Acoustic analysis of German vowels in the *Kiel Corpus of Read Speech*

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1 Introduction

There have been a number of acoustic surveys of the vowels of Standard German. These surveys vary with respect to the number of speakers investigated, speaker selection, the quantity and type of material elicited and the vowels surveyed. Jørgensen (1969) uses formant measurements from six male speakers producing word list material. Iivonen (1970) analyses words embedded in carrier phrases as well as in isolation produced by five female and four male subjects. Rausch (1972) analyses four male speakers (one phonetician and three elocutionists) reading a lengthy passage of scientific German. Iivonen (1986) studies one male speaker uttering test words embedded in a carrier phrase. Ramers (1988) analyses four male speakers each reading 63 disyllabic words and 20 sentences.

The studies of Standard German are based mainly on data taken from male subjects[1] and the selection of vowels surveyed is restricted, with little or no coverage being given to diphthongs, /ə/ and the monophthongal exponent of /ər/.

This study represents a first spectral survey of the vowel systems of 22 speakers (11 female, 11 male) from part of the PhonDat I corpus collected and labelled in Kiel (Kohler 1992) and is to date the largest survey of its kind on German. All vowels are covered including the diphthongs, /ə/ and the monophthongal correlate of /ər/.

In addition to providing a summary of the absolute values for the female and male speakers of the corpus we also attempt our own normalization of the vowel systems in order to be able to compare the intergender systemic relationships. As we will show, the results of both our own normalization as well as that described in Nearey (1978)

[1] A recent study (Heid et al. 1995) analyses 16 speakers each reading 64 sentences. However we feel this cannot be treated as a serious study because, among other things, it throws together F0 and formant Hertz values of male and female speakers.

produce very similar systems for female and male speakers, a result which we argue is most likely due to the large sample we are investigating.

2 Problems of measuring vowel systems

The most common way of examining the spectral characteristics of vowel systems is in terms of the first and second formant frequencies. Although it is has been claimed that this measure alone may be insufficient (Fant 1960; Maurer et al. 1992) to characterize vocalic quality and contrast, there is no doubt that measures of F1 and F2, given an appropriate graphical representation, allow us to talk about acoustic vowel systems in terms similar to those used in the auditory-proprioceptive (Catford 1977) domain of impressionistic phonetics.

However, in order to arrive at the acoustic characterization of a vowel system we have to decide on the data we examine, the measurements we make and the way we categorize those measurements. In this section we will examine each of these factors in turn.

2.1 Speakers and material

Any study, such as ours, which is conducting an investigation of a number of speakers should attempt to examine speakers producing the same material. This is not always possible. If spontaneous data are the object of investigation then only a limited comparability across speakers can be obtained even if elicitation has been carried out in a controlled fashion (Anderson et al. 1991; Kohler et al. 1995). However, if speakers are required to read words or sentences, one cannot ensure uniform stress and intonation patterns. Neither can one be sure that speakers will respond equally to the recording environment or the reading task being demanded of them. Speakers who are accustomed to the otherwise unusual activity of reading aloud in front of a microphone are likely to behave differently from those who are unaccustomed to the situation.

One idea which is misguided is that particular types of speakers, e.g. elocutionists or phoneticians, will provide the best data for the language under examination. A word deemed to be clearly enunciated will presumably contain one or more clearly enunciated vowels, but their phonetic shape will not therefore better represent the language than any other vowels. This notion of getting at the best is behind the choice of speakers (three elocutionists and one phonetician) found in Rausch (1972).

2.2 Segmentation and measurement

Acoustically characterizing vowel systems requires the identification, delimitation and measurement of appropriate signal portions. In general the portions to be measured will be vocalic, i.e. strictures of open approximation. There is much discussion about where to delimit the most appropriate portion (Fischer-Jørgensen 1954; Fant 1960; Peterson and Lehiste 1960; Klatt 1976; Raphael et al. 1980; Hertz 1991). The decision to include or omit stop releases, periods of aspiration or transitions into or away from consonantal strictures all depends on the particular investigation. Such decisions are critical in durational studies (e.g. Peterson and Lehiste 1960; Klatt 1976) as the inclusion of e.g. transitional periods will shape to a great extent the durational model proposed. For measurements in the spectral domain decisions on delimitation are less critical. Measurements taken at the centre of a vocalic portion will necessarily be affected by the establishment of the edges, but as long as delimitation is carried out in a relatively systematic fashion, resulting measurements will allow both intra- and interspeaker comparability.

2.3 Phonetic and phonological categorization of measurements

Measuring the phonetic correlates of phonological systems of languages is a problematic enterprise. Measuring the phonetic correlates of vowel systems is no exception, although at first sight it may seem to be simple.

Measurements made on the basis of an acoustic or any other instrumental record require categorization. The categories can be impressionistic phonetic, e.g. we can assign measurements to the category open vowel, or open back rounded vowel. The categories can be acoustic phonetic, in terms of different spectral characteristics, such as the height of F1 or the relationship of F1 to F2. One can also categorize measurements in terms of a linguistic system. Here, measurements are distributed among phonological units, e.g. /aː/. If we want to get at the phonetic correlates of a linguistic system, which is what we are doing when looking at the vowel system of a language, then the categorization must be carried out in linguistic terms. We consider the type of approach advocated by Iivonen merely sidesteps the issue:

> The sound symbols used represent normative recurrent German vowel types without any claim to strong phonological status. (Iivonen 1986: 125)

We can illustrate the problems of a purely phonetic categorization as opposed to a phonological categorization by examining possible pronunciations of the German words *solche* and *Seuche*. In the first syllable of both these words we can find diphthongs of similar quality. However, these diphthongs have different phonological origins. In *Seuche* the diphthong is a correlate of the phonological diphthong /ɔʏ/, in *solche* it is a correlate of the vowel-consonant cluster /ɔl/. We can see that a purely phonetic categorization is obliged to lump together the vocalic portions from both syllables. It is unlikely that such a purely phonetic approach could have anything very interesting to say about the phonetic correlates of the phonology of German.

It is important to make this clear distinction between the two different types of categorization and in particular we must recognize the implications of adopting a linguistic categorization of our instrumental measurements. What we measure and the categories

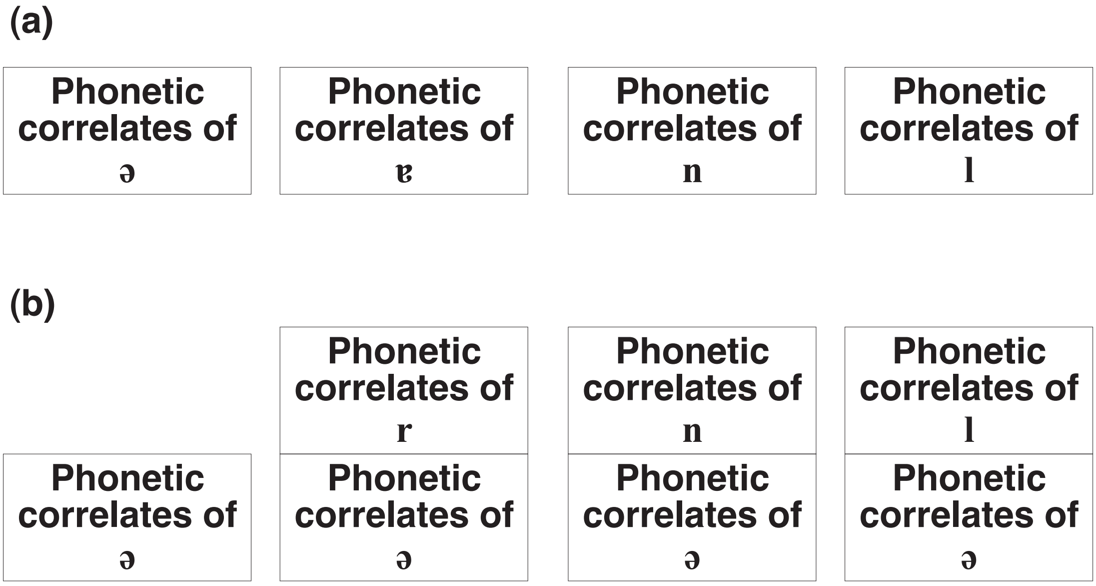


Figure 1: Different phonological approaches to the final syllables in *bitte*, *bitter*, *bitten* and *Beutel*.

we assign our measurements to, will all depend on the set of linguistic abstractions we are working with together with our idea of the way these linguistic abstractions are related to the phonic substance.

We can exemplify this by considering the phonetics and possible phonological treatments of weak syllables in German. The final syllables in *bitte* [bɪtə], *bitter* [bɪtɐ], *bitten* [bɪtn̩], and *Beutel* [bɔʏtl̩] are examples of such weak syllables. In an investigation of the German vowel system our phonological analysis will determine what we analyse and how we categorize the measurements we make. One analysis (see Figure 1a) might treat the phonetics as correlates of four different phonological units: /ə/ /ɐ/ /n/ and /l/. If we adopt this phonological analysis then only the final syllables of *bitte* and *bitter* would be analysed and the measurement in each case would be assigned to a different phonological category, /ə/ in one case, /ɐ/ in the other. In another analysis (see Figure 1b) all of the weak syllables might contain the phonological unit **ə**. The different phonetic shapes of the syllable would be treated in terms of differences in the temporal organization of the phonetic correlates of the phonological units involved. In this case the phonological unit we have also symbolized **ə** would have a different set of phonetic correlates from /ə/ in Figure 1a.

We have illustrated the analytical differences using weak syllables in German, but such differences pervade the whole of any vowel system. If we decide to treat the weak syllable /ər/ as phonologically and phonetically unitary then it is hard to justify not doing so for all other cases of vowel+r which we can find in words such as *wird*, *kurz*, *fort*, *hart*, etc. However, this unitary treatment of vowel+r is in itself problematic since it raises the question as to why one should not treat all vowel-consonant combinations in the same unitary fashion. It is relatively easy to see why this is not done, it is less easy to find any justification. The reasoning presumably goes something like this. The vocalic portion in the final syllable of *unser* [ʊnzɐ] may be phonologically complex, but it is phonetically a monophthong. Any categorization of measurements can more conveniently be assigned to a phonological simplex. In words such as *Bach* [b̥ɑ̟χ] and *Stadt* [ʃta̠t], the phonological complexes /ax/ of *Bach* and /at/ of *Stadt* can be related simply to the relevant vocalic portions and consonantal strictures of an impressionistic or acoustic record. Phonetic correlates of /a/ and /x/ or /a/ and /t/ do cooccur. The degree to which this happens may be less than it is for the correlates of /ə/ and /r/ in the final syllable of *unser*, but we do not consider the difference to be one of type, only degree.

3 Data

3.1 Corpus: recording and contents

The data which we have analysed in this study were collected as part of the PhonDat90 data base recordings (Thon and Dommelen 1992). All recordings were made in a sound-treated room using a Neumann U87 microphone, a Hardy M-1 microphone preamplifier and a Sony PCM-2500 DAT recorder. They were then transferred to a computer and digitized at 16 kHz with 16 bit amplitude resolution.

We have chosen a subset of the material collected and labelled at the IPDS Kiel (IPDS 1994) in which two sets of 100 short sentences were read. Each set of sentences was read by 12 speakers. Two speakers read both sets, giving a total of 22 different speakers. The speakers are evenly divided with respect to age and sex.

The two sets of sentences were taken from Sotschek (1976a, 1976b). Both sets contain an average of five words per sentence and provide a representative coverage of the German phonemic system as well as many of the possible biphonematic combinations. There are considerable differences in the stylistic and grammatical make-up of the two sets of sentences which we will discuss in more detail below. Orthographic and phonemic representations of the two sets, which we will henceforth refer to as Marburg and Berlin sentences, can be found in the Appendix.

We will continue to use the speaker index employed on the CD-ROM, which begins with the letter k followed by a number between 01 and 80. Uneven numbers indicate male speakers, even numbers females. Numbers 01-30 represent speakers under the age of 30, 61-80 represent speakers over the age of 30. Finally, two letters identify the sentence set: mr for Marburg, be for Berlin. The speaker-corpus k03be therefore identifies the set of Berlin sentences read by a male speaker under 30 years of age.

3.2 Segmentation and labelling of the corpus

Before launching into the analysis of a data base one must be aware of the way in which the speech signals have been segmented and labelled. The way a data base has been constructed imposes limits on what one can analyse and has consequences for the results of any analysis. The data base we are using is phonetically linear and phonologically monosystemic. The acoustic signals are segmented temporally and aligned with mostly phonemic labels. When we talk of vowel then we are talking of a vowel in a monosystemic phonemic sense. As we have said above (section 2.2) decisions about where to place segment boundaries have consequences for the actual numbers which enter the statistical analysis.

In the rest of this section we give a brief outline of the way in which the corpus we are using has been annotated. For more detailed information on the labelling system and its use the reader is referred to Kohler (1994) and Kohler et al. (1995).

The segmental labelling of the *Kiel Corpus* involves the manual alignment of elements of a canonical phonological transcription of an utterance with the phonetic correlates of the phonological elements, together with a restricted set of modifications (Kohler et al. 1995). Segmentation and labelling is linear and exhaustive. Labels are aligned with the speech signal in sequence. A label is placed at the beginning of the portion of signal containing the chief phonetic correlates of the phonological unit represented by the label. At the same time the placement of one label temporally delimits the previous label.

The canonical transcription system is based on a phonemic system of German. The system caters for what might be termed a maximal Standard German (Kohler et al. 1995). It comprises 22 consonantal and 24 vowel units. The 24 vowels include 4 systemically marginal nasal vowels used primarily in the transcription of French loans, e.g. *Parfum*, *Restaurant*, *Teint*, *Saison*.

The use of the labelling system we have described helps to guarantee a relatively consistent and systematic annotation of large corpora even though a number of different segmenters are involved. As we can see, the strong phonological motivation behind the label inventory together with the phonetic alignment with the signal and restricted modifications make the labelling level employed most akin to Barry and Fourcin's (1992: 10) "broad phonetic".

The chief phonetic correlates of a vowel, i.e. that portion of a signal to be annotated with a vowel label are, in unproblematic cases, a voiced stricture of open approximation flanked by periods of consonantal stricture. The first diphthong of *dreißigsten* (at A) and the vowel of *paßt* (at C) in Figure 2 illustrate such cases. Included in the vowel are also any transitions away from or into adjacent consonantal strictures. Plosive burst and aspiration phases are segmented and labelled separately as well as periods of perseverative voicing into stop closures, which are assigned to the relevant consonantal label.

The vowel label is also retained in certain cases where the correlates of the vowel are no longer vocalic. So, for instance, short, non-open vowels in unaccented sylla-

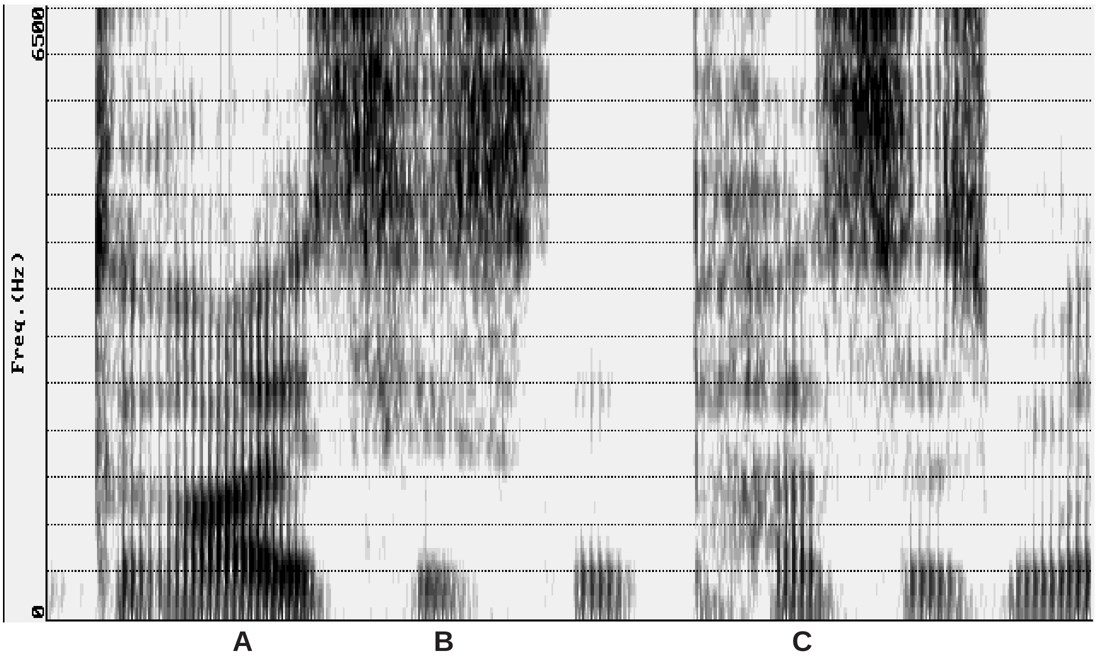


Figure 2: Sonagram of *dreißigsten paßt es* showing vocalic and consonantal correlates of phonological vowels.

bles, when flanked by fricatives (e.g. [s],[z],[ç]), are often realized as short periods of voiced or voiceless friction themselves, an example of which can be seen in the second syllable of *dreißigsten* (at B) in Figure 2. Again, we can see that the decision to treat phonetically non-vocalic utterance portions as correlates of phonological vowels will have implications for the shape of final analysis.

3.3 Vowels surveyed

Of the 24 vowels mentioned in the previous section we will only be dealing with 19. As none of the four nasal vowels occurs in the corpus under investigation they will receive no further attention. Furthermore, the half-open vowel /ɛː/ is also omitted, for although it was catered for in the canonical transcription of words such as *Käse*, most speakers produced such items with the closer vowel /eː/ which was labelled as such. /ɛː/ is also attributed dubious status in Standard German, often being treated as a product of the orthography (Kohler 1995: 172). Indeed, Ramers (1988) even required his subjects to read sentences alongside the words in isolation as a control for the realization of /ɛː/. The nineteen vowel units which we shall be examining are listed with examples in Table 1.

Many varieties of German including the standard also have a range of vocalic portions which are usually treated as a phonological complex of vowel+r, e.g. *wird*, *Fahrt*, *gern*, *Leser* (e.g. Vennemann 1982; Kohler 1995). Phonetically, these vocalic portions

Table 1: Vowels investigated with examples.

Vowel	**Example**		**Vowel**	**Example**	
iː	riːt	*riet*	ɪ	rɪt	*ritt*
yː	hˈyːtə	*Hüte*	ʏ	hˈʏtə	*Hütte*
eː	beːt	*Beet*	ɛ	bɛt	*Bett*
øː	hˈøːlə	*Höhle*	œ	hˈœlə	*Hölle*
aː	kaːn	*Kahn*	a	kam	*Kamm*
oː	boːk	*bog*	ɔ	bɔk	*Bock*
uː	muːs	*Mus*	ʊ	ʃlʊs	*Schluß*
aɪ	tsvaɪ	*zwei*			
aʊ	baʊx	*Bauch*			
ɔʏ	nɔʏn	*neun*			
ə	lˈeːzən	*lesen*			
ɐ	lˈeːzɐ	*Leser*			

can be monophthongal or diphthongal. One way of representing these vowels, which we also adopt in the transcriptions in the Appendix, is to treat them as a type of diphthong with /ɐ/ as the second element, e.g. *wird* /vɪɐt/, *Fahrt* /faːɐt/. We also follow the usual practice of representing the weak r-syllable, /ər/, as /ɐ/, e.g. *Leser* /leːzɐ/. This reflects the exclusively monophthongal character of the vocalic portion found in such syllables and is a symbolization that ensures a certain phonological uniformity as well as providing a general idea of the phonetic realization.

Following our discussion in section 2.3 we will be treating such r-vowels, except for /ɐ/, as correlates of the relevant phonological monophthong in a consonantal environment. This is of course a controversial decision to take since the phonetic correlates of postvocalic-r often characterize the same stretch as the correlates of the vowel itself. However, as we have said we do not consider this to be any different from the phonetic correlates of any other postvocalic consonant occurring together with the phonetic correlates of a vowel.

When dealing with categorization of vocalic portions which have been labelled as vowel replacements we have proceeded as follows. If the replaced vowel was anything other than one of the 'real' diphthongs (/aɪ/, /aʊ/, /ɔʏ/) the vocalic portion was treated as a correlate of the replacing vowel. If a diphthong was replaced by anything other than /ə/ then the vocalic portion was treated as a correlate of the diphthong.

The frequency of occurrence of certain vowels varies quite considerably from speaker to speaker. This is particularly the case for vowels in weak syllables which vary in their realization, e.g. the final syllable in a word such as *spielen* can vary in the production of the same speaker between [lən] and [ln̩], changing the number of /ə/ occurrences. Figure 3 shows the frequency of occurrence of each vowel as a proportion of all vowels.

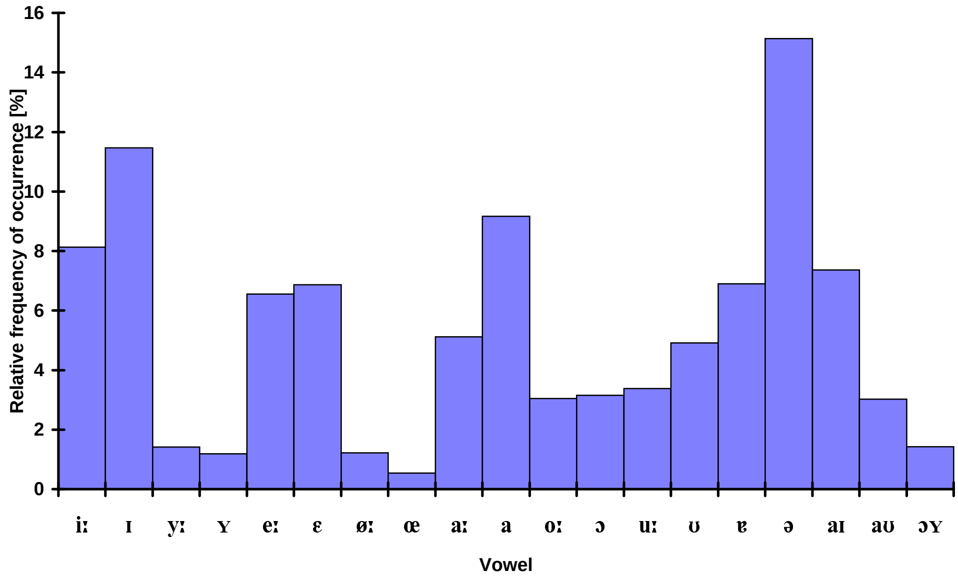


Figure 3: Relative frequency of occurrence of vowels in Berlin and Marburg sentences.

3.4 Analysis and measurement

Each utterance was subjected to an LPC formant analysis. A filter order of 14 was used for female voices and 16 for male voices. A record was calculated every 5 ms using a frame size of 20 ms. Each sentence was also subjected to an F0 analysis (Schäfer-Vincent 1982, 1983).

The frequency information in each analysis file was then sorted. Each resonance in a 5 ms record is assigned a number to the formant it is most likely to represent. The reference values for each formant are those of a 17.5 cm long open-ended tube of constant cross-sectional area (with resonant frequencies at 500, 1500, 2500, 3500 Hz for male and 10% higher for female voices). If two or more resonances have been assigned the same number, bandwidth information is used to decide which of the values to use. More details concerning analysis and sorting technique can be found in Scheffers and Simpson (1995).

The label file of each utterance is then used to assign a label to each 5 ms record of an analysis file.

Once each analysis record has been sorted and assigned a label, measurements of formants and bandwidths can be extracted automatically. Five methods for automatically extracting the formant values of vowels are given in Son and Pols (1990):

(a) formant: turning point, a minimum or maximum F1/F2 depending on vowel category

(b) average: average formant values over all complete periods assigned to vowel

(c) energy: values extracted at the strongest part of vowel

(d) stationary: place of least variance

(e) centre: middle of vowel

However, van Son and Pols conclude that there is no great difference in any of these methods. We have chosen to use the last of these methods. A single set of values is taken at the mid point of a monophthong. Establishing points to extract values which provide a suitable characterization of diphthongs is more problematic than for monophthongs. Our characterization will be in terms of measurement taken 20 ms from the onset of the vocalic portion and one measurement taken 20 ms from the offset. These two points give some indication of a diphthong's origin and its destination. Regardless of obvious deficiencies there are in characterizing diphthongs in terms of any set of temporally fixed points, we consider the method of measurement to be adequate for making certain comparisons across individuals and groups of speakers.

The automatic method of formant value extraction is no more problematic than a manual method. Errors and inconsistencies will occur in either, although they will undoubtedly differ in kind. The sorts of errors which will occur in an automatic extraction will involve the assignment of a value to the wrong formant during sorting. Likewise, automatic extraction may fall upon a record in the middle of vowel which for whatever reason is unrepresentative of its surroundings. Both of these areas of error are less likely to occur in manual measurement. On the other hand, an automatic extraction will not be 'wooed' by a portion of spectrogram at which formant values may be easier to measure, although they do not occur at the prescribed point in time.

4 Results

As we are dealing with a data base which has been labelled in a monosystemic fashion, we will be talking about our results in essentially monosystemic terms. We shall continue to enclose phonological vowel categories in slashes to reflect this monosystemic approach. Statements such as "/oː/ is further back than /uː/" are to be treated as an abbreviated way of saying "the phonetic correlates of /oː/ are further back than those of /uː/".

4.1 Absolute values

We begin by summarizing the absolute values. Table 2 presents the median values and lower/upper quartiles for the first three formants for each vowel for female speakers (2a) and male speakers (2b).

Table 2: Medians and upper (uq) and lower (lq) quartiles of first three formants for (a) 12 female speaker-corpora and (b) 12 male speaker-corpora. Diphthong values are medians of measurements taken 20 ms from vowel onset (V_{beg}) and 20 ms before vowel offset (V_{end}).

(a)

Vowel	F1	lq	uq	F2	lq	uq	F3	lq	uq	n
iː	329	292	385	2316	2125	2496	2796	2644	3000	719
ɪ	391	350	442	2136	1905	2348	2867	2660	3026	1014
yː	342	312	401	1667	1485	1833	2585	2437	2691	125
ʏ	406	369	466	1612	1475	1735	2631	2518	2779	105
eː	431	382	495	2241	1949	2472	2871	2691	3055	579
ɛ	592	517	687	1944	1774	2100	2867	2679	2997	607
øː	434	391	482	1646	1551	1739	2573	2440	2708	108
œ	509	452	584	1767	1620	1870	2640	2488	2757	48
aː	779	665	880	1347	1236	1439	2785	2644	2941	452
a	751	651	838	1460	1346	1583	2841	2679	2983	810
oː	438	395	487	953	789	1102	2835	2673	2990	269
ɔ	573	509	660	1174	1055	1279	2825	2668	2965	279
uː	350	319	405	1048	885	1220	2760	2624	2877	299
ʊ	450	387	504	1184	1074	1302	2749	2570	2960	434
ɐ	590	494	685	1608	1430	1754	2829	2679	2968	610
ə	420	369	482	1746	1554	1948	2811	2649	2968	1338
aɪ$_{beg}$	721	645	804	1527	1350	1663	2849	2651	2982	651
aɪ$_{end}$	499	426	607	2006	1864	2194	2873	2676	3017	655
aʊ$_{beg}$	707	624	786	1198	1122	1313	2876	2669	3039	267
aʊ$_{end}$	456	397	557	1068	960	1204	2929	2713	3055	267
ɔʏ$_{beg}$	550	501	613	1210	1078	1305	2815	2612	2927	126
ɔʏ$_{end}$	430	387	500	1781	1611	1988	2681	2540	2835	126

(b)

Vowel	F1	lq	uq	F2	lq	uq	F3	lq	uq	n
iː	290	266	337	1986	1813	2106	2493	2328	2668	710
ɪ	343	303	380	1803	1640	1956	2483	2309	2632	1009
yː	310	278	349	1505	1362	1624	2205	2117	2321	126
ʏ	374	333	401	1431	1345	1529	2284	2131	2445	102
eː	372	328	436	1879	1700	2006	2486	2324	2614	580
ɛ	498	443	552	1639	1517	1755	2451	2299	2599	613
øː	375	333	414	1458	1383	1505	2220	2104	2319	107
œ	437	407	501	1504	1376	1598	2179	2121	2327	49
aː	639	570	700	1225	1166	1292	2477	2316	2613	452
a	608	529	674	1309	1224	1386	2466	2317	2618	831
oː	380	352	429	907	774	1009	2415	2269	2570	265
ɔ	506	455	550	1060	992	1127	2415	2295	2546	283
uː	309	283	343	961	835	1145	2366	2247	2520	291
ʊ	382	332	439	1058	966	1165	2363	2225	2522	435
ɐ	503	440	561	1372	1253	1463	2430	2288	2570	610
ə	370	321	424	1521	1391	1660	2368	2219	2547	1286
aɪ$_{beg}$	594	535	653	1332	1224	1424	2427	2284	2569	639
aɪ$_{end}$	459	407	505	1636	1529	1773	2461	2318	2617	636
aʊ$_{beg}$	566	517	614	1059	1005	1170	2479	2333	2619	266
aʊ$_{end}$	438	379	485	967	900	1058	2487	2340	2632	266
ɔʏ$_{beg}$	477	443	535	1046	982	1115	2389	2250	2556	125
ɔʏ$_{end}$	398	367	440	1440	1297	1638	2311	2168	2425	125

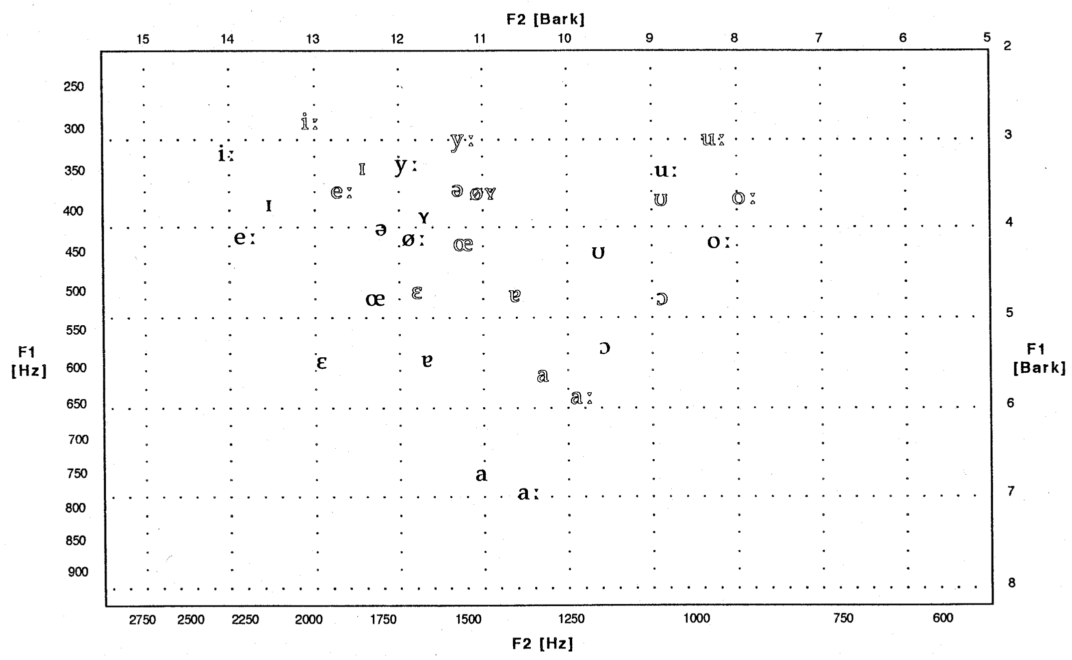


Figure 4: Formant plot of female (solid) and male (outline) median values.

Monophthongs

The results presented in Table 2 together with plots of F1 and F2 in Figure 4 are in general agreement with the findings of previous studies (Jørgensen 1969; Rausch 1972; Iivonen 1986; Ramers 1988). The short vowel set /ɪ/, /ʏ/, /ɛ/, /œ/, /a/, /ɔ/ and /ʊ/ are all more central than their long congeners. The F1 values of the high short vowels /ɪ/, /ʏ/ and /ʊ/ are at approximately the same height as the F1 values of long mid vowels /eː/, /øː/ and /oː/ and the slope of F1 values from /ɪ/ through /ʏ/ to /ʊ/ parallels that of the F1 slope from /iː/ through /yː/ to /uː/. Only the open vowel pair /a/ and /aː/ are very similar in quality, /a/ being slightly further forward and closer for both male and female speakers. This too matches up with previous findings (Sendlmeier 1982; Ramers 1988; Kohler 1995) which have shown that the chief difference in the phonetic correlates of /a/ and /aː/ is one of duration and not quality, as is the case in other short-long pairs, which was convincingly shown in Sendlmeier 1982's perceptual experiments.

The high F1 of non-open short vowels has led to at least two, in our opinion, erroneous phonological treatments (Lass 1984; Ramers 1988) of the German short quantity vowels in which the similar phonetic height of /ɪ/ and /eː/ or /ʊ/ and /oː/ is translated directly into the relational categories of the same phonological height.

The male and female values for /ə/ support recent findings reported in Barry (1995) on a smaller corpus, which indicate on average a half-close vowel having an F1 somewhere in the region of /eː/. Measurements of /ə/ from the spontaneous speech of two male speakers also produced F1 values well below 500 Hz (Pätzold and Simpson 1995). The necessity of maintaining a functional contrast with /ɐ/ would seem to be one possible reason for this relatively close quality. Barry states that the low F1 value he finds for /ə/ stand in contrast to other German studies, which generally characterize /ə/ as a more open vowel. However, it is possible to draw other conclusions from the literature. Mid or open of mid characterizations of /ə/ are generally based on essentially impressionistic observations (Delattre 1965; Ulbrich 1972; Meinhold 1989; Kohler 1995). In only one study (Iivonen 1970) based on data from one female speaker reading words in isolation do we find values for F1 of /ə/ which are even more open than /ɛː/. Sovijärvi (1965) cited in Iivonen (1970) and Meyer-Eppler (1959) both provide values for male /ə/ that are below 500 Hz. To summarize, the picture of a mid or mid-open /ə/ is essentially impressionistic, whereas acoustic measurements of /ə/ are scant and can just as easily be seen to provide evidence of an acoustic vowel closer than mid.

Another striking difference from previous German studies (Jørgensen 1969; Rausch 1972)[2] is the position of /oː/ in relation to /uː/. As we would have expected /oː/ is more open than /uː/, but it is also acoustically further back for both female and male speakers. In only three (k05be, k69mr, k70mr) of the 24 speaker-corpora does /oː/ have a higher F2 than /uː/. Only in one study[3] (Ramers 1988) have we found formant values for one speaker which parallel our own findings. The acoustically backer quality of /oː/ also matches up with auditory and visual impressions, which are of a vowel which in many environments is close of half-close, has tight lip rounding and is further back than /uː/.

There are at least three possible reasons for the discrepancy between our findings and those of earlier German studies. The first obvious reason is that /oː/ for the speakers in our study is acoustically further back than those of speakers analysed in other studies. The second reason for the difference could reside in the consonantal contexts of /uː/ and /oː/ in the lexical items in both sets of sentences, favouring back realizations of /oː/ and front realizations of /uː/. Of the 23 /oː/ occurrences in the Marburg sentences 7 occur before back dorsal fricatives (4 in *Doris* and 3 in *hoch*) whereas in 25 cases of /uː/ only 2 occur in the similar context of a back dorsal fricative (*Besuch* and *besucht*). However, in the Berlin sentences median values for both female and male speakers also exhibit lower F2 values for /oː/ than for /uː/, although similar contextual bias is not apparent. Indeed the balance of consonantal contexts favouring back realizations of /uː/ and /oː/ in the Berlin sentences is the opposite of that found in the Marburg sentences. There are 3 cases of back dorsal fricatives following /uː/ in the Berlin sentences and no analogous postvocalic contexts for /oː/. The third possible reason for differences may reside purely in different ways of establishing formant values. The difficulty of separating and measuring the formants of back rounded vowels from paper spectrograms with any degree of reliability is well-known and the studies cited

[2]The figures presented in Kohler (1995) are taken from Rausch (1972).

[3]A similar relationship can be found in one of the Viennese German speakers investigated in Iivonen (1987)

above are all based on such measurements. It does not seem unreasonable to assume that an assumption that F2 of /oː/ should be higher than that for /uː/ may indeed have led to a certain bias in measurement.

Diphthongs

In this section we will be dealing with the ‘real’ diphthongs /aɪ/, /aʊ/ and /ɔʏ/. As we said above the phonetic diphthongs which are correlates of phonological monophthongs followed by /r/ have been measured and categorized alongside their appropriate monophthong.

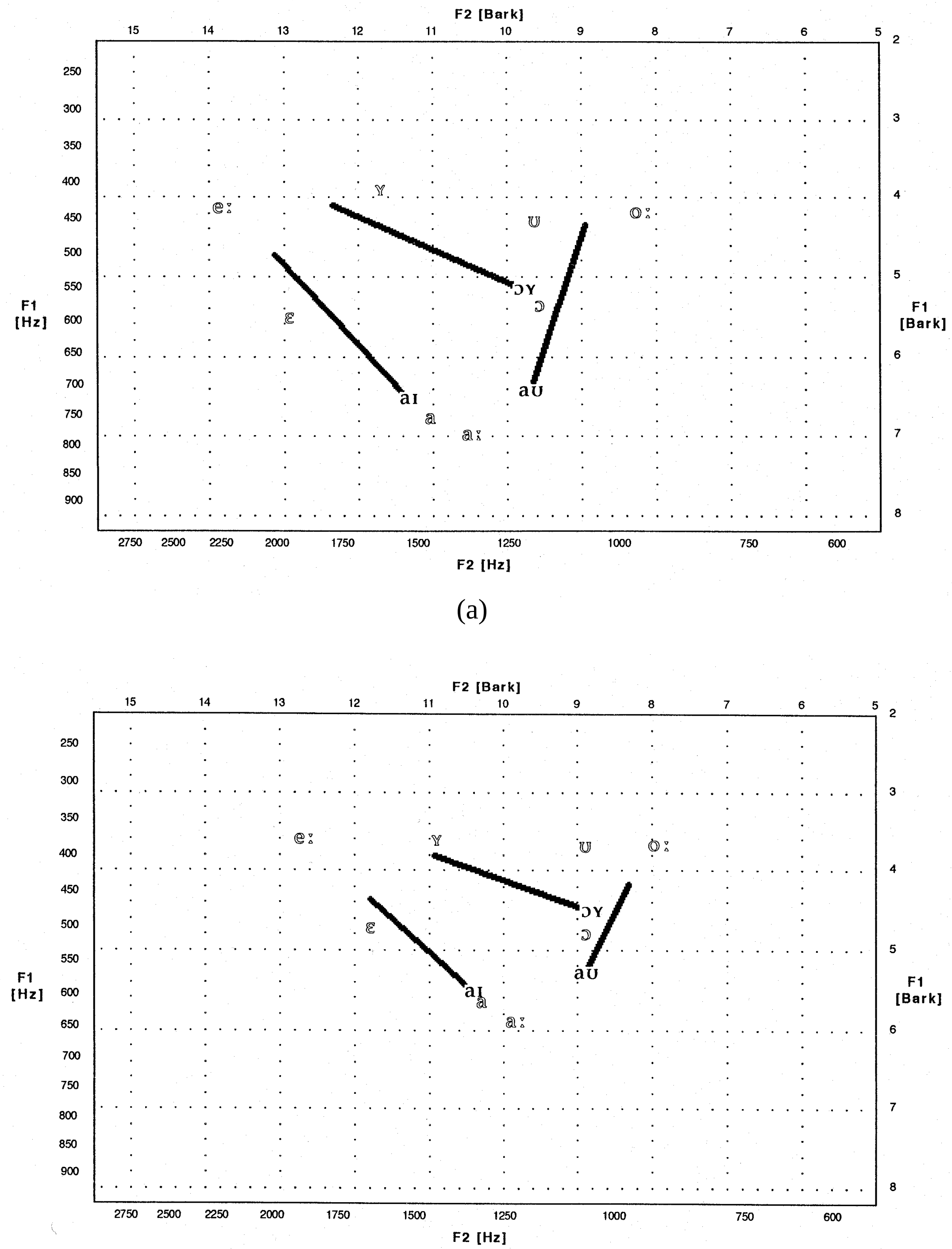
Plots of female and male diphthongs are shown in Figure 5. The position of the diphthong symbolization represents the median of values taken 20 ms after the vowel onset, the end of the line the median of values taken 20 ms prior to the vowel offset. A selection of neighbouring monophthongal vowels has also been plotted to show a diphthong’s location in relation to the rest of the system.

Although, as we have said (section 3.4), we are not satisfied with the characterization of diphthongs we have chosen, we can see interesting similarities and differences in the male and female speakers. For both sets of speakers the starting point for each of the diphthongs is in approximately the same location. For /aɪ/ the beginning is front and close of /a/, for /aʊ/ the beginning is at approximately the same height as /aɪ/ but begins further back, open of /ɔ/. The starting point for /ɔʏ/ is at approximately the same place as /ɔ/. One of the most striking differences between the female and male diphthongs is in their end position. Male /aɪ/ and /aʊ/ end more open than their female counterparts. Female /aɪ/ ends midway between the location of /eː/ and /ɛ/, whereas for male speakers /aɪ/ ends close to the location of /ɛ/. Likewise, while female /aʊ/ ends at the height of /oː/ and /ʊ/, the male again ends a good deal more open. This pattern continues with /ɔʏ/, ending front of /ʏ/ for female speakers and at approximately the same location as /ʏ/ for male speakers.

Intercorpus comparison

We would expect different measured vowel systems from the same speaker reading different sets of material. We can get some idea of these differences by examining the female and male speakers who produced both the Berlin and Marburg sentences.

Figure 6 shows formant plots for the four speaker-corpora k62be, k62mr, k61be and k61mr. The most striking difference that we can see is the acoustic space covered by k62mr in comparison to k62be. The larger space produced for the Marburg sentences is brought about by vowels which are on average more peripheral than their counterparts in the Berlin corpus. This same tendency can be seen for k61, though to a lesser extent. Of course, the measured vowel system of any speaker will differ from one set of material to another and will depend on immediate contextual factors such as neighbouring consonants. But in this case we suggest that the differences may be related both to the lexical content as well as the stylistic level of the different sentence



(a)

(b)

Figure 5: Formant plot of (a) female and (b) male diphthongs. Position of diphthong symbolization marks origin, end of solid line destination. Outline vowels show positions of neighbouring monophthongs.

sets. In both sets of sentences the average number of words per sentence is approximately the same (Berlin: 5.24, Marburg: 5), however the lexical content and stylistic level of the Marburg sentences is very different from the Berlin set. The Marburg sentences have a lower proportion of function words (28%) than the Berlin sentences (42%). The stylistic form of several Marburg sentences is also, contrary to Kohler's (1992) claim, far from colloquial, exhibiting a combination of uncommon syntax and slightly archaic lexical content, e.g. *Lärmt nicht, Jung's, Vater schreibt!*. Any or all of these factors may be giving rise to both speakers adopting different reading styles, the phonetic correlates of which are in part to be found in more or less peripheral vowel qualities.

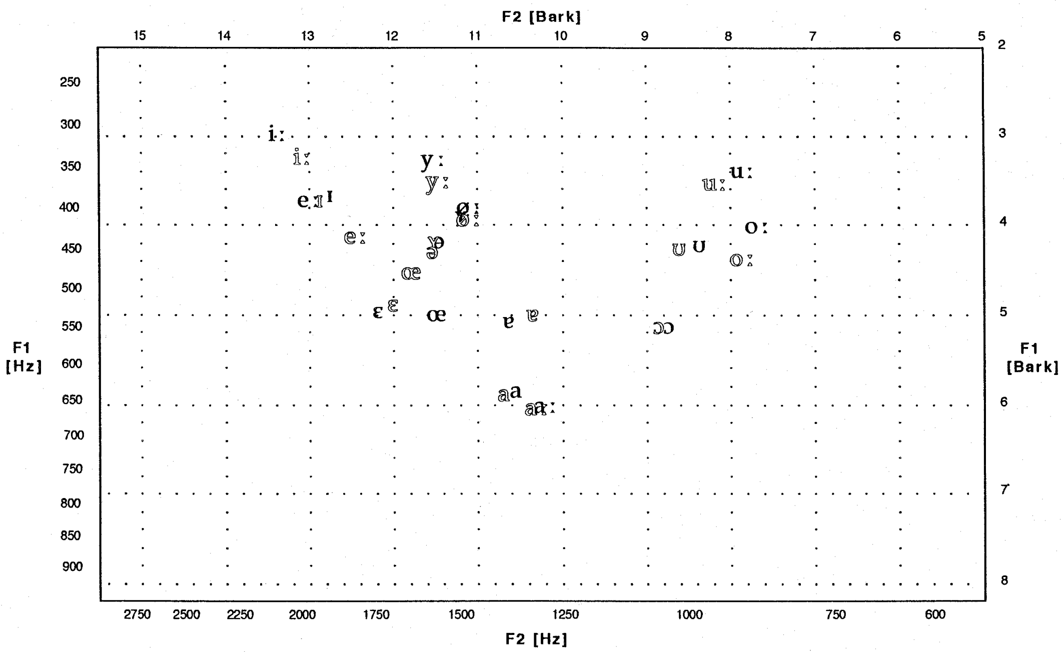
Acoustic space size and shape

In this section we would like to give some idea of the considerable interspeaker variation in the dimensions of the individual vowel systems. These differences manifest themselves both in the area of the acoustic space taken up by a vowel system as well as in its geometric shape. One simple, but effective, way of characterizing the acoustic size of a vowel system is to calculate the area of the polygon formed by lines drawn between the peripheral vowels /iː/, /eː/, aː/, /oː/ and /uː/ plotted on a Bark-scaled F1/F2 plane. We can take this as an indication, among other things, of the degree of dispersion of vowels within a particular system. Figure 7 plots male and female speakers as a function of their acoustic space size. As we can see, although there is certain overlap between the largest male and smallest female systems, the female speakers have on average larger spaces than male speakers. This finding is in agreement with other studies (Fant 1975; Diehl et al. 1996) which report a non-uniform relationship between the vowel categories of male and female subjects across languages, female speakers exhibiting greater acoustic distances between vowel categories than male speakers.

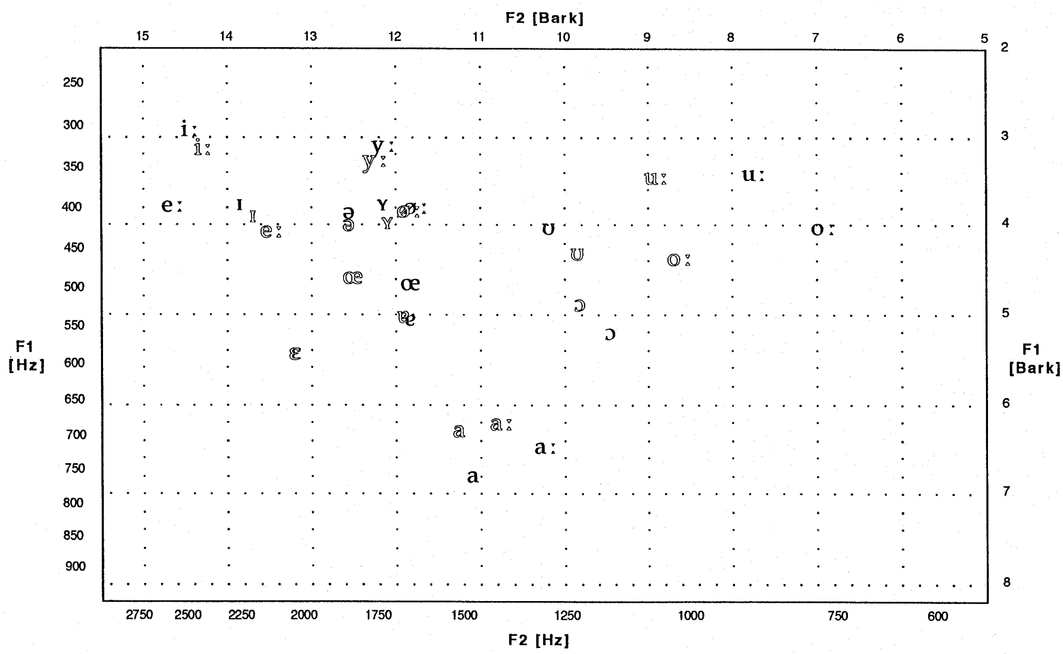
Besides the intergender differences we can also see in Figure 7 that there is also considerable intragender variation. These extremes are illustrated well if we compare the male and female extremes. Figure 8 shows the peripheral plots of the smallest (circle) and largest (square) female (solid) and male (dashed) systems.

The differences between the female and male extremes illustrate the ways in which vowel systems can differ. So, while the male extremes differ mainly in one dimension, i.e. F1, the difference between the largest and smallest female systems is distributed evenly along both the F1 and F2 dimensions, one system enclosing the other.

The largest female system, k68mr, can be treated in part at least, as a product of hypercorrect articulation which was noted by segmenters at the time this particular speaker-corpus was annotated. However, auditory inspection of both k63be and k01be does not give the impression that the speakers differ with respect to the way they are carrying out the reading activity.



(a)



(b)

Figure 6: Formant plots comparing individual speaker-corpora: (a) k61mr (solid) k61be (outline) and (b) k62mr (solid) k62be (outline).

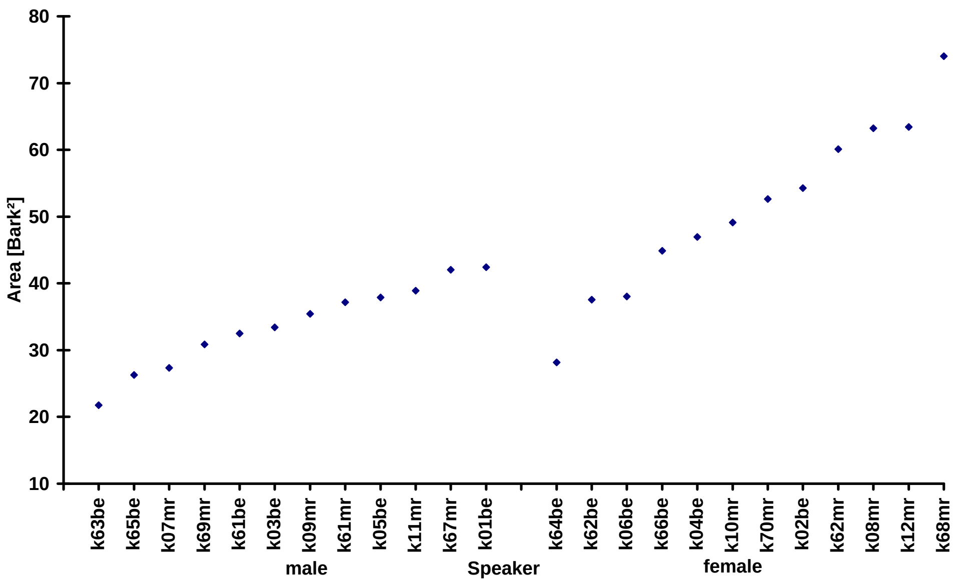


Figure 7: Vowel space areas for individual speaker-corpora in ascending order of size. Male spaces are on the left, female on the right.

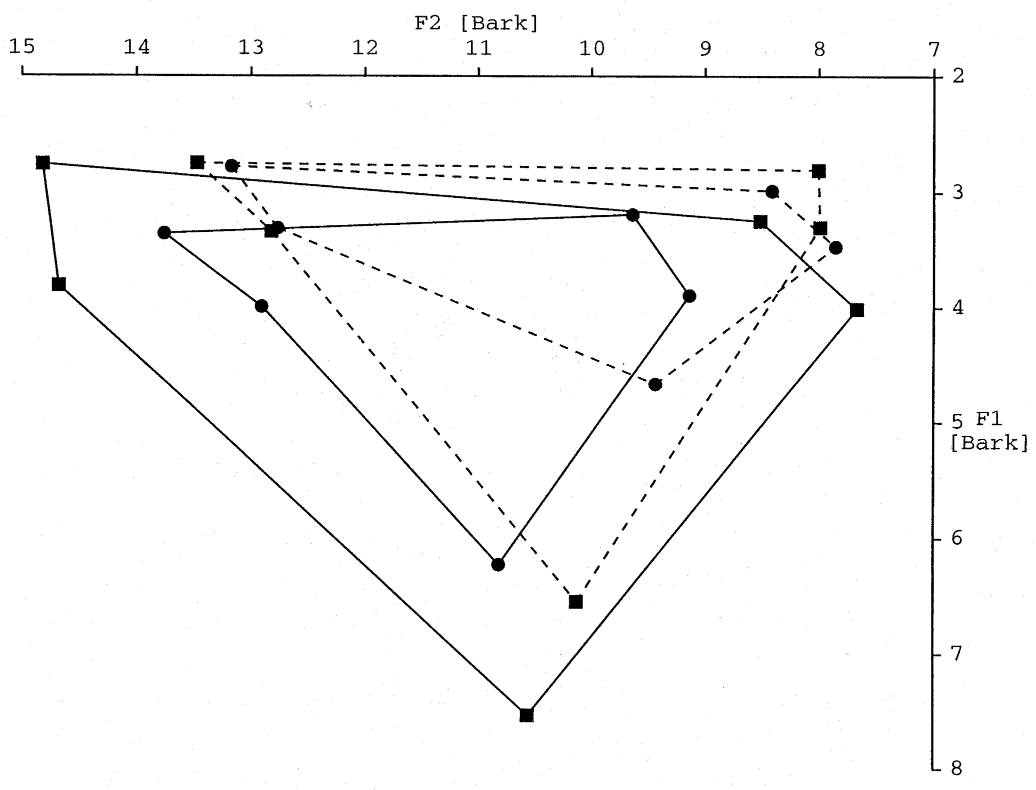


Figure 8: Schematic female (solid line) and male (dashed line) vowel space extremes. Smallest spaces are marked with circles, largest with squares.

4.2 Normalized values

In this section we present our own attempt at comparing the vowel systems of speakers in relative terms. Of course, we have been making relative statements when talking about the absolute values. However, statements about systemic relationships are hindered by speaker-specific aspects. Numerous normalization algorithms have been proposed which, among other things, attempt to filter out these speaker-specific aspects. A summary of some of these algorithms and an assessment of their degree of success is presented in Disner (1980). Normalization algorithms are of generally two types which we can call external and internal. External normalizations (Fant 1967; Fant 1975; Bladon et al. 1983; Henton 1995) involve the attempt to find one or more constants which map one absolute system onto another, whereas internal normalizations such as Nearey (1978) carry out a system-dependent, immanent normalization. We consider system-dependent normalization to be the most appropriate both from a descriptive as well as a perceptual point of view.

The normalization we propose relativizes a vowel system by creating a reference grid bounded by the maximum and minimum F1 and F2 medians for each system. In most cases this means that /iː/ provides the minimum F1 and maximum F2 values, /oː/ the minimum F2 and /aː/ the maximum F1 value. The coordinates of the individual vowels are then determined by calculating their position relative to the anchor points defined by these formant maxima and minima:

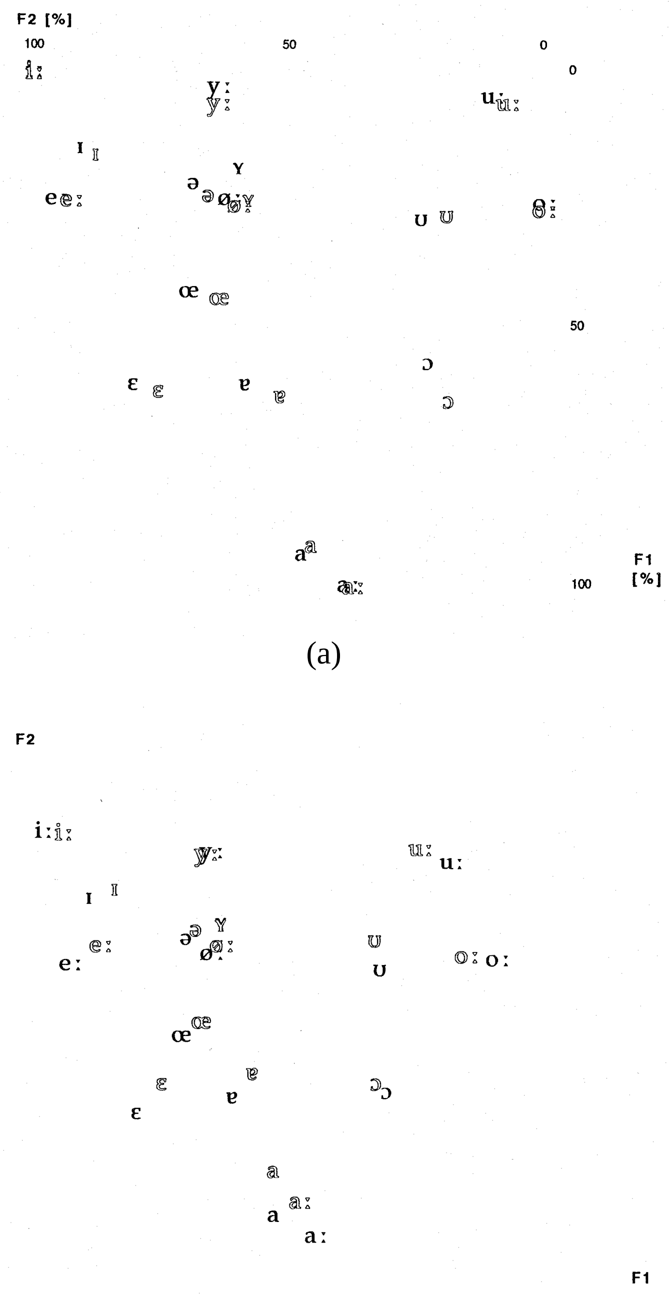
$$F_{ij_{rel}} = \frac{(\tilde{F}_{ij} - \tilde{F}_{i_{min}})}{(\tilde{F}_{i_{max}} - \tilde{F}_{i_{min}})}, \quad i = 1, 2 \; j \in \{\text{i,ɪ,yː,ʏ,eː,ɛ,øː,œ,aː,a,oː,ɔ,uː,ʊ,ə,ɐ}\}$$

The relative values have been calculated using Bark-transformed median formant frequencies of each vowel (Zwicker and Fastl 1990).

We can compare our relativization with the normalization proposed in Nearey (1978) which calculates the average of the log-transformed frequency of the first and second formant. The log-transformed formant frequencies of each vowel are then corrected with this system average.

Figure 9 shows a comparison of our relativization (9a) with Nearey's normalization (9b).

As we can see both our own and Nearey's normalizations show astonishing similarity in the relative systems of the averaged female (solid) and male (outline) speakers. This means that not only are the topological relationships among the various vowels the same, which is apparent when looking at absolute vowel plots, but also the magnitude of the intrasystemic distances for the female and male groups are also almost identical. We would argue that the similarity of the female and male relative systems has only come about as a result of the large sample we are working with. Indeed, the similarity across the male and female groups is not even paralleled when we calculate separate relative systems for the female and male speakers who produced both sets of sentences. The relative plots of k62mr and k62be shown in Figure 10 illustrate this



(a)

(b)

Figure 9: Normalized formant plots of female (solid) and male (outline) vowel systems: (a) relative plot of median Bark values; (b) Nearey normalization using log-transformed Hertz means.

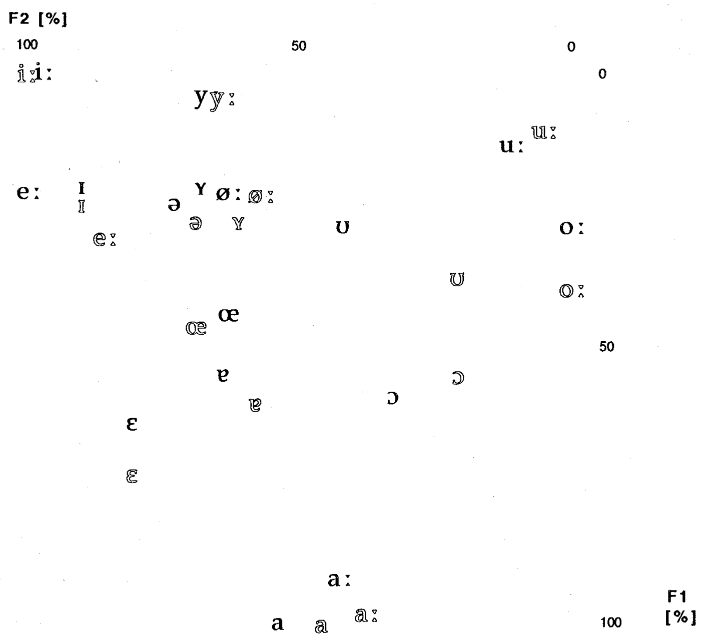


Figure 10: Relative formant plots of the individual speaker-corpora k62mr (solid) and k62be (outline).

well. There are differences in the relative positions of vowels such as /eː/ and /ʊ/ which are far greater than anything found in a comparison of the female and male systems.

What we have also done is to calculate separate relative systems for each individual speaker-corpus and an average over these relative systems. This stands in contrast to the calculation above which computed relative female and male systems on the basis of averages for each vowel for each group of speakers. Figure 11 shows the relative female (a) and male (b) systems computed from averaging over relative systems of individual speaker-corpora (outline) compared with the relative systems computed from averages of each vowel for each group (solid). Despite the different methods used to arrive at the different relative male and female systems, we can see scarcely any differences. This would seem to be further support for our claim that the intersystemic similarity has been arrived at in part as a result of the large sample we are working with, but it would also seem to indicate that the male and female samples are representative of the same population.

In comparison with the two internal normalizations we have shown it is worth considering the application of external normalizations, such as Fant (1975) and Henton (1995) to our data. As we would expect from Fant's own findings the mapping from the male to the female system is non-uniform, involving the calculation of a different factor for each formant for each vowel. This procedure might seem to be inevitable if the only similarity between two systems is of topological equivalence. Bladon et al. (1983) and

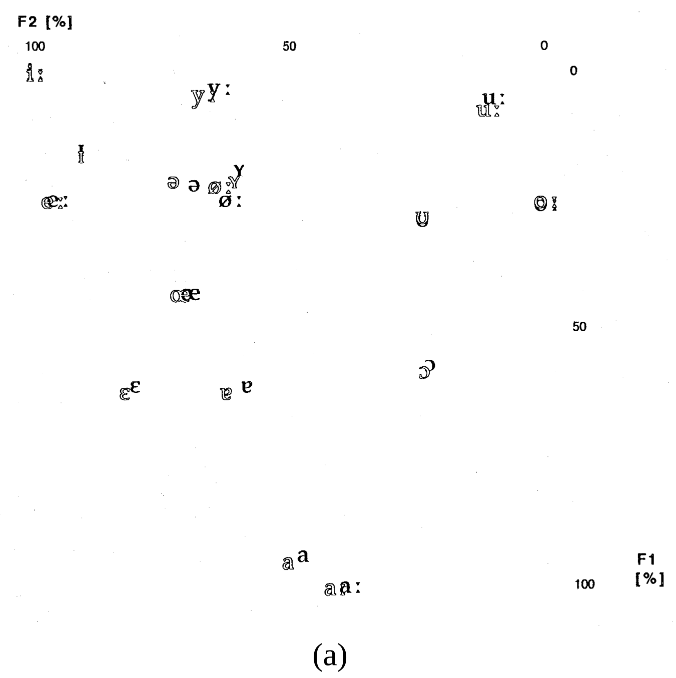


Figure 11: Relative formant plots for (a) female and (b) male calculated by averaging over individual relative systems (outline) and averaging over each vowel for each group (solid).

Henton (1995) propose a mapping of male onto female values by adding one Bark to the male values, which is then used to provide evidence for phonetic differences between male and female speakers if the data fails to exhibit such a mapping. A cursory glance at Figure 4 shows that a one Bark mapping inadequately characterizes the relationship between the absolute values. The female vowels are more greatly dispersed in real terms than their male congeners. It is not clear whether this non-linear relationship is due to sociolinguistic factors (Henton 1995) or differences in F0 (Diehl et al. 1996) or whether anatomical differences are indeed involved which present vocal tract models fail to take into account.

5 Discussion

The results of our survey reflect to a great extent the findings of earlier studies of German. However, the approach adopted to arrive at these results is very different. The data base is large (2400 sentences read by 22 speakers) in comparison with earlier studies and comprises exclusively read sentences. In contrast to Rausch (1972) and Jørgensen (1969) the majority of the speakers (except k61 and k62 who are both phoneticians) are phonetically naïve. The measurement of vowels was arrived at in a semi-automatic fashion, the manual work involving the initial labelling of the data base.

The most interesting finding to come out of this study is that the female and male groups represented by the respective speakers in the corpus exhibit no significant differences in terms of their relative vowel systems. What conclusions can we draw from this finding?

Perceptual experiments using synthetic stimuli, such as Ladefoged and Broadbent (1957), have shown that the same stimulus is perceived as different vowel categories depending on previously heard stimuli. These findings show that absolute values alone cannot be responsible for vowel perception. The relativization of the measurements we have made on real data, show that despite considerable absolute differences in formant values between male and female speakers, the relationships among vowels remain the same. We can only interpret the similarity in the relative systems as evidence that intrasystemic relationships play a significant rôle in vowel perception. In our opinion it is not only the topological relationships (‘more open than’, ‘further back than’), but also the location of the terms in the relative system that are drawn upon in perception. We do not consider the locations themselves to be necessary for the perception of a vowel category, but the location might well be used to arrive at a particular vowel quality within a given vowel category, e.g. a more or less peripheral variant of /eː/, which in turn might be an indicator of a different articulatory style.

We consider we have only arrived at this result on the basis of the large data base we have used. This in turn casts doubt on the validity of acoustic statements made about a variety of a language on the basis of smaller samples. As we saw in Figure 10 the relative systems of the same speaker (k62) producing different sets of sentences exhibited greater differences across the same category than the male group did from the female group. This is important when we consider the types of comparison we find in analyses such as Bladon et al. (1983) in which data collected from *one* female are compared with data averaged over five male speakers.

We suggest that the relationships we have observed represent the gender-independent systemic locations, which of course include the topological relations, for the vowels of Standard German[4]. This is a strong claim to make, but we are at pains to find alternative interpretations of our results. At the outset of such an analysis we are only in a position to make a priori judgements of the speakers' accents as being Standard German or not. However, the striking similarity of the female and male relative systems provides us with post hoc support for claiming that the speakers are representative of a particular variety of German, which we are calling Standard German for the want of a better descriptive label.

References

Anderson, A., M. Bader, E. Bard, E. Boyle, G. Doherty, S. Garrod, S. Isard, J. Kowtko, J. McAllister, J. Miller, C. Sotillo, H. Thompson, and R. Weinert (1991). The HCRC map task corpus. *Language and Speech 34*, 351–366.

Barry, W. J. (1995). Schwa vs. schwa + /r/ in German. *Phonetica 52*, 228–235.

Barry, W. J. and A. J. Fourcin (1992). Levels of labelling. *Computer Speech and Language 6*, 1–14.

Bladon, R., G. Henton, and J. Pickering (1983). Towards an auditory theory of speaker normalization. *Language and Communication 4*, 59–69.

Catford, J. (1977). *Fundamental Problems in Phonetics*. Edinburgh: Edinburgh University Press.

Delattre, P. (1965). *Comparing the phonetic features of English, German, Spanish and French*. Heidelberg: Julius Groos Verlag.

Diehl, R. L., B. Lindblom, K. A. Hoemeke, and R. P. Fahey (1996). On explaining certain male-female differences in the phonetic realization of vowel categories. *Journal of Phonetics 24*, 187–208.

Disner, S. F. (1980). Evaluation of vowel normalization procedures. *Journal of the Acoustical Society of America 67*, 253–261.

Fant, G. (1960). *Acoustic Theory of Speech Production*. The Hague: Mouton.

[4]Of course, these relationships are dimensionless. But they can just as easily be translated back into absolute values by establishing maxima and minima for the first two formants.

Fant, G. (1967). A note on vocal tract size factors and non-uniform F-pattern scalings. *STL-QPSR 4*, 22–30.

Fant, G. (1975). Non-uniform vowel normalization. *STL-QPSR 2–3*, 1–19.

Fischer-Jørgensen, E. (1954). Acoustic analysis of stop consonants. *Miscellanea Phonetica 2*, 42–59.

Heid, S., M.-B. Wesenick, and C. Draxler (1995). Phonetic analysis of vowel segments in the PhonDat data base of spoken German. In *Proc. XIIIth ICPhS*, Volume 4, Stockholm, pp. 416–419.

Henton, G. (1995). Cross-language variation in the vowels of female and male speakers. In *Proc. XIIIth ICPhS*, Volume 4, Stockholm, pp. 420–423.

Hertz, S. (1991). Streams, phones and transitions: toward a new phonological and phonetic model of formant timing. *Journal of Phonetics 19*, 91–109.

Iivonen, A. (1970). *Experimente zur Erklärung der spektralen Variation deutscher Phonemrealisationen. Commentationes Humanarum Litterarum*, Volume 45. Helsinki: Societas Scientiarum Fennica.

Iivonen, A. (1986). A set of German stressed monophthongs analyzed by RTA, FFT, and LPC. In R. Channon and L. Shockey (Eds.), *In Honour of Ilse Lehiste*. Dordrecht: Foris.

Iivonen, A. (1987). Monophthonge des gehobenen Wienerdeutsch. *Folia Linguistica 21*, 293–336.

IPDS (1994). *The Kiel Corpus of Read Speech*, Volume 1, CD-ROM#1. Kiel: Institut für Phonetik und digitale Sprachverarbeitung.

Jørgensen, H. (1969). Die gespannten und ungespannten Vokale in der norddeutschen Hochsprache mit einer spezifischen Untersuchung der Struktur ihrer Formantfrequenzen. *Phonetica 19*, 217–245.

Klatt, D. H. (1976). Linguistic uses of segmental duration in English: acoustic and perceptual evidence. *Journal of the Acoustical Society of America 59*, 1208–1221.

Kohler, K. J. (1992). Erstellen eines Textkorpus für eine phonetische Datenbank des Deutschen. In K. J. Kohler (Ed.), *Phonetisch-akustische Datenbasis des Hochdeutschen: Kieler Arbeiten zu den PHONDAT-Projekten 1989–1992*, AIPUK 26, pp. 11–39.

Kohler, K. J. (1994). *Lexika of the Kiel PHONDAT Corpus Vol. I & II.* AIPUK 27 & 28.

Kohler, K. J. (1995). *Einführung in die Phonetik des Deutschen* (2 ed.). Berlin: Erich Schmidt.

Kohler, K. J., M. Pätzold, and A. P. Simpson (1995). *From scenario to segment: the controlled elicitation, transcription, segmentation and labelling of spontaneous speech*. AIPUK 29.

Ladefoged, P. and D. Broadbent (1957). Information conveyed by vowels. *Journal of the Acoustical Society of America 39*, 65–88.

Lass, R. (1984). *Phonology. An Introduction to Basic Concepts*. Cambridge: Cambridge University Press.

Maurer, D., N. Cook, T. Landis, and C. D'Heureuse (1992). Are measured differences between the formants of men, women and children due to F_0 differences? *Journal of the International Phonetic Association 21*, 66–79.

Meinhold, G. (1989). Das problematische [ɐ]. In Slembek (Ed.), *Von Lauten und Leuten. Festschrift für Peter Martens zum 70. Geburtstag (Sprache und Sprechen 21*, pp. 119–125. Frankfurt am Main: Scriptor Verlag.

Meyer-Eppler, W. (1959). Zur Spektralstruktur der /r/-Allophone des Deutschen. *Akustica 9*, 246–250.

Nearey, T. M. (1978). *Phonetic feature systems for vowels*. Bloomington: Indiana University Linguistics Club.

Pätzold, M. and A. P. Simpson (1995). An acoustic analysis of hesitation particles in German. In *Proc. XIIIth ICPhS*, Volume 3, Stockholm, pp. 512–515.

Peterson, G. and I. Lehiste (1960). Duration of syllable nuclei in English. *Journal of the Acoustical Society of America 32*, 693–703.

Ramers, K. H. (1988). *Vokalquantität und -qualität im Deutschen*. Linguistische Arbeiten 213. Tübingen: Niemeyer.

Raphael, L., M. Dorman, and A. Liberman (1980). On defining the vowel duration that cues voicing in final position. *Language and Speech 23*, 297–307.

Rausch, A. (1972). Untersuchungen zur Vokalartikulation im Deutschen. In H. Kelz and A. Rausch (Eds.), *Beiträge zur Phonetik. IPK-Forschungsberichte*, Volume 30.

Schäfer-Vincent, K. (1982). Significant points: Pitch period detection as a problem of segmentation. *Phonetica 39*, 241–253.

Schäfer-Vincent, K. (1983). Pitch period detection and chaining: Method and evaluation. *Phonetica 40*, 177–202.

Scheffers, M. T. M. and A. P. Simpson (1995). LACS: Label assisted copy synthesis. In *Proc. XIIIth ICPhS*, Volume 2, Stockholm, pp. 346–349.

Sendlmeier, W. (1982). Der Einfluß von Qualität und Quantität auf die Perzeption betonter Vokale des Deutschen. *Phonetica 38*, 291–308.

Son, R. J. J. H. v. and L. C. W. Pols (1990). Formant frequencies of Dutch vowels in a text, read at normal and fast rate. *Journal of the Acoustical Society of America 88*(4), 1683–1693.

Sotschek, J. (1976a). Methoden zur Messung der Sprachgüte I: Verfahren zur Bestimmung der Satz- und Wortverständlichkeit. *Der Fernmeldeingenieur 30*(10), 1–31.

Sotschek, J. (1976b). Methoden zur Messung der Sprachgüte II: Verfahren zur Bestimmung der Satz- und Wortverständlichkeit. *Der Fernmeldeingenieur 30*(12), 1–33.

Sovijärvi, A. (1965). Der mokschamordvinische ə-Vokal im Lichte der Sonagramme. In *Publicationes instituti phonetici universitatis Helsingiensis*, Volume 20, Helsinki.

Thon, W. and W. v. Dommelen (1992). PHONDAT90: Rechnerverarbeitbare Sprachaufnahmen eines umfangreichen Korpus des Deutschen. In K. J. Kohler (Ed.), *Phonetisch-akustische Datenbasis des Hochdeutschen: Kieler Arbeiten zu den PHONDAT-Projekten 1989–1992*, AIPUK 26, pp. 41–79.

Ulbrich, H. (1972). *Instrumentalphonetisch-auditive R-Untersuchungen im Deutschen*. Schriften zur Phonetik und Kommunikationsforschung Nr. 13. Berlin: Akademie Verlag.

Vennemann, T. (1982). Zur Silbenstruktur der deutschen Standardsprache. In T. Vennemann (Ed.), *Silben, Segmente, Akzente*, pp. 261–305. Tübingen: Niemeyer.

Zwicker, E. and H. Fastl (1990). *Psychoacoustics. Facts and Models*. Berlin: Springer.

A Berlin sentences

1.	Heute ist schönes Frühlingswetter.	hˈɔʏtə ʔɪst ʃˈøːnəs frˈyːlɪŋsvˌɛtɐ .
2.	Die Sonne lacht.	diː zˈɔnə lˈaxt .
3.	Am blauen Himmel ziehen die Wolken.	ʔam blˈaʊən hˈɪməl tsˈiːən diː vˈɔlkən .
4.	Über die Felder weht ein Wind.	ʔyːbɐ diː fˈɛldɐ vˈeːt ʔaɪn vˈɪnt .
5.	Gestern stürmte es noch.	gˈɛstɐn ʃtˈʏɐmtə ʔɛs nɔx .
6.	Montag war es uns zu regnerisch.	mˈoːntaːk vaːɐ ʔɛs ʔʊns tsuː rˈeːgnɐrɪʃ .
7.	Riecht ihr nicht die frische Luft?	rˈiːçt ʔiːɐ nɪçt diː frˈɪʃə lˈʊft ?
8.	Die Nacht haben Maiers gut geschlafen.	diː nˈaxt haːbən mˈaɪɐs gˈuːt gəʃlˈaːfən .
9.	Jetzt sitzen sie beim Frühstück.	jˈɛtst zˈɪtsən ziː baɪm frˈyːʃtˌʏk .
10.	Es ist acht Uhr morgens.	ʔɛs ʔɪst ʔˈaxt ʔˈuːɐ mˈɔɐgəns .
11.	Vater hat den Tisch gedeckt.	fˈaːtɐ hat deːn tˈɪʃ gədˈɛkt .
12.	Mutter konnte länger schlafen.	mˈʊtɐ kɔntə lˈɛŋɐ ʃlˈaːfən .
13.	Der Kaffee dampft in den Tassen.	deːɐ kˈafeː dˈampft ʔɪn deːn tˈasən .
14.	Messer und Gabel liegen neben dem Teller.	mˈɛsɐ ʔʊnt gˈaːbəl lˈiːgən neːbən deːm tˈɛlɐ .
15.	In der Mitte steht der Brötchenkorb.	ʔɪn deːɐ mˈɪtə ʃtˈeːt deːɐ brˈøːtçənkˌɔɐp .
16.	Wer möchte keinen Kuchen?	veːɐ mœçtə kˈaɪnən kˈuːxən ?
17.	Hans ißt so gerne Wurst.	hˈans ʔˈɪst zoː gˈɛɐnə vˈʊɐst .
18.	Gib mir bitte die Butter!	gˈiːp miːɐ bˈɪtə diː bˈʊtɐ !
19.	Wer möchte noch Milch?	veːɐ mœçtə nɔx mˈɪlç ?
20.	Bald ist der Hunger gestillt.	bˈalt ʔɪst deːɐ hˈʊŋɐ gəʃtˈɪlt .
21.	Günther muß noch einkaufen gehen.	gˈʏntɐ mʊs nɔx ʔˈaɪnkˌaʊfən gˈeːən .
22.	Achte auf die Autos!	ʔˈaxtə ʔaʊf diː ʔˈaʊtoːs !
23.	Überquere die Straße vorsichtig!	ʔyːbɐkvˈeːrə diː ʃtrˈaːsə fˈoːɐzɪçtɪç !
24.	Sonst wirst du leicht überfahren.	zˈɔnst vɪɐst duː lˈaɪçt ʔyːbɐfˈaːrən .
25.	Radfahrer sausen vorbei.	rˈaːtfˌaːrɐ zˈaʊzən foːɐbˈaɪ .
26.	Im Geschäft stehen viele Leute.	ʔɪm gəʃˈɛft ʃtˈeːən fˈiːlə lˈɔʏtə .
27.	Gleich hier sind die Nahrungsmittel.	glˈaɪç hˈiːɐ zɪnt diː nˈaːrʊŋsmˌɪtəl .
28.	Muß der Zucker nicht dort drüben stehen?	mʊs deːɐ tsˈʊkɐ nɪçt dˈɔɐt drˈyːbən ʃtˈeːən ?
29.	Jetzt suche ich das Weißbrot.	jˈɛtst zˈuːxə ʔɪç das vˈaɪsbrˌoːt .
30.	Ob ich Süßigkeiten kaufen darf?	ʔɔp ʔɪç zˈyːsɪçkaɪtən kˈaʊfən daɐf ?
31.	Hier gibt es Konserven.	hˈiːɐ gˈiːpt ʔɛs kɔnzˈɛɐvən .
32.	Öl fehlte wohl auch.	ʔˈøːl fˈeːltə voːl ʔaʊx .
33.	Zum Schluß an die Kasse.	tsʊm ʃlˈʊs ʔan diː kˈasə .
34.	Nun schnell nach Hause.	nuːn ʃnˈɛl naːx hˈaʊzə .
35.	Vater will sich eine Pfeife anzünden.	fˈaːtɐ vɪl zɪç ʔaɪnə pfˈaɪfə ʔˈantsˌʏndən .
36.	Seine Frau macht ein trauriges Gesicht.	zaɪnə frˈaʊ mˈaxt ʔaɪn trˈaʊrɪgəs gəzˈɪçt .
37.	Du solltest weniger rauchen.	duː zɔltəst vˈeːnɪgɐ rˈaʊxən .
38.	Die Ärzte sind damit gar nicht einverstanden.	diː ʔˈɛɐtstə zɪnt damˈɪt gˈaːɐ nɪçt ʔˈaɪnfɐʃtˌandən .
39.	Gib mir bitte mal die Zeitung!	gˈiːp miːɐ bˈɪtə mˈaːl diː tsˈaɪtʊŋ !
40.	Aber Schönes steht wohl nicht drin.	ʔaːbɐ ʃˈøːnəs ʃtˈeːt voːl nɪçt drˈɪn .
41.	Wer muß noch Schularbeiten machen?	veːɐ mʊs nɔx ʃˈuːlʔˌaɐbaɪtən mˈaxən ?
42.	Ich müßte lesen und rechnen.	ʔɪç mʏstə lˈeːzən ʔʊnt rˈɛçnən .
43.	Sieglinde zeichnet eine Figur.	ziːglˈɪndə tsˈaɪçnət ʔaɪnə fɪgˈuːɐ .
44.	Was macht denn dein verstauchter Fuß?	vas mˈaxt dɛn daɪn fɐʃtˈaʊxtɐ fˈuːs ?
45.	Ich spüre ihn nicht mehr.	ʔɪç ʃpˈyːrə ʔiːn nɪçt mˈeːɐ .
46.	Wir wollen heute spazieren gehen.	viːɐ vɔlən hˈɔʏtə ʃpatsˈiːrən gˈeːən .
47.	Da möchte ich gerne mit.	daː mœçtə ʔɪç gˈɛɐnə mˈɪt .
48.	Zuvor müssen wir uns stärken.	tsʊfˈoːɐ mʏsən viːɐ ʔʊns ʃtˈɛɐkən .
49.	Die Kartoffeln gehören zum Mittagessen.	diː kaɐtˈɔfəln gəhˈøːrən tsʊm mˈɪtaːkʔˌɛsən .

50.	Zum Schnitzel gibt es Erbsen.	tsʊm ʃnˈɪtsəl gˈiːpt ʔɛs ʔˈɛɐpsən .
51.	Dazu essen wir den Salat.	datsˈuː ʔˈɛsən viːɐ deːn zalˈaːt .
52.	Wer trinkt einen Kaffee?	veːɐ trˈɪŋkt ʔaɪnən kˈafeː ?
53.	Danach tut eine Wanderung gut.	danˈaːx tˈuːt ʔaɪnə vˈandəʁʊŋ gˈuːt .
54.	Können wir nicht Tante Erna besuchen?	kœnən viːɐ nɪçt tˈantə ʔˈɛɐnaː bəzˈuːxən ?
55.	Zieht vielleicht die festen Schuhe an!	tsˈiːt fɪlˈaɪçt diː fˈɛstən ʃˈuːə ʔˈan !
56.	Zurück geht's mit der Bahn.	tsʊrˈʏk gˈeːts mɪt deːɐ bˈaːn .
57.	Durch Wald und Feld führt unser Weg.	dʊɐç vˈalt ʔʊnt fˈɛlt fˈyːɐt ʔʊnzɐ vˈeːk .
58.	Wir hören den plätschernden Bach.	viːɐ hˈøːrən deːn plˈɛtʃɐndən bˈax .
59.	Hasen verschwinden im Dickicht.	hˈaːzən fɐʃvˈɪndən ʔɪm dˈɪkɪçt .
60.	Voller Glück sind wir am Ziel.	fˈɔlɐ glˈʏk zɪnt viːɐ ʔam tsˈiːl .
61.	Die Tante bewohnt ein nettes Häuschen.	diː tˈantə bəvˈoːnt ʔaɪn nˈɛtəs hˈɔʏsçən .
62.	Dahinter liegt der Rosengarten.	dahˈɪntɐ lˈiːkt deːɐ rˈoːzəngˌaɐtən .
63.	Manche Obstbäume blühen prächtig.	mˈançə ʔˈoːpstbˌɔʏmə blˈyːən prˈɛçtɪç .
64.	Am Zaun steht eine Regentonne.	ʔam tsˈaʊn ʃtˈeːt ʔaɪnə rˈeːgəntˌɔnə .
65.	Der gelbe Küchenofen sorgt für Wärme.	deːɐ gˈɛlbə kˈʏçənʔˌoːfən zˈɔɐkt fyːɐ vˈɛɐmə .
66.	Im Topf kocht das Wasser.	ʔɪm tˈɔpf kˈɔxt das vˈasɐ .
67.	Ein Sofa steht an der Wand.	ʔaɪn zˈoːfaː ʃtˈeːt ʔan deːɐ vˈant .
68.	Aus dem Radio klingt Musik.	ʔaʊs deːm rˈaːdjoː klˈɪŋt muːzˈiːk .
69.	Frische Gardinen hängen am Fenster.	frˈɪʃə gaɐdˈiːnən hˈɛŋən ʔam fˈɛnstɐ .
70.	Auf dem Brett leuchten bunte Tulpen.	ʔaʊf deːm brˈɛt lˈɔʏçtən bˈʊntə tˈʊlpən .
71.	Rückt die Stühle an den Tisch!	rˈʏkt diː ʃtˈyːlə ʔan deːn tˈɪʃ !
72.	Wie wär's mit 'nem kleinen Skat?	viː vɛːɐs mɪt nəm klˈaɪnən skˈaːt ?
73.	Die drei Männer sind begeistert.	diː drˈaɪ mˈɛnɐ zɪnt bəgˈaɪstɐt .
74.	Vater mischt gleich die Karten.	fˈaːtɐ mˈɪʃt glˈaɪç diː kˈaɐtən .
75.	Er gewinnt sechs Spiele nacheinander.	ʔeːɐ gəvˈɪnt zˈɛks ʃpˈiːlə naxaɪnˈandɐ .
76.	Ist es nicht Zeit zum Aufbruch?	ʔɪst ʔɛs nɪçt tsˈaɪt tsʊm ʔˈaʊfbrˌʊx ?
77.	Der Bahnhof liegt sieben Minuten entfernt.	deːɐ bˈaːnhˌoːf lˈiːkt zˈiːbən mɪnˈuːtən ʔɛntfˈɛɐnt .
78.	Löst doch die Fahrkarten am Schalter!	lˈøːst dɔx diː fˈaːɐkˌaɐtən ʔam ʃˈaltɐ !
79.	Wir gehen auf den Bahnsteig.	viːɐ gˈeːən ʔaʊf deːn bˈaːnʃtˌaɪk .
80.	Da läuft der Zug ein.	daː lˈɔʏft deːɐ tsˈuːk ʔˈaɪn .
81.	Die Bremsen quietschen gräßlich.	diː brˈɛmzən kvˈiːtʃən grˈɛslɪç .
82.	Die Station wird angesagt.	diː ʃtatsjˈoːn vɪɐt ʔˈangəzˌaːkt .
83.	Die Eiligen steigen schnell aus.	diː ʔˈaɪlɪgən ʃtˈaɪgən ʃnˈɛl ʔˈaʊs .
84.	Nun sind wir gleich im Wagen.	nuːn zɪnt viːɐ glˈaɪç ʔɪm vˈaːgən .
85.	Wir haben ein Abteil extra für uns.	viːɐ haːbən ʔaɪn ʔaptˈaɪl ʔˈɛkstraː fyːɐ ʔʊns .
86.	Der junge Zugbegleiter pfeift zur Abfahrt.	deːɐ jˈʊŋə tsˈuːkbəglˌaɪtɐ pfˈaɪft tsʊɐ ʔˈapfˌaːɐt .
87.	Leise rollen wir aus dem Bahnhof.	lˈaɪzə rˈɔlən viːɐ ʔaʊs deːm bˈaːnhˌoːf .
88.	Draußen fliegt die Landschaft vorbei.	drˈaʊsən flˈiːkt diː lˈantʃaft foːɐbˈaɪ .
89.	Die Rinder sind noch auf der Weide.	diː rˈɪndɐ zɪnt nɔx ʔaʊf deːɐ vˈaɪdə .
90.	Ein Bauer arbeitet auf seinem Acker.	ʔaɪn bˈaʊɐ ʔˈaɐbaɪtət ʔaʊf zaɪnəm ʔˈakɐ .
91.	Der Pflug zieht tiefe Furchen.	deːɐ pflˈuːk tsˈiːt tˈiːfə fˈʊɐçən .
92.	Daneben grünt schon Wintersaat.	danˈeːbən grˈyːnt ʃoːn vˈɪntɐzˌaːt .
93.	Hier richten Zimmerleute ein Dach.	hˈiːɐ rˈɪçtən tsˈɪmɐlˌɔʏtə ʔaɪn dˈax .
94.	Es gehört zu einer Feldscheune.	ʔɛs gəhˈøːɐt tsuː ʔaɪnɐ fˈɛltʃˌɔʏnə .
95.	Schon bald sind wir zu Hause.	ʃoːn bˈalt zɪnt viːɐ tsuː hˈaʊzə .
96.	Die Fahrt war ja mächtig kurz.	diː fˈaːɐt vaːɐ jaː mˈɛçtɪç kˈʊɐts .
97.	"Zug endet hier!" verkündet die Ansage.	tsˈuːk ʔˈɛndət hˈiːɐ ! fɐkˈʏndət diː ʔˈanzˌaːgə .
98.	Alle eilen gleich links ins Freie.	ʔˈalə ʔˈaɪlən glˈaɪç lˈɪŋks ʔɪns frˈaɪə .
99.	In der Dämmerung kommen wir heim.	ʔɪn deːɐ dˈɛmɐrʊŋ kˈɔmən viːɐ hˈaɪm .
100.	Das war jetzt aber ein schöner Tag.	das vaːɐ jˈɛtst ʔaːbɐ ʔaɪn ʃˈøːnɐ tˈaːk .

B Marburg sentences

1.	Geld allein macht nicht glücklich.	gˈɛlt ʔalˈaɪn mˈaxt nɪçt glˈʏklɪç .
2.	Böse Menschen verdienen ihre Strafe.	bˈøːzə mˈɛnʃən fɐdˈiːnən ʔiːrə ʃtrˈaːfə .
3.	Mittwoch kommt uns Besuch passend.	mˈɪtvɔx kˈɔmt ʔʊns bəzˈuːx pˈasənt .
4.	Ich bin nicht naß geworden.	ʔɪç bɪn nɪçt nˈas gəvɔɐdən .
5.	Unsere Eltern tanzen Wiener Walzer.	ʔʊnzɐrə ʔˈɛltɐn tˈantsən vˈiːnɐ vˈaltsɐ .
6.	Lärmt nicht, Jung’s, Vater schreibt!	lˈɛɐmt nɪçt , jˈʊŋs , fˈaːtɐ ʃrˈaɪpt !
7.	Wer weiß dort genau Bescheid?	veːɐ vˈaɪs dˈɔɐt gənˈaʊ bəʃˈaɪt ?
8.	Er geht links, sie rechts.	ʔeːɐ gˈeːt lˈɪŋks , ziː rˈɛçts .
9.	Leider ist dies Haus teuer.	lˈaɪdɐ ʔɪst diːs hˈaʊs tˈɔʏɐ .
10.	Dienstag wieder frisch gebrannte Mandeln.	dˈiːnstaːk viːdɐ frˈɪʃ gəbrˈantə mˈandəln .
11.	Heute jeder Platz: Eins fünfzig.	hˈɔʏtə jˈeːdɐ plˈats , ʔˈaɪns fˈʏnftsɪç .
12.	Nervöse Menschen brauchen viel Ruhe.	nɛɐvˈøːzə mˈɛnʃən brˈaʊxən fˈiːl rˈuːə .
13.	Unser Treffpunkt: Zwei Uhr am Neumarkt.	ʔʊnzɐ trˈɛfpˌʊŋkt , tsvˈaɪ ʔˈuːɐ ʔam nˈɔʏmˌaɐkt .
14.	Gegen Abend wird’s kühl.	geːgən ʔˈaːbənt vɪɐts kˈyːl .
15.	Adolf möchte wohl Lehrer werden.	ʔˈaːdɔlf mœçtə voːl lˈeːrɐ veːɐdən .
16.	Iß dein Essen nie hastig!	ʔˈɪs daɪn ʔˈɛsən nˈiː hˈastɪç !
17.	Diese Kleider findet Inge herrlich.	diːzə klˈaɪdɐ fˈɪndət ʔˈɪŋə hˈɛɐlɪç .
18.	Bist Du sehr kalt geworden?	bɪst duː zˈeːɐ kˈalt gəvɔɐdən ?
19.	Ursel weint, aber Heinz lacht.	ʔˈʊɐzəl vˈaɪnt , ʔaːbɐ hˈaɪnts lˈaxt .
20.	Stehend macht man seine Aussage.	ʃtˈeːənt mˈaxt man zaɪnə ʔˈaʊszˌaːgə .
21.	Diese Durchsage ist ohne Gewähr.	diːzə dˈʊɐçzˌaːgə ʔɪst ʔˈoːnə gəvˈɛːɐ .
22.	Hauptsache: Gesund und glücklich.	hˈaʊptzˌaxə , gəzˈʊnt ʔʊnt glˈʏklɪç .
23.	Laß bitte das Licht brennen!	lˈas bˈɪtə das lˈɪçt brˈɛnən !
24.	Wie finden Sie meinen neuen Hut?	viː fˈɪndən ziː maɪnən nˈɔʏən hˈuːt ?
25.	Nehmt doch Butter zum Brot!	nˈeːmt dɔx bˈʊtɐ tsʊm brˈoːt !
26.	Doris fährt zu weit links.	dˈoːrɪs fˈɛːɐt tsuː vˈaɪt lˈɪŋks .
27.	Begreifen Sie meine schwierige Lage?	bəgrˈaɪfən ziː maɪnə ʃvˈiːrɪgə lˈaːgə ?
28.	Manche Menschen vertragen keine Erdbeeren.	mˈançə mˈɛnʃən fɐtrˈaːgən kˈaɪnə ʔˈeːɐtbˌeːrən .
29.	Nichts verletzt mehr als Spott.	nˈɪçts fɐlˈɛtst mˈeːɐ ʔals ʃpˈɔt .
30.	Dietrich erwartet Dich um drei.	dˈiːtrɪç ʔɛɐvˈaɐtət dɪç ʔʊm drˈaɪ .
31.	Öfen brauchen Kohlen und Briketts.	ʔˈøːfən brˈaʊxən kˈoːlən ʔʊnt brɪkˈɛts .
32.	Heute jeder Strauß Blumen zwei Mark.	hˈɔʏtə jˈeːdɐ ʃtrˈaʊs blˈuːmən tsvˈaɪ mˈaɐk .
33.	Du begrüßt erst Deinen Gast.	duː bəgrˈyːst ʔˈeːɐst daɪnən gˈast .
34.	Wir werden Euch nie vergessen.	viːɐ veːɐdən ʔɔʏç nˈiː fɐgˈɛsən .
35.	Darf ich Deine Schleife binden?	daɐf ʔɪç daɪnə ʃlˈaɪfə bˈɪndən ?
36.	Wir spielen alle Tage.	viːɐ ʃpˈiːlən ʔˈalə tˈaːgə .
37.	Schlaf vor Mitternacht ist gesund.	ʃlˈaːf foːɐ mˈɪtɐnˌaxt ʔɪst gəzˈʊnt .
38.	Deine Uhr steht drei Minuten.	daɪnə ʔˈuːɐ ʃtˈeːt drˈaɪ mɪnˈuːtən .
39.	Sie ißt kein salziges Gericht.	ziː ʔˈɪst kˈaɪn zˈaltsɪgəs gərˈɪçt .
40.	Sechs Mädchen wollen Schwester werden.	zˈɛks mˈɛːtçən vɔlən ʃvˈɛstɐ veːɐdən .
41.	Guten Morgen, meine Damen und Herren!	gˈuːtən mˈɔɐgən , maɪnə dˈaːmən ʔʊnt hˈɛrən !
42.	Du darfst dich wieder setzen.	duː daɐfst dɪç viːdɐ zˈɛtsən .
43.	Freilich, trockenes Wetter brauchen wir.	frˈaɪlɪç , trˈɔkənəs vˈɛtɐ brˈaʊxən viːɐ .
44.	Sie sollte Medizin nehmen.	ziː zɔltə meːdɪtsˈiːn nˈeːmən .
45.	Gut Ding will Weile haben.	gˈuːt dˈɪŋ vɪl vˈaɪlə haːbən .
46.	Vor’m Essen Deine Hände waschen!	foːɐm ʔˈɛsən daɪnə hˈɛndə vˈaʃən !

47.	Mach Dir’s bequem, alter Freund!	mˈax diːɐs bəkvˈeːm , ʔˈaltɐ frˈɔʏnt !
48.	Abends lieber zeitig schlafen gehen.	ʔˈaːbənts lˈiːbɐ tsˈaɪtɪç ʃlˈaːfən gˈeːən .
49.	Schnupfen stört uns natürlich sehr.	ʃnˈʊpfən ʃtˈøːɐt ʔʊns natˈyːɐlɪç zˈeːɐ .
50.	Lange nicht geseh’n, mein Lieber.	lˈaŋə nɪçt gəzˈeːn , maɪn lˈiːbɐ .
51.	Motoren brauchen Benzin, Öl und Wasser.	moːtˈoːrən brˈaʊxən bɛntsˈiːn , ʔˈøːl ʔʊnt vˈasɐ .
52.	Unser Doktor besucht Vater täglich.	ʔʊnzɐ dˈɔktoːɐ bəzˈuːxt fˈaːtɐ tˈɛːklɪç .
53.	Ich bin dreißig Jahre alt.	ʔɪç bɪn drˈaɪsɪç jˈaːrə ʔˈalt .
54.	Er schüttelt kräftig Deine Hand.	ʔeːɐ ʃˈʏtəlt krˈɛftɪç daɪnə hˈant .
55.	Jungen lieben Streit, Mädchen Eintracht.	jˈʊŋən lˈiːbən ʃtrˈaɪt , mˈɛːtçən ʔˈaɪntrˌaxt .
56.	Doris will ihre Suppe essen.	dˈoːrɪs vɪl ʔiːrə zˈʊpə ʔˈɛsən .
57.	Nüsse muß man gut kauen.	nˈʏsə mʊs man gˈuːt kˈaʊən .
58.	Deine Uhr geht vor.	daɪnə ʔˈuːɐ gˈeːt fˈoːɐ .
59.	Allzu lebhafte Kinder machen nervös.	ʔˈaltsuː lˈeːphaftə kˈɪndɐ mˈaxən nɛɐvˈøːs .
60.	Edith möchte gern Haushalt lernen.	ʔˈeːdɪt mœçtə gˈɛɐn hˈaʊshˌalt lˈɛɐnən .
61.	Alle Kinder essen gern Eis.	ʔˈalə kˈɪndɐ ʔˈɛsən gˈɛɐn ʔˈaɪs .
62.	Unsere beiden Hunde haben Durst.	ʔʊnzɐrə bˈaɪdən hˈʊndə haːbən dˈʊɐst .
63.	Jeden Freitag gibt’s frischen Fisch.	jˈeːdən frˈaɪtaːk gˈɪpts frˈɪʃən fˈɪʃ .
64.	Kein gutes Wetter, wenig Gäste.	kˈaɪn gˈuːtəs vˈɛtɐ , vˈeːnɪç gˈɛstə .
65.	Erste Stunde Deutsch, dann Englisch.	ʔˈeːɐstə ʃtˈʊndə dˈɔʏtʃ , dan ʔˈɛŋlɪʃ .
66.	Nun bin ich mächtig gespannt.	nuːn bɪn ʔɪç mˈɛçtɪç gəʃpˈant .
67.	Mein Arzt empfahl dringend Bäder.	maɪn ʔˈaɐtst ʔɛmpfˈaːl drˈɪŋənt bˈɛːdɐ .
68.	Diese Wohnung liegt zu hoch.	diːzə vˈoːnʊŋ lˈiːkt tsuː hˈoːx .
69.	Zentner für zwölf Mark frei Haus.	tsˈɛntnɐ fyːɐ tsvˈœlf mˈaɐk frˈaɪ hˈaʊs .
70.	Unser Haar braucht Pflege.	ʔʊnzɐ hˈaːɐ brˈaʊxt pflˈeːgə .
71.	Vorsicht, Zug fährt ab!	fˈoːɐzɪçt , tsˈuːk fˈɛːɐt ʔˈap !
72.	Mein Dackel pariert auf’s Wort.	maɪn dˈakəl parˈiːɐt ʔaʊfs vˈɔɐt .
73.	Zum Ausweis gehört ein Lichtbild.	tsʊm ʔˈaʊsvˌaɪs gəhˈøːɐt ʔaɪn lˈɪçtbˌɪlt .
74.	Leider darf Doris nicht bleiben.	lˈaɪdɐ daɐf dˈoːrɪs nɪçt blˈaɪbən .
75.	Unsere Söhne lieben flotte Tänze.	ʔʊnzɐrə zˈøːnə lˈiːbən flˈɔtə tˈɛntsə .
76.	Diese Mannschaft schoß gleich drei Tore.	diːzə mˈanʃaft ʃˈɔs glˈaɪç drˈaɪ tˈoːrə .
77.	In Eurer Wohnung waren Diebe.	ʔɪn ʔɔʏrɐ vˈoːnʊŋ vaːrən dˈiːbə .
78.	Anschrift und Marke nicht vergessen!	ʔˈanʃrˌɪft ʔʊnt mˈaɐkə nɪçt fɐgˈɛsən !
79.	Adler fliegen tausend Meter hoch.	ʔˈaːdlɐ flˈiːgən tˈaʊzənt mˈeːtɐ hˈoːx .
80.	Diese Gegend nennt man Sandwüste.	diːzə gˈeːgənt nˈɛnt man zˈantvˌyːstə .
81.	Alle Jungen spielen Fußball.	ʔˈalə jˈʊŋən ʃpˈiːlən fˈuːsbˌal .
82.	Keiner darf diesen Raum verlassen.	kˈaɪnɐ daɐf diːzən rˈaʊm fɐlˈasən .
83.	Verkehrsampeln leuchten grün, gelb, rot.	fɐkˈeːɐsʔˌampəln lˈɔʏçtən grˈyːn , gˈɛlp , rˈoːt .
84.	Was kostet ein Glas Selterswasser?	vas kˈɔstət ʔaɪn glˈaːs zˈɛltɐsvˌasɐ ?
85.	Doris will draußen Schnee fegen.	dˈoːrɪs vɪl drˈaʊsən ʃnˈeː fˈeːgən .
86.	Dort muß jedes Auto bremsen.	dˈɔɐt mʊs jˈeːdəs ʔˈaʊtoː brˈɛmzən .
87.	Steigt Dein Drachen sehr hoch?	ʃtˈaɪkt daɪn drˈaxən zˈeːɐ hˈoːx ?
88.	Einige Busse fahren heute später.	ʔˈaɪnɪgə bˈʊsə fˈaːrən hˈɔʏtə ʃpˈɛːtɐ .
89.	Sonntags trinken viele Männer Bier.	zˈɔntaːks trˈɪŋkən fˈiːlə mˈɛnɐ bˈiːɐ .
90.	Danach kannst Du Dich wirklich richten.	dˈaːnaːx kanst duː dɪç vˈɪɐklɪç rˈɪçtən .
91.	Diese zarten Blumen welken rasch.	diːzə tsˈaːɐtən blˈuːmən vˈɛlkən rˈaʃ .
92.	Öffnet doch gleich beide Türen!	ʔˈœfnət dɔx glˈaɪç bˈaɪdə tˈyːrən !
93.	Endlich läuft unser Wasser wieder.	ʔˈɛntlɪç lˈɔʏft ʔʊnzɐ vˈasɐ viːdɐ .
94.	Hör auf Deine Frau!	hˈøːɐ ʔaʊf daɪnə frˈaʊ !
95.	Schulkinder müssen Rechnen und Schreiben lernen.	ʃˈuːlkˌɪndɐ mʏsən rˈɛçnən ʔʊnt ʃrˈaɪbən lˈɛɐnən .
96.	Nicht jeder verträgt kaltes Bier.	nɪçt jˈeːdɐ fɐtrˈɛːkt kˈaltəs bˈiːɐ .
97.	Unserer Tante fehlt gar nichts.	ʔʊnzɐrɐ tˈantə fˈeːlt gˈaːɐ nˈɪçts .

98.	Es geht hier ums Prinzip.	ʔɛs gˈeːt hˈiːɐ ʔʊms prɪntsˈiːp .
99.	Inge wäscht noch diese Woche.	ʔˈɪŋə vˈɛʃt nɔx diːzə vˈɔxə .
100.	Laß bloß Dein verdammtes Maulen!	lˈas blˈoːs daɪn fɐdˈamtəs mˈaʊlən !