Vowel devoicing/deletion in English and German*

Jonathan E. J. Rodgers

1 Introduction

This paper presents and discusses data on vowel devoicing in English from Ph.D. research being carried out under Sarah Hawkins at Cambridge, and more recently with Klaus Kohler at the Institut für Phonetik und digitale Sprachverarbeitung in Kiel; and data on vowel deletion in German from the Kiel Corpus of Spontaneous Speech (IPDS 1995, 1996) reported most recently by Pétur Helgason and Klaus Kohler (Helgason and Kohler 1996). There are three main aims:

1. to point out how the work reported fits into the tradition of recent work at Kiel, and into the HCM-PLP project;

2. to reveal important methodological issues in the study of connected speech processes through a comparison of the nature of the two sets of data;

3. to reveal similarities in the data from English and German that typify the kind of cross-language regularities that we are trying to address in a European-wide research project such as HCM-PLP.

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2 History

When the Human Capital Mobility Project was established, researchers in Kiel working on Phrase Level Phonology took as their aim the examination of phonetic reduction processes that underlie deletions and insertions marked in the *Kiel Corpus of Spontaneous Speech* (IPDS 1995, 1996). Besides describing and accounting for these processes, post-doctoral students sought to draw comparisons with other languages, which have included Dutch, Danish, Icelandic, French and English. Work has already been reported on glottalization (Kohler 1994), and more recently we have been looking at both single and multiple deletions of vowels and consonants in the Corpus. Work on consonant deletion (Rodgers et al. 1997) satisfactorily mirrors our work on vowels (Helgason and Kohler 1996). Cross-linguistically, there has also been preliminary comparison of data on deletions of /d/ in German (Helgason 1996), Icelandic and Danish, and on vowel devoicing and deletion in English and German (Rodgers 1996), which can now be reported less preliminarily, though it should be stressed that this is work in progress.

3 English

The comparison begins with the presentation of what is to be compared; a word on terminology serves to introduce the English data. The title of this paper is vowel deletion/devoicing: there are obvious and not irrelevant differences between the terms. Vowel *devoicing* is the term that I use to describe the phenomenon under examination in English: it refers to the greater duration of voicelessness in the vowel than you might expect to find simply because of differences in VOT due to place of articulation, stress, or vowel quality, which are widely documented.

An example probably makes this more accessible: the second vowel of *carpeting*, *multiple*, *blanketing* is likely to be partially voiceless; in fact in the data it is often completely devoiced. This is clear in the acoustic signal: the waveforms and spectrograms in Figure 1 contrast two utterances of the word *identity* in which the vowel is normally voiced in the first case and fully devoiced in the second; in this instance the difference in degree of devoicing is associated with a faster rate of articulation in the devoiced token. The utterances are time-aligned on the critical syllable, which starts at 6.68 sec. in the top pair. Visible in the normally voiced token at the top are a voicing bar, the regular formant structure expected for /ɪ/ — low F1, F2 high and close to F3, and in the waveform three or four cycles of periodicity. Then follows the silence that is the closure for the next /t/. In the devoiced token at the bottom, the waveform shows no periodicity, and in the spectrogram there is a burst followed by a long phase of frication, but no voicing. Especially for comparison with the German data, this is not the best example of a devoiced vowel: a heavily lenited release overlays what is perceived as high vowel quality. But in most cases, albeit not here, there is a phase of aspiration and a more clearly visible formant structure. There is no onset of voicing,
Figure 1: Waveforms and spectrograms of the word *identity* in which the vowel of the syllable /ɪtɪ/ is normally voiced *(top)*, and fully devoiced *(bottom)*.
just the period of silence representing the closure for the next /t/. To talk of voice onset time here seems counter-intuitive.

Devoicing — in consonants as well as in vowels — has of course been widely documented in several languages. Mary Beckman and her group at Ohio have examined the phenomenon in Japanese, Korean, French, German and Turkish. In these languages they have treated devoicing as allophonic variation, and one avenue of research has been to see what devoicing in English has in common with devoicing in other languages, specifically stress-timed rather than the syllable-timed languages others have dealt with to date. What happens in stress-timed languages, and more specifically, in words with Latinate and Germanic stress, may add useful insights to what we know about the devoicing gesture.

Performing a literature survey on vowel devoicing in English, however, is a fairly fruitless task: Gimson’s 1980 survey was impressionistic by his own admission, and made no attempt to quantify contexts or conditions under which devoicing might take place (Gimson 1975). His approach is the norm. This means that in designing experiments aimed at establishing for English what might be called the ground-rules of devoicing — where and when does it happen and why — hypotheses were based on others’ anecdotal impressions and informal observations of my own, which relied on deduction from the sound patterns of other languages in which vowel devoicing occurs, and on some rudimentary principles of the aerodynamics of voicing that are mentioned here briefly, but to which my work, and less specifically this paper, will return later.

In 1975, John Ohala attempted to show how speech sounds pattern in certain regular ways across languages, and how the regularities he found might stem from universal physical properties of the speech mechanism — these properties being things like anatomical, elasto-inertial, neuro-muscular, acoustic and aerodynamic (Ohala 1975). He simulated some of the relevant parameters of these properties with a mathematical model of speech aerodynamics. Some of this model’s predictions for vowels feature in Figure 2.

Figures 2 and 3 refer to two VCV utterances: the first V is the spread open vowel [æ], C is a voiceless unaspirated bilabial stop, the second V either the open vowel [æ] again, or the close vowel [ɪ]: so the utterances are [æpæ] and [æpɪ]. Figure 3 shows a mid-sagittal section of the vocal tract appropriate to these two types of vowel. The oral area and oral pressure corresponding to the two utterances are superimposed and plotted against time. As the occlusion is made for the stop, oral area decreases, and oral pressure rises, then at release, Ohala’s model suggests that a close vowel like [ɪ] (broken line) creates an appreciably higher oral pressure than an open vowel like [æ] (solid line). The high oral pressure we find in high vowels interferes with the pressure drop across the glottis needed for voicing. High vowels favour devoicing.

Jaeger took this idea one step further by applying the predictions of Ohala’s model to the Stanford Phonology Archive (Jaeger 1978). She looked at 30 languages that allophonically devoiced a subset of their total vowel inventory, and confirmed a very

1Much of this is summarized in Beckman (1996)
Figure 2: Mathematical simulation of two VCV utterances [æpæ] (solid line) and [æpɪ] (broken line), from Ohala (1976).

Figure 3: Vocal tract configuration of two VCV utterances simulated in Figure 2, where [æpæ] is the solid line and [æpɪ] the broken line, after Ohala (1976).
strong tendency for high vowels to exhibit devoicing. There were no counter-examples of low vowels that devoiced.

Her findings confirmed what Greenberg had proposed in 1969, which is reproduced in Table 3 (Greenberg 1969). In this table, the voiceless vowels are all close or close-mid ones and there are no voiceless open vowels; no vowel that is voiceless is more open than the central vowel schwa. A caveat to be borne in mind is that these are phonological rather than phonetic data, and we lack direct evidence of the phonetic realization of these vowels.

Ohala’s insight into the way bio-mechanical properties of the vocal apparatus might affect the aerodynamics of voicing informed two major experiments that have been carried out to date. In these the influence of structural segmental properties of the critical syllable, and the syllable immediately preceding and immediately following that critical syllable have been examined. The focus of the data is the critical syllable, as the experiments have established that, to the extent that structural properties affect devoicing, their influence is confined to that critical syllable: for example, the height and length of the preceding vowel is not significant, nor is there any evidence of vowel-to-vowel coarticulation across the critical syllable. The critical syllable is what counts, and these are the structural properties that matter and how they were established.

The design of these experiments is summarized in Figure 4. In two experiments fifteen speakers of Standard Southern British English read passages aloud under studio conditions, but in a style that imitated casual speech. The passages contained, along with suitable foils, polysyllabic words in which were embedded syllables in which the stress, onset, vowel and coda of a critical syllable were systematically varied. In article, the word in Figure 4, the syllable of interest is unstressed /tɪk/. So, being unstressed, it would serve for comparison with stressed syllables; or its onset /t/ could be compared with those of syllables /pɪk/ and /kɪk/; it’s vowel /ɪ/ with those of /tæk/ and /tʊk/; it’s coda /k/ with those of /tɪs tɪd tɪz/. Subjects’ speech was digitized appropriately and the absolute durations of voicelessness and voicing of the vowel of the critical syllable measured. Summing these, obviously, gives the total vowel duration. In what follows results are presented in the form of proportions, and the preference for this form over absolute values of duration and proportions should be

<table>
<thead>
<tr>
<th>Language</th>
<th>Voiced and voiceless</th>
<th>Voiceless only</th>
</tr>
</thead>
<tbody>
<tr>
<td>Awadhi</td>
<td>i, u, e</td>
<td>a, o</td>
</tr>
<tr>
<td>Campa</td>
<td>i</td>
<td>o, e, a</td>
</tr>
<tr>
<td>Chatino</td>
<td>i, u</td>
<td>o, e, a</td>
</tr>
<tr>
<td>Dagur</td>
<td>i, u, ə</td>
<td>o, a</td>
</tr>
<tr>
<td>Huichol</td>
<td>i, i, e</td>
<td>u, a</td>
</tr>
<tr>
<td>Serbo-Croatian</td>
<td>i, u</td>
<td>e, o, a</td>
</tr>
<tr>
<td>Tunica</td>
<td>u</td>
<td>i, e, ə, a, ɔ, ə, ɔ</td>
</tr>
<tr>
<td>Uzbek</td>
<td>i, u</td>
<td>e, ə, o, a</td>
</tr>
</tbody>
</table>

Table 1: Distribution of voiced and voiceless vowels, from Greenberg (1969)
If measuring and comparing voicing in syllables like /ptm tm km/ or /ptt pæt/ or unstressed versus stressed syllables, differences would be expected. There are VOT differences due to place of articulation, there are differences in inherent vowel duration due to height — open vowels are longer than close ones — and differences due to stress — stressed syllables are typically longer than unstressed. Naturally, absolute durations as well as proportions must be examined; but in most instances there is no difference, and that is here the case. Proportions are presented so as to prevent inherent patterns from distracting from the presentation of patterns due to devoicing, and to avoid presenting differences that are artifactual. This is what was found, and accounted for in terms of the aerodynamics of voicing.

Figure 5 plots the proportion of voicelessness in the vowel of syllables which were either stressed or unstressed, so could have been something like /tIk/ in article and articulate. There is a significantly greater proportion of voicelessness in unstressed than in stressed syllables. Stressed syllables are produced with greater force of articulation than unstressed: the greater subglottal pressure in stressed syllables means there is a sufficient pressure drop across the glottis to ensure full voicing.

Figure 6 shows the proportion of voicelessness in unstressed syllables contrasting in the place of articulation of the onset, so the syllables might be /ptp ttp ktp/. A greater proportion of voicelessness was predicted the closer to the glottis the onset is articulated, in the order velar /k/ greater than alveolar /t/ greater than bilabial /p/. The reason for this pattern is that pressure is inversely proportional to volume: by which is meant that, the further the constriction from the glottis — as shown in Figure 7 — the greater the supraglottal volume, and the lower the intra-oral pressure, the greater
Figure 5: Proportion of voicelessness in vowel of syllables varying in stress.

Figure 6: Proportion of voicelessness in vowel of syllables varying in onset.
Figure 7: Mid-sagittal section to show difference in distance from the glottis that may affect the transglottal pressure drop required for voicing to occur (cf. Figure 6).

the drop in pressure across the glottis. But note from Figure 6 that devoicing is in fact greater after /t/ than /k/: a post hoc explanation of this discrepancy may be that, with this being casual speech, many /k/ tokens were heavily lenited, and in a lenited stop, with an incomplete closure — so with a leak of air — there is less build-up of oral pressure, and voicing is easily resumed soon into the vowel. Without wishing to pre-empt the issue, there is also evidence for this in the German data.

Turning to the nucleus of the vowel, Figure 8 plots the proportion of voicelessness in the vowels of critical syllables contrasting in the identity of the vowel: typical syllables would be /tɪp tæp tɒp/. There is significantly greater devoicing in high vowels than in low vowels. In accordance with Ohala’s prediction, there is a greater pressure drop across the glottis in open than in close vowels. A further consideration here is that the tongue raising that is found in high front vowels like /ɪ/ — as shown in Figure 3 — tends to make the vocal folds tense, so higher subglottal pressure is needed to make them start vibrating (Honda 1983). Furthermore, between /ɪ/ and /æ/ there is the open but rounded vowel /ɒ/, which is more devoiced than its spread counterpart /æ/. A combination of the slight lip-rounding and the pharyngeal constriction that characterize /ɒ/ seem to have the same effect as tongue-raising, that is, of hindering the achievement of a pressure drop across the glottis. The rounding and backing found in /ɒ/ favour devoicing more than /æ/.

All these differences were statistically significant and had been predicted. However, still at the level of the critical syllable, it was predicted that a voiceless coda would allow devoicing of a preceding vowel, while a voiced coda would preclude it.
The rationale was that for production of a voiceless coda the vocal folds are held apart — they are wider apart in production of a fricative than for a stop — wider even than in inspiration — while for production of a voiced coda they are adducted.

It is clear from Figure 9 that the difference is anything but significant, however. Figure 10 shows that voiced and voiceless fricative codas are preceded by the greatest
proportion of voicing. I attribute this fact to the faster rate of tongue movement to form a stop rather than fricative occlusion; with a stop the closure is rapidly made and oral pressure rises rapidly, in the fricative however, the occlusion is more slowly achieved and voicing lasts longer. Hoole (forthcoming) in a chapter on laryngeal co-articulation to appear in Harckaste’s book on co-articulation, supports this.

To summarize the findings of these experiments, vowel devoicing is most likely to happen in unstressed rather than stressed syllables article rather than articulate; in high rather than low vowels article rather than *artackle; after stops articulated closer to the glottis article greater than *arickle greater than *arpickle; and where the coda is voiceless stop article greater than *artiddle, artist or artisan. In English at least, the devoiceable syllable par excellence is unstressed, has a /t/ or /k/ onset, a high vowel nucleus, and a voiceless stop coda.

4 German

There are two parts to the presentation of the data for German, and again a word on terminology is used to introduce them. Vowel deletion is the term used by researchers on the Kiel Corpus of Spontaneous Speech: this is where the canonical transcription suggests a vowel, but those labelling the data base have used a minus sign — their convention for a missing segment — to mark “the absence of a segmentable vocalic section in the speech signal, i.e. an oral aperture associated with voicing, manifesting itself as a typical formant structure” (Helgason and Kohler 1996: 143). To give another example, the vowel of the syllable /fɪl/ in vielleicht, /tsu/ in zu spät or /tsɪp/ in
Figure 11: Waveform and spectrogram of the word *vielleicht* in which the vowel of the syllable /fil/ is normally voiced.

Figure 12: Waveform and spectrogram of the word *vielleicht* in which the vowel of the syllable /fil/ is devoiced.

*prinzipiell* might be partially or completely voiceless.
5.46 5.48 5.50 5.52 5.54 5.56 5.58 5.60 5.62 5.64 5.66 5.68 5.70 5.72 5.74 5.76 5.78

Figure 13: Waveform and spectrogram of the phrase *mir zum Arbeitsfrühstück* in which the vowel of the syllable /tsum/ is normally voiced.

In Figure 11 the canonical *vielleicht* has the labio-dental fricative, the high front vowel, and the diphthong, which are in the 1:2:6 ratio typical of this word. In the devoiced token of Figure 12, formant structure is visible in the aperiodic excitation immediately before the /l/.

Furthermore, cases have been highlighted with the notation MA where the deletion notation alone does not accurately describe what we perceive in the signal, where, indeed there is a residue of the purportedly deleted segment — this convention has been the starting-point for two surveys of such deletions, in vowels (Helgason and Kohler 1996) and in consonants (Rodgers et al. 1997). In the waveform-spectrogram pair in Figure 13 a canonical *zu* appears in the phrase *mir zum Arbeitsfrühstück*: it has the sibilant structure followed by oral opening synchronized with voice onset, and then the bilabial closure and velic lowering. In the devoiced version in Figure 14, from the word *zumindest* there is delayed voice onset, so we have formant structure and aspiration before the bilabial closure.

### 4.1 Part One

The *Kiel Corpus of Spontaneous Speech* is just that — spontaneous — and it must come as no surprise to learn that unlike the RP speakers in the Cambridge experiments, German speakers do not seem spontaneously to utter balanced sets of words containing syllables contrasting in their segmental properties, although it would be very convenient if they did. The first step in examining vowel deletion in German was
to use awk\textsuperscript{2} scripts to extract from the label files of the Corpus — which are plain text files — all examples of vowel deletion, then examine these in turn to establish what principles underlie the phenomenon.

We can extract an overview from Table 4.1: schwa has by far the highest frequency of deletion, which radically sets it apart from other vowel deletions. As regards other deletions, high vowels (\textipa{iː}, \textipa{I}, \textipa{yː}, \textipa{Y}, \textipa{uː}, \textipa{U}) are deleted more frequently than mid vowels (\textipa{eː}, \textipa{E}, \textipa{2ɪ}, \textipa{9}, \textipa{oː}, \textipa{O}), low vowels (\textipa{eː}, \textipa{aː}, \textipa{A}), diphthongs (\textipa{aɪ}, \textipa{aʊ}, \textipa{OY}) and the central open-mid vowel \textipa{ɛ}. Also, the high vowels are more likely to be marked with an \textipa{MA} than mid and low vowels or diphthongs. So in the Corpus the same vowels as in English undergo symbolic deletion in largely the same environments as in English: unstressed high vowels and schwa are most frequently deleted, and their ideal deletion context tends to be surrounded by or at least preceded by voiceless obstruents.

Generally speaking, a few words in the data base contribute a large number of the cases of single vowel deletions, as Table 4.1 confirms. If we take the five words in Table 4.1 — \textit{vielleicht}, \textit{zu} (alone or in compounds), \textit{und} (counting both the function word \textit{und}, and \textit{-und-} as part of compound numbers such as \textit{vierundzwanzig}), the function word \textit{es}, and the indefinite article \textit{ein-} (in its various forms) — vowel deletions in these words alone make up approximately one half of the total number of single vowel deletions. Adding 5 more items (-\textit{zehn-}, \textit{ist}, \textit{ich}, \textit{in/im}, \textit{den/dem}) provides another 168.

\textsuperscript{2}awk, a utility that takes its name from its designers (Aho, Weinberger and Kernighan) makes it possible to handle simple data-reformatting jobs easily with just a few lines of code.
Table 2: The frequency of occurrence of symbolic vowel deletions for different vowel types, from Helgason and Kohler (1996)

<table>
<thead>
<tr>
<th>Vowel type</th>
<th>N total</th>
<th>deleted</th>
<th>deletions with MA</th>
<th>deleted vowels</th>
<th>MA cases among del.</th>
</tr>
</thead>
<tbody>
<tr>
<td>High</td>
<td>9400</td>
<td>476</td>
<td>179</td>
<td>5.1%</td>
<td>38%</td>
</tr>
<tr>
<td>Mid</td>
<td>7084</td>
<td>219</td>
<td>21</td>
<td>3.1%</td>
<td>10%</td>
</tr>
<tr>
<td>Low</td>
<td>7240</td>
<td>26</td>
<td>6</td>
<td>0.4%</td>
<td>23%</td>
</tr>
<tr>
<td>Diphthong</td>
<td>2971</td>
<td>83</td>
<td>1</td>
<td>2.8%</td>
<td>1%</td>
</tr>
<tr>
<td>@</td>
<td>1195</td>
<td>27</td>
<td>6</td>
<td>2.3%</td>
<td>22%</td>
</tr>
<tr>
<td>@</td>
<td>4810</td>
<td>2844</td>
<td>27</td>
<td>59.1%</td>
<td>1%</td>
</tr>
</tbody>
</table>

Table 3: Deletion data for common words in the spontaneous speech data base, after Helgason and Kohler (1996)

<table>
<thead>
<tr>
<th>word</th>
<th>total</th>
<th>deleted</th>
<th>% deleted</th>
</tr>
</thead>
<tbody>
<tr>
<td>vielleicht</td>
<td>175</td>
<td>99</td>
<td>57%</td>
</tr>
<tr>
<td>zu</td>
<td>278</td>
<td>52</td>
<td>19%</td>
</tr>
<tr>
<td>und</td>
<td>715</td>
<td>87</td>
<td>12%</td>
</tr>
<tr>
<td>es</td>
<td>243</td>
<td>121</td>
<td>50%</td>
</tr>
<tr>
<td>ein-</td>
<td>346</td>
<td>71</td>
<td>21%</td>
</tr>
</tbody>
</table>

The 10 items listed above contribute more than 70% of the single vowel deletions. Obviously this should be taken into account in any statistical analysis since the results can easily be distorted by effects caused by the frequency of occurrence of a particular word type.

4.2 Part Two

The second part of the data stems from trying to recreate the paradigm of the experiment on English, that is, extracting syllable types and measuring durations of voicing and voicelessness. This is work in progress; so far it is clear that there is a very strong overlap between what has been found for English, as shown in Figures 5–10, and what is found in German. However, it is perhaps not surprising that the syllables of the English study are anything but precisely mirrored in the German data: the English experimental materials were carefully selected to contain matched numbers of syllables, and to this end even nonsense syllables were used (although a pilot experiment confirmed that there was no significant real/nonsense effect). Furthermore, the German data, gathered for the Verbmobil project, feature a lexicon that is intentionally rela-
tively limited, with much repetition of key items. For example, all examples of the syllable /k'iː/ in the corpus are in the word *Kiel*, all those of /p'iː/ are in *zum Beispiel*. Where possible, therefore, comparisons are drawn between syllables that exist both in the English and the German data, and here there appears to be a good correlation.

The German data, however, offer the opportunity to examine syllables that were excluded from the English study — although they are interesting from an articulatory point of view — either because they simply do not exist in English, e.g. the vowel of *müssen*, the palatal fricative /ç/; or because production studies tend to be limited in scope, so fricative onsets, for example, were excluded.

## 5 Similarities and differences between data

The properties described in English and German indicate noteworthy similarities between what I call vowel devoicing in English and what the Kiel researchers call vowel deletion in German. This is because German deletion is *symbolic* deletion, the absence in the signal of the *canonical* properties of the segment the labeller is offered. In both English and German, a vowel is no less a vowel for being voiceless, at the phonetic level: it is perceived, the vocal tract configuration is that for the vowel, yet there is simply no periodic excitation. The data suggest, then, that the devoicing/deletion issue is just a small difference of terminology, and that the phenomenon under examination is largely the same one. Furthermore, in both sets of data what we call devoicing or symbolic deletion may happen in at least three ways:

1. a shift in the timing of gestural components: voice onset after closure release
2. a reduction in gesture magnitude: lenitions and fricated releases
3. changes in phonation type or voicing amplitude: creak in German, breathy voice in English

Having established what happens and how, it is of course obvious to ask the next question: why? In order to achieve isochrony, unstressed syllables following stressed syllables in the same foot tend to be compressed more or less in proportion to the number of syllables in the foot. Speakers perform this compression of unstressed syllables by means of a complex interplay of syllable reorganization and/or consonant and vowel reduction. In this framework it might be appropriate to view vowel devoicing as one of several possible — and possibly competing — production strategies that underlie casual speech. An experiment on rhythm in support of this is in its early stages.

It is important though, to stress an important difference that may be relevant to future work and projects of this type: how the Cambridge data and the Kiel data are gathered is diametrically opposed. The data from English were acquired in a largely classical experimental fashion: the isolation of the phenomenon is followed by a literature review to establish what is known about it, then hypotheses are formed where
the literature offers no more insight, and experiments designed to test these hypothe-
ses. By contrast, the Kiel Corpus data are not experimental. The researchers who have
gathered them have no a priori interest in discovering evidence of vowel devoicing,
symbolic deletion, or any other connected speech process. Anything that they find is
grist to the mill; for them the Corpus is a linguistic microcosm in which everything is
of potential interest. If anything, the vital thing for corpus researchers even more than
experimental phoneticians, is to remember that a corpus, like any data, is a microcosm
and not the cosmos itself.

In this connection the labelling is a vital issue: although the corpus-user’s first and
most useful tool is the labels, it is essential to recall that the labels are not the data:
corpus data is worse than useless if we think the labels are reality. But if the labelling
is good it offers a powerfully revealing insight into the patterns that the data hold. As
an aside, it is worth pointing out that labelling that is segmental and linear may fail to
capture processes spreading over more than one label. To address one aspect of this
problem, researchers on the Kiel Corpus are integrating prosodic labelling into the data
base for more refined searching.

Largely through advances in computer storage and access, and greater experience
of corpus gathering, well-labelled data bases no longer simply back up the findings of
the lab. phonetician, but enlarge on, albeit not in an experimentally systematic way, the
phenomenon under examination in the laboratory, and may even point to the questions
we should be asking in the lab. In this vein, a project at York\footnote{see http://www.york.ac.uk/~rao1/job.html} aims to examine reduc-
tion with its data drawn from a corpus, and account for what it finds in a declarative
framework.

6 Conclusion

This paper has aimed to summarize at least two strands of research and point out their
relevance to work in Kiel and the HCM-PLP project generally; I have then tried to draw
comparisons between the sets of data, and point out some advantages of experimental
and corpus research, and to present any disadvantages rather as areas where caution
is needed. The challenge for experimenters using lab speech is to elicit phenomena
they believe exist in and mirror real speech; the challenge for corpus researchers is to
account for the patterns they finds in their data base. That sentence, I realize, tends
to suggest what I do not believe will be the case, namely that we must be either ex-
perimenetal or corpus phoneticians. Work on vowel devoicing shows how the corpus
and experimental approaches intertwine, and what they have to offer each other; it also
shows the insights gained from cross-linguistic study of phenomena. We might hope
that the researcher using corpora and the one using experimental data, and the one who
studies phenomena in English and and the one who studies phenomena in German will
not be two different people; rather, cross-linguistic studies that use both approaches
will be the norm, and we can look for rich rewards from the complementarity of the approaches.

References


