of speaker SW is shown in (2). This is a rendition of a two-clause utterance, where the clauses are separate prosodic domains, here analyzed as intonational phrases. The prosodic division is marked by a dramatic breath-pause and by a sequence of L%H% boundary tones. The first four peaks show successive downstep, while the fifth peak on the nuclear stress exhibits a reset. (The notation L* H used here is intended to leave open whether H is the second part of a pitch-accent, or a boundary tone of a smaller prosodic domain. See Truckenbrodt 2001 for discussion.)

(2) *The Southern German domain-final reset (speaker SW, Pattern C)*



'The bricklayer and his apprentice want to paint a llama for Werner in Kamerun, and the painter wants to live in Murnau in January.'

This phenomenon is interesting in particular in connection with the theories of Ladd (1988, 1990), and, incorporating some of his ideas, van den Berg, Gussenhoven, and Rietveld (1992), which tie the occurrence of resets to domain-initial positions generally and derive the partial reset in this position.

I proceed as follows. Section 2 outlines the main properties of the Southern German reset. Section 3 offers an analysis. Section 4 sums up the conclusions.

2. The Southern German reset

2.1. Overview of the reset patterns

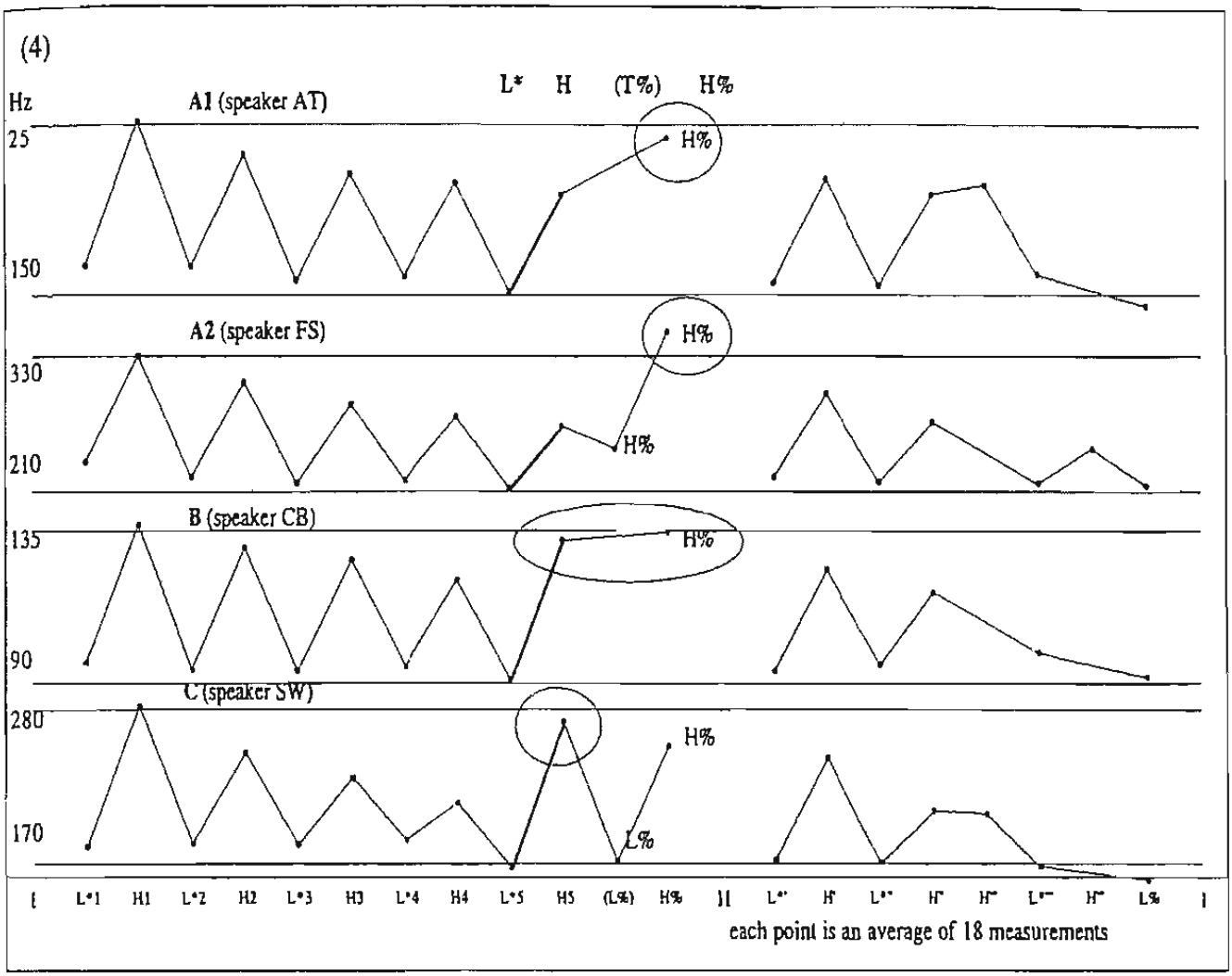
The experiment summed up here is reported in detail in Truckenbrodt 2001. Data from eight speakers of Southern German is reported, all of whom show the domain-final reset. The speakers turned out to fall into four different groups, possibly on the basis of dialect. The groups are here called Pattern A1 (speakers AT, NA, and BK), Pattern A2 (speaker FS), Pattern B (speakers CB, TL, and MG), and Pattern C (speaker SW). Recording of 72 tokens of two-clause utterances were made and analyzed for each speaker. Renditions were controlled for focus and choice of normal narrative sentence melody by a combination of brief instruction before recordings and explicit context for each rendition. The stimuli systematically varied in the length of the first clause from two pitch-accents as in (3a) to five pitch-accents as in (3b).

(3) *Example stimuli*

a. Was gibt's Neues?
[x x] Die Lola will das Nähen lernen,
[x x x] und die Manu und die Lena sollen ihr eine Nähmaschine kaufen.
'What's new?
Lola wants to learn to sew,
and Manu and Lena are supposed to buy her a sewing-machine.'

b. Was gibt's Neues?
[x x x x x] Die Lola und die Manu wollen der Lena im November Maronen geben,
[x x x] und der Werner will der Hanne ihr Leinen weben.
'What's new?
Lola and Manu want to give Lena chestnuts in November,
and Werner wants to weave her linnen for Hanne.'

An illustration of the four reset patterns is given in (4), using the averaged measurements of the longest recordings for each speaker. The rise on the nuclear stress is indicated by a thick line. The H tones affected by the reset are circled in (4). It can be seen that the reset in Patterns A1 and A2 falls on the H% boundary tone, not affecting the nuclear pitch-accent. In Patterns B and C, on the other hand, the reset occurs in the position of the nuclear pitch-accent. Another distinction across the medial patterns lies in the manifestation of additional boundary tones after the nuclear pitch-accent. A tonal analysis of the boundary tone configurations of these patterns will be outlined below.

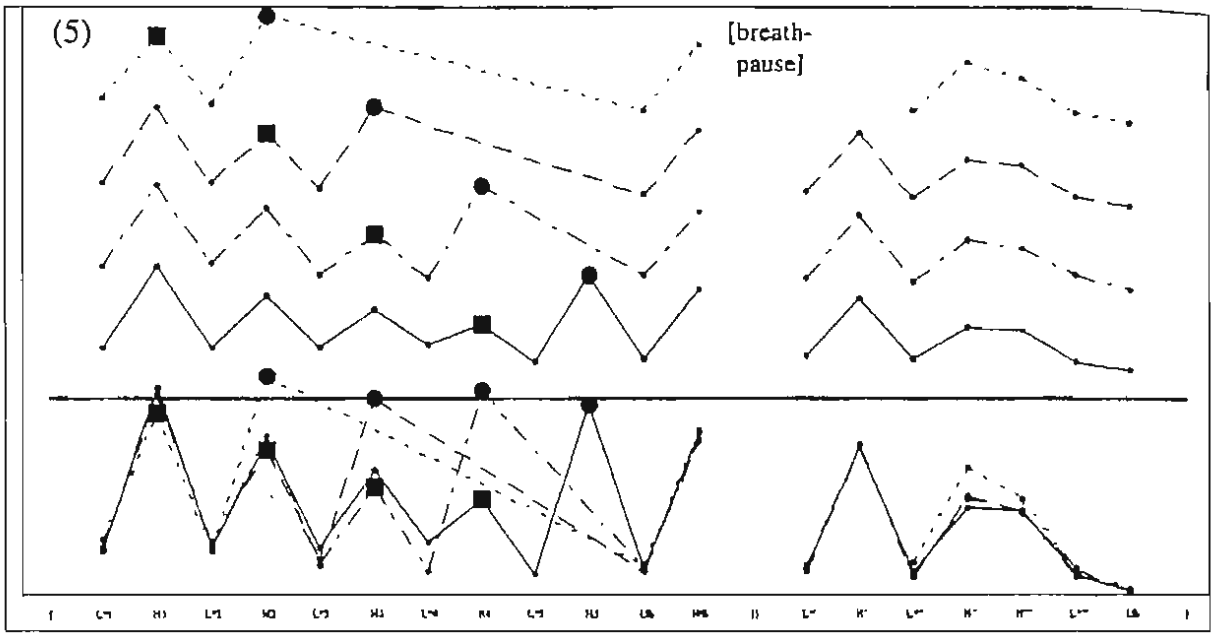


2.2. Properties of the reset

The main properties of the Southern German reset are here briefly illustrated with data from one speaker, SW. Similar evidence was found for the other speakers, though sometimes with systematic complications not discussed here. The points illustrated graphically below are strengthened by statistical analysis in Truckenbrodt 2001.

The properties of the reset are relevant in two respects. First, they solidify the analysis of the phenomenon at hand as a reset of some kind. Second, they are what the analysis of the reset later in this paper will have to explain.

Consider the diagram in (5). Here the averaged data of speaker SW are first displayed separately for the four sets of stimuli of different length. The reset values on the nuclear L*+H pitch-accent of the first clause are highlighted with black dots, and the immediately preceding peaks are highlighted with black squares. The bottom diagram combines the four plots into one (with a larger scale). The combined plot serves to illustrate a number of properties of the Southern German reset, as follows.



Complete reset. The Southern German reset is a complete reset, rather than a partial reset. To bring this out more clearly, the combined plot in (5) includes a horizontal reference-line at the average height of the utterance-initial peaks. It can be seen that the reset values are all around the height of this reference-line. (For some speakers, the identity of initial height and reset height can be offset by a small amount of declination,[2] visible for speaker AT in (4) above, and by a process of raising of H% in addition to the reset when following another tone at the boundary, as in the case of FS in (4).)

Neutralization of preceding downstep. Minimal remnants apart, the tonal height in the reset is independent of the tonal height brought about by preceding downstep. This can be seen by comparing the four sets in the combined plot in (5). The peaks preceding the reset (black squares) are successively lower, the later they occur. This is attributed to downstep: Among any two adjacent black dots, the later one is lower, as it has undergone one more step of downstep. These differences in pre-reset peaks do not carry over to the following reset values: The reset values are all of the same (approximate) height.

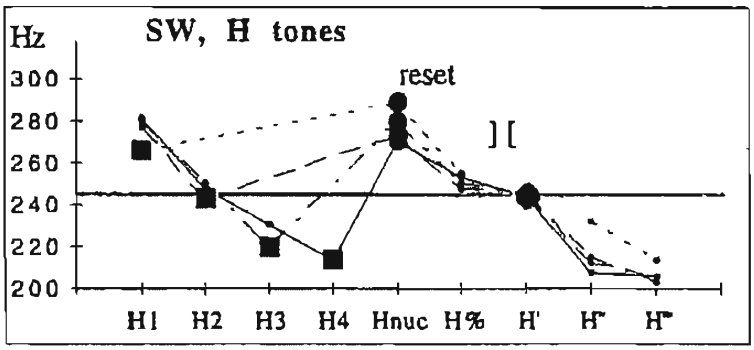
Medial but not final. Though the reset is found at the right edge of a prosodic domain, it is found only at the right edge of non-final clauses. Thus in (5), the values of the utterance-final pitch-accent H+L* do not give rise to a reset peak.

Downstep after the reset. The reset is followed by downstep on the next pitch-accent. It can be seen in (5) that the first peak after the breath-pause, on the initial L*+H tone in the second clause, is lower than the reset peaks. The relative amount of lowering can be assessed in (6), where only the H tones are plotted. Here the diacritic markings of pre-reset peaks (black squares) and reset peaks (black dots) are retained, and the first

[2] Declination, first postulated by Pierrehumbert 1980, is a process of gradual lowering of the tonal space during the utterance, that makes tones later appear lower in absolute height, everything else being equal. Pierrehumbert and Beckman 1988 found declination to be variable among their Japanese speakers, which appears to also be the case for my Southern German speakers. See also Gussenhoven and Rietveld 1988.

post-boundary peaks are marked with black diamonds. A horizontal reference-line is drawn through the average values of the post-boundary peaks.

(6)



The reference-line facilitates the comparison of the post-boundary peaks with the squared downstepped values to the left of the reset. The relations are as expected if the post-boundary peaks have undergone one step of downstep relative to the reset peaks. Thus, the post-boundary peaks (reference-line) are lower than the first black square (the initial peak, which has not undergone downstep), as high as the second black square (which has likewise undergone one step of downstep relative to the highest level), and higher than the third and fourth black squares (which have undergone more than one step of downstep).

This concludes the survey of properties of the Southern German reset. The first three of these properties are used in Truckenbrodt 2001 to argue against an alternative analysis of the phenomenon at hand for Patterns B and C. In the alternative analysis, the renewed height on the nuclear pitch-accent would be due to 'boosting' under prominence, as the nuclear stress is stronger than the preceding beats of stress. This alternative faces the following obstacles: *Complete reset*: The boosting analysis does not predict that the boosted values would be as high as the initial peaks. *Neutralization*: The boosting analysis leads one to expect a strong correlation of the boosted values with the preceding downstepped values, rather than the independence of the boosted/reset peaks from the preceding peaks that is found in the data. *Medial but not final*: The boosting analysis would predict an amplification of values in both the nuclear accent of a non-final domain and the nuclear accent of a final domain. However, the phenomenon at hand is limited to non-final position.

An analysis will thus have to explain the following properties of the Southern German reset:

- It precedes rather than follows a prosodic boundary;
- it is a complete reset;
- like other resets, it neutralizes preceding downstep distinctions;
- it applies in medial but not final position;
- it is related by downstep to the first peak in the following clause.

3. The account of the Southern German reset

3.1. The reset as an upstepped boundary tone

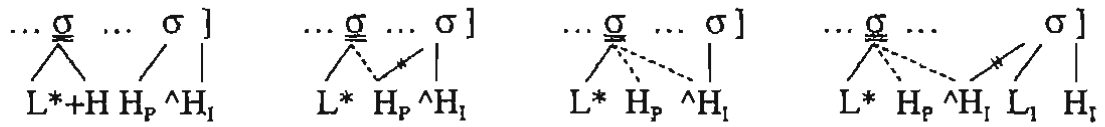
The present account identifies the Southern German reset with the phenomenon of *upstep* after a H phrase accent postulated in Pierrehumbert 1980 and Beckman and Pierrehumbert 1986. These authors analyze the intonational pattern of English yes/no questions as in (7a). A H *phrase accent* following L* is responsible for a first phonetic rise to a medial level, which may extend to a plateau. It is followed by a dramatic additional rise at the right edge of the question, which is analyzed as an upstepped H% boundary tone (transcribed ^H% in (7a)). The upstep is crucially triggered by the preceding H phrase accent. By contrast, a L phrase accent in the analysis of the continuation rise in (7b) does not lead to upstep of the H% boundary tone. Thus, in examples of (7b), the H% boundary tone is typically considerably lower in phonetic height than H*.

(7) a. L* H ^H% (English yes/no questions)
b. H* L H% (English continuation rise after H*)

According to Grice et al. (2000), both these contours also occur in German, with upstep likewise applying to H% after a H phrase accent but not after a L phrase accent. The present analysis of the Southern German reset as an upstepped H follows the suggestion of Grice et al. (2000) to transcribe the phenomenon investigated here with the upstep diacritic. The properties of the Southern German reset are thus analyzed here as properties of upstepped H boundary tones.

The tonal analysis of the Southern German patterns that allows us to see the reset as upstep is outlined in (8). The crucial element across patterns is the postulated presence of a boundary tone H_P that triggers upstep on an immediately following boundary tone H_I. This notation of boundary tones is taken from Hayes and Lahiri 1991. Its application to the case at hand and the details of the analysis are justified in more detail in Truckenbrodt 2001. Here the tonal structures are briefly reviewed and related to the plots in (4).

(8)



Consider first Pattern A2. It is the only pattern analyzed as involving a L*+H pitch-accent. At the medial phrase boundary, this pitch-accent is followed first by a boundary tone H_P and then by the upstepped boundary tone H_I. The phonetic manifestations of the three H tones can be seen in (4) above: The first H defines an initial peak close to the nuclear stress, the second defines the right edge of an elbow stretching rightward from there, and the third defines a subsequent rise to the upstepped level.

The other three patterns are analyzed as using L* pitch-accents, with the high peaks stemming from high boundary tones that may spread to the nuclear syllable. In Pattern A1 in (8), the H_P boundary tone links to the nuclear syllable and lets go of its

association with the right edge, which it would otherwise have to share with the subsequent H_I boundary tone. Phonetically, this gives rise to the shape seen for Pattern A1 in (4): A steep rise on the nuclear syllable is followed by a more shallow rise to the upstepped H_I. Pattern B results from additional spreading of the final H_I boundary tone to the nuclear stress. The upstep thus takes effect with the rise on the nuclear stress, as seen for Pattern B in (4). In Pattern C, furthermore, H_I itself gets dissociated from the right edge, due to the presence of yet additional boundary tones, specific to the speaker representing this pattern. As can be seen in (4), the upstep of Pattern C is confined to the nuclear stress, and is followed by the valley and peak of the subsequent boundary tones.

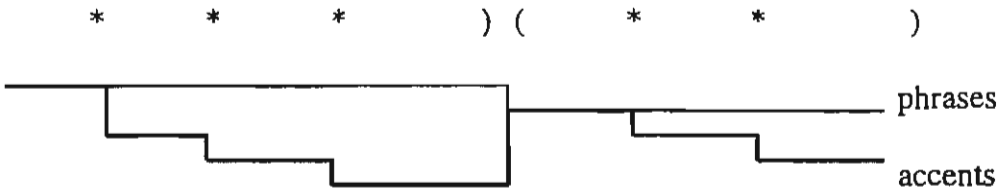
Thus, the sequence H_P ^H_I, is associated in different ways across the patterns. In the present analysis, H_P is then seen to be the trigger of upstep on the following H_I. This process is seen to be parallel to upstep in (7): The H phrase accent in (7) is analyzed as a boundary tone of the intermediate phrase in Beckman and Pierrehumbert 1986. Across the English and German patterns, then, we may say that upstep is triggered on a H boundary tone by a preceding H boundary tone.

This analysis explains why the Southern German reset occurs in medial but not utterance-final position in declaratives: It is triggered by a sequence of two H boundary tones. H boundary tones are assigned in medial position in German, but not in final position in declaratives. The utterance-final position thus lacks both the trigger of upstep (H_P) and the target (H_I).

3.2. Register levels

I here analyze the Southern German reset in the overall model of phonetic register of van den Berg, Gussenhoven, and Rietveld (1992) (vdBGR92 in the following), which is informed by the model of Ladd (1987). The model also has parallels to the model developed by Pierrehumbert and Beckman (1988) for Japanese, and it incorporates suggestions made by Ladd (1988, 1990) with regard to English. The relevant aspects of the model are schematically illustrated in (9).

(9)

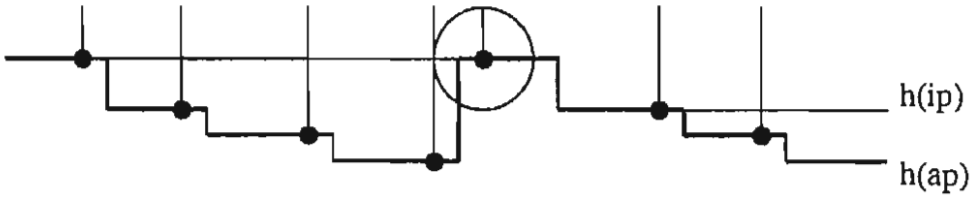


Ladd (1987), Pierrehumbert and Beckman (1988) (PB88 in the following) and vdBGR92 use phonetic models that separate scaling or register on the level of the phrase from scaling or register within phrases. Across Japanese (PB88), English (Pierrehumbert 1980, Beckman and Pierrehumbert 1986, Ladd 1988, 1990), and Dutch (vdBGR92), downstep within phrases may be triggered by accents or pitch-accents, while boundary tones may undergo, but may not trigger downstep. The effects within phrases are attributed in these models to a fine-grained register calculation here called *register of the accents*. In (9), the accents are indicated by stars, and the downstep of the register of the accents is shown by the thick line. This is also the register in which all (H) tones are scaled. The *register of the phrases*, in these models, is indicated by the thin line in (9). It is constant within each phrase, but may differ from one phrase to the next. The high initial register and the domain-initial reset are both captured by identifying the register of the accents with the

register of the phrase in phrase-initial position. In this kind of model, vdBGR92 incorporate an insight due to Ladd (1988, 1990): Downstep may occur between larger domains that themselves contain downstep. As shown in (9), the register of the second phrase may be downstepped relative to the register of the first phrase. Within these phrases thus downstepped relative to each other, more fine-grained downstep takes place on the register of the accents. This model also incorporates Ladd's (1988, 1990) suggestion for the representation of a *partial reset*: As shown in initial position of the second phrase in (9), a partial reset is a reset to a level that has suffered downstep at a higher level, here on the level of the phrase.

What, then, is the phonetic implementation of upstep in this model? I argue that upstep is phonetically a return to the register on the level of the phrase, as shown in (10).

(10) (L* H_p L* H_p L* H_p L* H_p ^H_I) (L* H_p L* H_p L*)



Here the H tones undergo downstep with each pitch-accent. At the right edge of the first phrase, the Southern German reset, or upstep, is represented as a return to the register of the phrase in phrase-final position. The properties of the Southern German reset support this analysis as follows. *Complete reset.* It is now correctly predicted that the Southern German reset is a complete reset because the register of the phrase is the same initially and medially. *Neutralization of preceding downstep.* It is correctly predicted that distinctions due to preceding downstep are neutralized, since the reference-line for the phrase is defined independently of the reference line of the accents. *Downstep after the reset.* The reset is correctly predicted to be followed by downstep, due to the lowering-relation between the phonetic registers of the phrases. While the downstep between phrases otherwise shows its effects at a distance in the partial reset as in (9), the Southern German domain-final reset, in this application of the model, shows the lowering-relation between phrases in adjacent tones.[3] Finally, it is allowed that the reset occurs to the left of the boundary, in the form of an upstep, without a change in the model that otherwise derives a domain-initial reset. Thus, recall that the domain-initial reset in (9) is represented as the identification of the register of the accents and the register of the phrase in phrase-initial position. This identification is retained in (10). The upstep, however, anticipates the identification of the two registers in domain-final position.

[3] vdBGR92 report for their four Dutch subjects that the ratio of lowering among the higher domains is smaller than the ratio of lowering between pitch-accents within phrases. They suggest more generally that the downstep ratio may differ for the different register levels. In my Southern German data, the lowering ratio between phrases and within phrases are indistinguishable for five of the eight speakers. For the three other speakers, there is more dramatic lowering between phrases than between accents within phrases.

4. Conclusion

The present analysis postulates that upstep in domain-final position and reset are partly the same phenomena: The Southern German reset, neutralizing preceding downstep, is analyzed as an upstep phenomenon, triggered by a H boundary tone on a following H boundary tone. At the same time, the analysis suggests that upstep generally is a reset phenomenon in the sense that it represents a return of the register of the accents to the register of the phrase, sharing this with the domain-initial reset. However, the present analysis does not affect the phrase-initial identification of the two register levels, which leads to the 'normal' domain-initial reset in the absence of preceding upstep.

The analysis supports the phonetic model that separates the register of the accents from the register of the phrase (Ladd 1987, PB88, vdGBR92): This model allows for a formalization of the upstep or domain-final reset as a return of the register of the accents to the register of the phrase in phrase-final position. The Southern German data, in this analysis, furthermore supports the conclusions of Ladd (1988, 1990) and vdBGR92 that downstep may be embedded within downstep: The downstep relation among the phrases (which contain embedded downstep among pitch-accents) is seen in the Southern German case as downstep between the upstepped register level at the end of the first phrase and the register level at the beginning of the second phrase.

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