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HOW TO MUMBLE. THE TEXTUAL CONDITIONING OF PHONOLOGICAL PROCESSES

1. INTRODUCTION

One of the most obvious facts about perceiving a native language is that we do it quickly and effortlessly, even if it is spoken fast and carelessly. Spontaneous speech with its phonetic variation is not an impoverished form of language; "abbreviated derivatives" are the result of natural processes indispensable to speech. Jakobson/Halle (1956: 6) are both right and wrong in assuming that "The slurred fashion of pronunciation is but an abbreviated derivative from the explicit clear-speech form which carries the highest amount of information ...". The statement is right; wrong is the attitude towards the speech variation. It is enough to delete "but" from the statement to make it plausible. Examples of phonetic variation are abundantly supplied by contemporary studies, see Gulden (1985) for English, Rues (1993) for German, Herok/Tonelli (1977) for examples of phonological variation in different languages, or Dogil (1984) for a survey of how different phonological theories deal with fast/casual speech phenomena.

In human perception there is a strong tendency to perceive the world more "correctly" than would be expected from sensory stimulation. It applies also to the perception of speech. Most of the phonological processes occurring in spontaneous speech (i. e., the speech of everyday life, not prepared, not elaborated with respect to pronunciation) in one's native language are not noticed by the perceivers. The smooth reconstruction of speaker's intention is possible, because spontaneous speech processes are not accidental: they set up a highly organised structure. This article tries to shed some light on processes which usually escape speaker's (and perceiver's) attention.

2. SPEECH VARIATION

2.1. General approach

A common way of arranging data when discussing the variation in speech can be illustrated by the following example taken from Zwicky (1972):

	English: <i>I gave him a hat</i>	Welsh: <i>yr oeddwn i yn canu</i> 'I was singing'
Lento:	[ai geiv him ə hæʔ]	[rɔ jðun i: ən kani]
Andante:	[ai geiv ɪm ə hæʔ]	[rɔ jðun i:n kani]
Allegretto:	[ai geiv m ə hæʔ]	[rɔ jnɪm kani]
Presto:	[ay gei m ə hæʔ]	[rɔ nɪm kani]

Table 1. English, Welsh

Compare also Flemming/Wright (1993) "did you eat jet":

- 2.1.a. [dʰɪd ju iʔtʰ jɛʔt]
- 2.1.b. [dʰɪd ju iʔt jɛʔt]
- 2.1.c. [dʰɪdʒu iʔjɛʔ]
- 2.1.d. [dʒuiʔjɛʔ]
- 2.1.e. [dʒiʔjɛʔ]

The examples given above capture very well the processes possible in spontaneous speech, showing characteristic assimilations and deletions; here, the faster the pronunciation, the less remains with respect to the basis of comparison.

Such arrangement of data also suggest, however, that the whole utterance may be pronounced either carefully or by mumbling, or that speech processes affect more or less evenly everything which is being said in a given speech style. It does not capture what is essential in spontaneous speech, mainly the possibility of drawing the listener's attention to different fragments of a speech chain. Not the speed as such, but changes in tempo and clarity are the inseparable attributes of spontaneous speech.

2.2. Segmental variation in Polish

In order to illustrate segmental speech processes in Polish the data will be arranged as follows:

TRANSCRIPTION	UNITS	EXAMPLE	LEVEL OF ABSTRACTION
–	–	Actual realisation: speech	does not apply
Phonetic transcription of actual realisations	Phonetic segments, narrow transcription	[mʲiwɔɕ] (here: final <i>-t</i> deletion)	I
Phonematic transcription, pronunciation model	Allophonic segments, narrow transcription	[mʲiwɔɕl]	II
Phonological transcription	Phonemes, broad transcription	/ miwɔɕl /	III
Orthography	Letters	<i>miłość</i> 'love'	does not apply

Table 2. Interdependencies between transcriptions

The pronunciation model reflects the context-dependent clear-speech form (target pronunciation), and serves as a basis of comparison for actual realisations. It is rendered in italic square brackets (cf. Madelska 1987a for detailed discussion). The phonological representation is context-free thus it can be used as *tertium comparationis* for entries in dictionaries and catalogues.

The utterance given below illustrates spontaneous speech processes characteristic of contemporary Polish:

- 2.2.a. właściwie od początku tam wszystko jest sztucznie pielęgnowane
 'anyway from (the) beginning there everything is artificially cultivated'
 [wacɫiv^jje ɔt pɔ,ɔntku tam fʃistkɔ jest ʃtu,ʒɛ pʲjɛlɛŋnɔvane]

Possible ways of pronouncing such a speech chain (primary and secondary stress is marked after the respective vowel; [ʃ] represents a syllabic fricative):

- 2.2.b. [vwacɫi^jv^jje ɔt pɔ,ɔntku ta^m fʃi^jstkɔ jɛst ʃtu^j,ʒɛ pʲjɛ^jlɛŋnɔva^{nɛ}]
 2.2.c. [vwacɫi^jv^jje ɔt pɔ,ɔntku ta^w fʃi^jskɔ jɛs ʃtu^j,ʒɛ pʲjɛ^jlɛŋnɔva^{nɛ}]
 2.2.d. [acɪ^jje ɔt pɔ,ɔntku tã ʃi^jskɔ ɛʃ ʃtu^j,ʒɛ pʲjɛ^jlɛŋnɔva^{nɛ}]
 2.2.e. [ɕiɛ ɔ pɔ,ɔ^jŋku ã ʃskɔ ə ʃtu^j,ʒɛ pʲjɛ^jlɛŋnɔva^{nɛ}]
 2.2.f. incomprehensible fragments

Examples 2.2.b – 2.2.e illustrate gradual application of processes characteristic of Polish spontaneous speech

- simplification of consonant clusters, here: [t] in [-stk-], etc.;
- deletion processes, here: [ŋŋ] → [ɲ]; the cluster [ɲɲ] is alien to Polish orthoepy but is quite common in speech; spontaneous speech processes often enrich the phonotactics producing sequences which do not occur in prescribed pronunciation (cf. Dressler/Madelska 1989);
- deletion and assimilation in consonant clusters, here: [-st ʃ-] → [-s ʃ] → [-ʃ ʃ-];
- weakening leading to the deletion of glides [j], [w], (here: /[-ɔ jɛ-]/ → [-ɔ ɛ-]);
- gliding of nasals and nasalisation of preceding vowel as a compensatory process, especially frequent after a vowel and before a fricative; here: [-am f-] → [-a^w f-], [-ã f-];
- shortening of unstressed words and expressions of little information value in a given utterance, here [vwacɫiv^jje] → [ɕiɛ];
- syllabification of consonants, here: [fʃi^jstkɔ] → [ʃskɔ], cf. Dressler/Madelska (1989) for detailed information.

Gradual vowel contrast reduction (difficult to express in phonetic transcription) can also be perceived in spontaneous Polish, but is relatively less noticeable than in stress-timed languages like English or German¹.

The general basis of segmental processes in spontaneous speech can be best described within the framework of articulatory phonology². In most cases of reductions (coarticulations and deletions)³ the movements of the speech apparatus are not precise enough in pro-

1 Strong vowel reduction is one of the most characteristic features of Polish spoken with an "American" or a German accent. On the other hand, one of the most typical features of English or German spoken with Polish accent is too clear pronunciation of unstressed vowels.

2 cf. Browman/Goldstein (1986, 1989).

3 I am aware that such classification of segmental processes (i. e., additions, substitutions, and reductions (assimilations and deletions)) is oversimplified; cf. Luschützky (1997).

ducing the closures required by the target pronunciation. Nevertheless, in order to understand the nature of phonological processes, to be able to make predictions with respect to the speech of everyday life, or to prepare computer programs generating synthetic speech one needs a broader approach than the one provided by articulatory phonology.

3. TEXT PHONOLOGY

3.1. Selected data

The examples given in 2.1. – 2.2. illustrate what may happen in fast/casual speech, but they do not represent the range of this phenomenon. Detailed investigations based on longer texts are rare because they are time consuming and strenuous. Unfortunately, this is the only way to obtain data reflecting the frequency and distribution of processes shaping the actual pronunciation.

My Ph.D. dissertation (Madelska 1987a) concerns phonetic variation in Polish. The empirical basis consists of 30 recordings of spontaneous conversations with University students. Stretches of 20–30 minutes from each of these conversations (about 8 hours of spoken text altogether) were transcribed phonetically by at least two trained phoneticians; in case of any divergences selected fragments were analysed instrumentally⁴. The transcriptions consist of about 60.000 words. On the basis of the transcriptions, the "Dictionary of actual pronunciation" and the "Catalogue of consonant and vowel cluster pronunciation" were elaborated upon with the help of a computer.

3.2. Selected data from the "Dictionary of actual pronunciation"

The pronunciation of words can be found in the "Dictionary ...". It is based on 52.562 actual realisations of words that amount to 8.607 entries. Each entry consists of the following components:

RANK	No.	REPRESENTATION	N.r.	REALISATION	%
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RANK Rank order; the relative frequency of a given word in the investigated texts

4 Phonetic transcriptions of spontaneous speech, even the most precise ones, based on spectrograms etc., reflect the perception of the transcriber and cannot be treated as an objective set of data. On the other hand, people speak in order to be understood rather than to provide a phonetician with a set of measurable parameters. Just as the perceiver must be allowed to interpret the speech signal in order to understand the message (for instance, in case of a foreign accent or under bad technical conditions), the transcriber must be allowed to decide what is relevant for the transcriptions.

No.	Number of occurrences; the absolute number of occurrences of a given word in the investigated texts
REPRESENTATION	Phonological representation
N.r.	The number of occurrences of a given phonetic realisation. For example, in the first row of the table the number of realisations equals 358 which means that [jest] was realised as [jes] 358 times
%	The percentage of a given phonetic realisation within a given entry
√	Acceptance mark preceding the transcription indicates realisations which are in accordance with the pronunciation model, for example: √ [jest]: clear-speech form word -finally or before a devoiced consonant √ [jɛst]: clear-speech form before [i] √ [jezd]: clear-speech form before a voiced consonant (sandhi)

For illustration, the following words were chosen:

- *nie* /nɔ/ 'no'; (also as an equivalent to tag questions; phatic function)
- *jest* /jɛst/ '(it) is'
- *znaczy* /znaɨ/ '(it) means'
- *sobie* /sɔbjɛ/ '-self', reflexiv pronomen
- *właściwie* /vwɔɕɪvɲɛ/ 'actually' or rightly, in the right way
- *miałam* /mjawam/ '(I) had (fem. sg., past tense)'
- *trzeba* /tʃɛba/ 'one should'
- *bibliotekoznawstwo* /bibljɔtɛkɔznafstfɔ/ 'library science'
- *miałem* /mjawɛm/ '(I) had (masc. sg., past tense)'

According to the data presented in the *Table 3*, word-final /-st/ of *jest* /jɛst/ '(it) is' was hardly ever pronounced in conformity with the pronunciation model. Various weakening processes also occurred in /vwɔɕɪvɲɛ/ or /znaɨ/, although their pronunciation should be relatively easy for a native Polish speaker.⁵

The particle *nie* /ʔɛ/ 'no' was nearly always realised according to the model, but in some cases a palatal nasal [ɲ] was followed by an epenthetic [j]. Such additions are rarely connected with casual/spontaneous speech. They can be best explained within a framework of articulatory phonology – in slow or careful pronunciation certain transitions can start to live their own life. Strengthening of transitions are hardly ever perceived by native speakers as separate speech sounds, although they can be recognised as separate units in automatic speech segmentation.

5 Such clusters as [zn] or [ɕɨ] should be a trifle for speakers of the language where /rpspsɬr/, for example *karp z pstrągiem* 'a carp with a trout', are phonotactically acceptable.

RANK	No.	REPRESENTATION	N.r.	REALISATION	%
2)	1679	/ʔɛ/	1647	√ [ʔɛ]	98.1
			14	[ʔjɛ]	0.8
			13	[ʔɛ:]	0.8
			3	[ʔi]	0.2
			1	[ʔɛ]	0.1
			1	[əʔɛ]	0.1
11)	760	/jest/	358	[jes]	47.1
			136	√ [jest]	17.9
			114	[jez]	15.0
			39	[ɛs]	5.1
			16	[jɛ]	2.1
			13	[jestɪ]	1.7
			11	[jes:]	1.4
			10	[ɛz]	1.3
			8	√ [jezd]	1.1
			7	[ɛst]	0.9
			7	[jezɪ]	0.9
			7	[jezɪ]	0.9
			6	[jesɪ]	0.8
			5	[jezdɪ]	0.7
			4	[s]	0.5
			2	[ɛsɪ]	0.3
			2	√ [jestʲ]	0.3
			2	[jeɕ]	0.3
			1	[is]	0.1
			(+ 12 other forms)		
30)	226	/zna,i/	141	√ [zna,i]	62.4
			67	[na,i]	29.6
			8	[za,i]	3.5
			4	[sna,i]	1.8
			3	[naʃi]	1.3
			2	[ɲ,i]	0.8
			1	[n,i]	0.4
41)	166	/sɔbjɛ/	124	√ [sɔbjɛ]	74.7
			19	[sɔjɛ]	11.4
			11	[sɔɛ]	6.6
			10	[sɛ]	6.0
			1	[sɔbʲi]	0.6
			1	[ʂbʲjɛ]	0.6

44)	157	/vwacivje/	87	√ [vwacivje]	55.4
			20	[vacivje]	12.7
			12	[vwacije]	7.6
			7	[vacivje]	4.5
			7	[vwacivje]	4.5
			4	[chivje]	2.5
			4	[vwacije]	2.5
			4	[vacije]	2.5
			2	[vacivje]	1.3
			2	[vwacivje]	1.3
			2	[vwacivje]	1.3
			1	[acije]	0.6
69)	101	/mjawam/	76	[mjjaam]	75.2
			18	√ [mjjawam]	17.8
			2	[mjjaaw]	2.0
			2	[mjjaam:]	2.0
			(+ 3 other forms)		
142)	42	/tʃeba/	14	[,ea]	33.3
			11	[,eba]	26.2
			7	[,ʃea]	16.7
			7	[,ʃeba]	16.7
			1	[,ʃa]	2.4
			1	[tʃea]	2.4
			1	√ [tʃeba]	2.4
158)	38	/mjawem/	26	[mjjaem]	68.4
			7	√ [mjjawem]	18.4
			3	[mjjaew]	7.9
			1	[mjjaew]	2.6
			1	[mjjawem:]	2.6
1439)	3	/bibljɔtɛkɔznafstɔ/	2	√ [bibljɔtɛkɔznafstɔ]	66
			1	[bibljɔtɛkɔznafstɔ]	33

Table 3. From the "Dictionary of phonetic realisations", Madelska (1987a)

Interestingly, long and complicated clusters, such as /-fstf-/ in *bibliotekoznawstwo* were often pronounced in conformity with the pronunciation model, although they could be easily simplified. Generally speaking, according to my data the tendency to avoid simplifications of long and complicated consonant clusters if they occur word-internally is quite strong, although it seems to contradict some common assumptions concerning the processes in spontaneous speech.

Such results provoke an additional question – not only why and where weakening processes apply, but why, in some cases, they do not apply. The answer to this question cannot be found either in the "Catalogue ..." or in the "Dictionary ...". Only the investigation of the interplay among the segmental, prosodic, and syntactic levels helps to understand the teleology of a phonetic variation.

3.3. Selected data from the "Catalogue of Vowel- and Consonant Clusters"

The "Catalogue of Vowel- and Consonant Clusters" contains 1.926 entries which represent the phonetic realisations of 170.837 units⁶. Entries are phonological representations of vowels, vowel groups, consonants and consonant clusters. Approximants /j/ and /w/ were analysed as parts of vocalic groups. Sonorants were treated as parts of consonant clusters.

The "Catalogue ..." allows for the analysis of the realisations of a chosen speech chain in any phonetic position (word- or phrase- final, internal or initial). A speech chain can be divided as follows:

jej siostra chciała 'her sister wanted'

/ jej ɕostra xława / → [jej], [ɕ-], [-ɔ-], [-str-], [-a], [xł-], [-awa]

In the "Catalogue ..." under each phonological entry all phonetic realisations were listed and given in square brackets; space between a bracket and a given unit indicates a word boundary, and a hyphen shows the position of a given unit within a word.

Vocalic and consonant clusters turned out to be very useful units for investigations of spontaneous speech processes in Polish. The arrangement of the data allows one to investigate syllable structures as well, but the division of a speech chain into syllables has not been fruitful thus far.

3.3.1. Vocalic variation

The dispersion of the vowel quality in spontaneous Polish, although present for a trained ear, do not cause dramatic changes in the syllable structure, although it reveals social and dialectal background of a speaker. Generally speaking, in comparison to stress-timed languages (such as Russian or German), the vowel contrast reduction is not very strong. The deletions of vowels are seldom: deletions of the most frequent vowel /a/ hold for about 0.1% of cases, deletions of /i/ and /ɛ/ concern about 0.2% of realisations, and the less stable vowel /i/ undergoes deletion in 1.5% of cases. Especially the deletion of /i/ can leave traces

6 Having 170.837 units at my disposal I have chosen just a handful of examples, trying to illustrate the most typical processes.

in form of a syllabification of a preceding consonant. Syllabification of consonants as a consequence of vowel deletion is not a frequent, but quite an interesting process in spontaneous Polish, cf. *znaczy* '(it) means' /zna.ɨ/ → [ɲ.ɨ] in Table 3.

Nasal vowels are orthographically rendered with *-ą*, *-ę* or *ń*. According to the Polish orthoepic norm, they can occur only word-finally or preceding fricatives. The realisation of nasal vowels in Standard Polish is asynchronic.⁷ The "carrier" of the nasalisation can be transcribed as /j/ (preceding palatal fricatives) and /w̃/ (preceding non-palatal fricatives or phrase-finally). These nasal glides, which are treated as phonemes by some linguists, have a phonological status in my system (cf. Table 4 below):

ORTHO-GRAPHY	GLOSSE	PHONOLOGICAL REPRESENTATION	PRONUNCIATION MODEL	POSSIBLE REALISATIONS	COMMENTS
<i>kąski</i>	small bites	/kɔw̃ski/	[kɔw̃ski]	[kɔw̃ski] [kɔski]	neutral; standard Polish sociolect (old intelligensia)
<i>koński</i>	horse-like	/kɔŋski/	[kɔŋski]	[kɔŋski]	neutral; standard Polish
<i>idą</i>	(they) go	/idɔw̃/	[idɔw̃]	[idɔw̃] [idɔ] [idɔw] [idɔ] [idɔm]	neutral; standard Polish sociolect (old intelligensia) sociolect (new intelligensia) dialect (eastern Poland) dialect (Great Poland and Small Poland)
<i>on już</i>	he already	/ɔn juʃ/	[ɔn juʃ]	[ɔn juʃ] [ɔ? juʃ] [ɔŋ juʃ] [ɔŋjuʃ] [ɔŋjuʃ] [ɔŋ]	neutral; standard Polish spontaneous speech variation spontaneous speech variation spontaneous speech variation spontaneous speech variation spontaneous speech variation

Table 4. Nasal vowels

22 of 30 informants realised word-final *-ą* always (or nearly always) according to the prescribed pronunciation (that is [-ɔw̃] or [-ɔ]). Dialectal pronunciation prevails⁸ in the performance of 3 informants: nasal [-m] replaces an approximant nasal [-w̃], for example (*z tą panią* '(with) this woman' was realised as [tɔm paɲɔm] instead of [tɔw̃ paɲɔw̃]).⁹

7 As one can easily notice on spectrograms, the word-final asynchrony is stronger than the word-internal. The degree of asynchrony depends on speech tempo, social status (synchronic pronunciation can be still heard in the pronunciation of old *intelligensia*) and many other factors.

8 For detailed discussion cf. Madelska (1987b).

9 Such dialectal forms were used occasionally by 6 informants.

In case of so-called denasalised pronunciation (where the "carrier" of the nasalisation loses its nasal component, for example *z tobą* /s tɔbɔw̃/ → [s tɔbɔw] 'with you') one has to distinguish between pathological *rhinolalia clausa* and sociolectal variation. The last can be heard in *new intelligentsia* pronunciation in the Warsaw region. Among my informants only one person had a strong inclination to such pronunciation.

Word-finally, the nasal realisation of *-ę* is recommended by the prescribed pronunciation, but not obligatory. According to my data, *-ę* was hardly ever realised with the nasal component: oral [ɛ] occurred in 97.7% of cases (1715 times); the nasal realisation occurred in 2% of cases (35 times), and other realisations were noticed in this position 5 times (0.2%). The realisation of word-final *-ę* can be treated as an indicator of formality: the more formal the situation, the stronger the tendency to preserve the nasalisation.¹⁰

In vocalic groups, the deletion of /w/ was relatively frequent. In the realisation of /awa/, which occurred 704 times in my corpus, /w/ was deleted 399 times (56.7%), it was preserved 295 times (41.9%), while other realisations were noticed 10 times (1.4%). For more information concerning such mysteriously high rates of deletion one has to check either the "Dictionary of actual pronunciation" or the computerised transcriptions: nearly all the /w/-deletions in between vowels are to be found in past-tense verbal morphemes, for example in the verb forms, *miałam* /mjawam/ → [mjjaam] '(I) had, *feminine*' and /mjawem/ → [mjjaem] '(I) had, *masculine*' the deletion ratio is about 80%, cf. Table 3. A similar phonetic chain not embedded in a verbal morpheme hardly ever undergoes deletion. Here, morphology clearly interacts with the phonetic performance.

3.3.2. Consonants

Deletion of single consonants in a vocalic environment is seldom (usually below 1% of occurrences). The highest deletion rate, about 3% (96 occurrences), concerns the pronunciation of /b/. Here, closer investigation shows that there is a strong tendency to simplify the pronunciation of *sobie*: in 166 occurrences of this reflexive pronoun there were 40 omissions of /b/. Additionally, 23 cases of /d/ deletions can be explained by a tendency to simplify the pronunciation of *trzeba* '(one) should', cf. Table 3. Moreover, a conditional morpheme *bym* '(I) would' was realised 96 times according to the pronunciation model, that is [bim], but 23 times it was replaced by a syllabic nasal [m̩]. To summarise, only two specific words and one morpheme make up more than a half of /b/-deletions.

The interplay between a cluster-type and a sandhi position can be illustrated with the realisation of the cluster /zdv/, which occurred 36 times in the corpus. Word-final /d/ was

10 If this tendency is too strong, the utterance sounds artificial; the perceivers describe such tendency even as impertinent or pert.

expected 27 times and was always deleted. Word-initial /d/ was expected 9 times and was never deleted. It allows us to conclude that the deletion of a plosive is highly probable in an utterance like *jest wesóły* '(he) is cheerful' [jɛzd vɛsɔwi] → [jɛz vɛsɔwi], but the realisation of a type *raz dwoje ludzi* 'once two people' [raz dvɔjɛ luʃi] → [raz vɔjɛ luʃi], with the word-initial /d/ deletion, is very unlikely, cf. Table 5.

/ZDV/: 36 REPRESENTATIONS	PHONETIC REALISATION	N.r.	% WITHIN THE ENTRY	COMMENT
	[z v]	17	47.2	sandhi; deletion of word-final /-d/ preceding non-palatalised [v]
	[z dv]	9	25.0	no deletion of word-initial /d-/
	[z vʲ]	10	27.7	sandhi; deletion of word-final /-d/ preceding palatalised [v]

Table 5. The phonetic realisation of the consonant group /zdv/

The example given above illustrates the influence of the word boundary on spontaneous speech processes: longer consonant clusters tend to be simplified (as a consequence of smoothing of the articulatory movements), but the actual realisation of a given cluster depends on the syntactic structure as well.

The realisation of /ɕt:/, which occurred 571 times in my corpus, also depends on the position in a word:

- word-internally: the cluster was realised 78.3% according to the model (447 times), there were 35 cases of gemination (6.2%) and 8 cases of /-t/ deletion (1.4%)
- word-initially: there were no cases of deletion (12 examples).
- word-finally: in 61 of /-ɕt/, 24 cases of [-t] deletion occurred, that is 10.7% within the entire group, but about 40% word/finally.

In a similar cluster, /zʲ/, 46 occurrences, the deletion of /ʲ/ took place 9 times, but word-finally only.

The cluster /tst/, 37 occurrences, was mostly realised as [tst]: 23 occurrences (62.2%). Fricativisation /tst/ → [s:t] took place 4 times, there were 5 cases of /t/ deletion and 5 cases of other realisations.

There is a tendency to delete a plosive in a fricative surrounding. In the cluster /stf/ (67 occurrences), the model realisation occurred 51 times (76.2%), and the deletion of /t/ took place 16 times (23.4%).

In the cluster /stn/, which occurred 39 times, /t/ deletion was observed 26 times: 5 times as a word-internal deletion /-stn-/ → [-sn-], and 21 times word-finally: /-st n-/ → [-s n-]. Otherwise /t/ was nearly always realised with a nasal plosion, which is typical for dental plosives followed by /n/.

In another cluster, /fsk/ (altogether 30 occurrences, but 29 times word-internally), the /f/-deletion took place 19 times (63.3%). The /fsk/-cluster is to be found mostly in adjective morphemes (cf. *krakowski* '(of) Cracow'; in such morphemes the /f/-deletion is even approved by the (otherwise strict) orthoepic rules for spontaneous Polish.

The most frequent 3-consonant cluster /stk/ occurred 268 times; different ways of its realisation are worth noticing. Word-internally, middle /-t-/ was deleted in 74.2% of cases. Word-finally, /-t / was expected 8 times: it was kept just once (0.4%), and 7 times it was deleted; the deletion rate is 2.6% within the group, but 87.5% word-finally (cf. Table 6):

/STK/: 268 REPRESENTATIONS	PHONETIC REALISATION	N.r.	% WITHIN THE ENTRY	COMMENT
1	[sk ^j] or [sk]	199	74.2	word-internally, /-t-/ deletion
2	[stk] or [stk ^j]	61	22.8	word-internally, model pronunciation
3	[s k]	7	2.6	sandhi, word-final /-t-/ deletion
4	[st k]	1	0.4	sandhi, model pronunciation

Table 6. The phonetic realisation of the consonant group /stk/

The "Catalogue ..." allows one to investigate not only the realisations of particular sequences, but also types of sequences. Table 6 illustrates the realisation of a bilabial nasal /m/ between a vowel (V) and a fricative consonant (S). There is a tendency towards the reduction of an articulatory gesture (labial closure in this case); the nasalisation remains, spreading over to the preceding vocalic element. This tendency is stronger in a sandhi position: words like *zamszowy* /zamʃɔvɨ/ 'suede' tend to be realised according to the pronunciation model, i. e. [zamʃɔvɨ], whereas expressions like *mam szorty* /mam ʃorti/ '(I) have shorts' are more prone to trigger assimilation processes, i. e. [mãw ʃorti] or [mã ʃorti].¹¹ To summarise, as a realisation of /mam zamʃɔvɨ ʃorti/ '(I) have suede shorts', we would rather expect [mã zamʃɔvɨ ʃorti] than [mam zãʃɔvɨ ʃorti] (cf. Table 7 below).

/VMS/: 87 REALISATIONS	WORD INTERNALLY	SANDHI
/VmS/→[VmS] (model realis.)	92% (80 cases)	86.9% (932 cases)
/VmS/→[Ṽw] (assimilation)	3.4% (3 cases)	12.8% (137 cases)
other realisations	4.6% (4 cases)	0.4% (4 cases)

Table 7. The realisation of /m/ between a vowel (V) and a fricative consonant (S) in spontaneous Polish

11 The tendency to carry over unconscious phonological processes from the native language to other languages can be illustrated by characteristic pronunciation of English spoken by Poles:
something → [samsɲɪŋk] / [samθɪŋ] / [sãθɪŋ] etc.

Seldom, but nevertheless interesting is a syllable /sxV/: here, the deletion of a prenuclear /-x-/, compensated by a slight prolongation of /s-/ does not lead to misunderstanding. The perceptual behaviour of "native perceivers" can be shortly summarised as follows:

INPUT	MEANING	ACTUAL INTERPRETATIONS
[sxɔɖi]	<i>schody</i> 'staircase'	<i>schody</i> 'staircase'
[sɔɖi]	not used, but a possible form: <i>sody</i> 'soda-waters'	<i>schody</i> 'staircase' or <i>sody</i> 'soda-waters'
[s:ɔɖi]	does not exist in standard Polish	<i>schody</i> 'staircase'
[xɔɖi]	not used, but possible: 'walks, ways of walking'	'walks, ways of walking'

Table 8. Perceptual strategies

If a coined word [s:ɔɖi] is embedded in a longer utterance, such as *powiedział: dziwne [s:ɔɖi]*

'(He) said: strange [s:ɔɖi]', it will be interpreted by native speakers as *dziwne schody* 'strange stairs'. The lack of a prenuclear /-x-/ goes unnoticed. This can be explained by the acoustic characteristics of both consonants, because the acoustic features of /x/ are at least partially present in the spectrum of a sibilant. The transitions between these fricatives and a following vowel are also relatively similar.

Until now no generally accepted model of speech perception has emerged. The listener's strategy towards a message produced by another native speaker of his language/dialect might be described as follows: "No matter how you say it I will hear it right". Thus it is to assume that speech production and speech perception processes have to be of a complementary nature. In order to optimize communication, what is lost in production has to be mentally added in perception (cf. Madelska 1996).

3.3.4. What can be expected

Fricativisations of affricates and plosives are frequent, but 'plosivisation' of affricates was hardly ever noticed in the data, so that it should be interpreted as a 'slip of the tongue', if it happens at all. Gliding of nasal consonants preceding fricatives seems to be a prototypical process in spontaneous Polish. Voicing of any elements is very rare, devoicing processes are to be found in abundance. Moreover, phrase-final devoicing of vowels, sonorants or even syllables is much more common than phrase-initial devoicing of respective elements and groups. Such changes are caused by incomplete articulatory closures, temporal shift in the execution of articulatory gestures and the inertia of speech organs. They can be explained in the framework of an articulatory phonology or in other phonological frameworks in which the phonetic foundations of spoken language are treated seriously (cf. Browman/Goldstein 1986, 1989; Luschützky 1997, 1998).

3.3.5. ... and where

The sandhi position, where word final and word initial clusters meet, produces much more complex combinations than found word internally, which triggers phonetic variation. However, word-final elements undergo simplifications much easier than word-initial ones. The consonants in a prenuclear position are much more stable than postnuclear ones. Phrase-initial position is more stable than the phrase-final one. Word-internal complicated phonetic clusters are found first of all in low-rank long words: here, the phonetic variation is much less frequent than it should be expected on the basis of the phonetic conditions only.

4. PHONETIC PHRASE

Let us compare three different actual realisations of a phrase *on już tam jest* 'he is there already'. It consists of one-syllable words, thus each of them is potentially stressed.

/ ɔn już tam jest /
 s s s s

The three utterances were pronounced by a female native speaker in different ways, in answer to such questions like "Who is already there: she or he?" or "When is he going there" etc. They were described by native listeners as natural and typical for Standard Polish. The spectrograms of these utterances are given below.¹²

The first utterance was realised relatively carefully, with the second and the fourth syllable stressed (cf. the spectrogram 08ab,1):

4.a. [ɔɹ̩ już tam̩ jest]
 w s w s

In the second utterance the final syllable was stressed; moreover, the first two syllables are realised as one rhythmic unit (cf. spectrogram 07ab,1):

4.b. [ɔɹ̩f tam̩ jest^h]
 w w s

In the third utterance the first syllable was stressed (cf. spectrogram 09b,1):

4.c. [ɔ̌ɹ̩f uɹ̩ tam̩ jes]¹³
 s w w w

12 The spectrograms were prepared at Research Laboratory of Acoustics, Austrian Academy of Science, with the help of S_Tools, an acoustic workstation developed by Deutsch and Noll (1994). I am indebted to Sylvia Moosmüller for her help.

13 The transcription given in spectrogram 09b,1: [ɔ̌ɹ̩f] underlines the asynchronic nature of Polish nasal voles: the nasal component grows stronger during the pronunciation of the initial vocalic element.

spectrogram 08ab,1

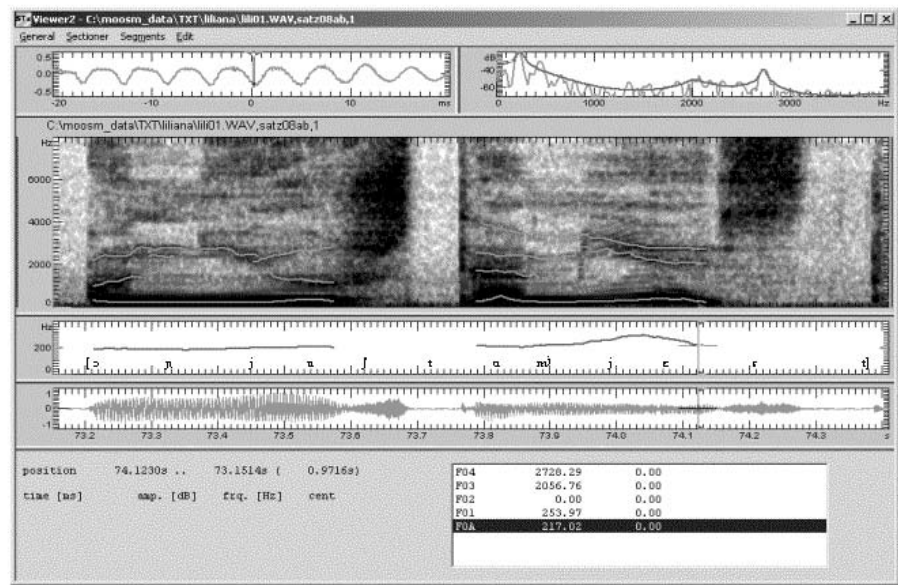


Diagramm 1: „on jui ten jest“ (He already there is)

Legend:
Left upper panel: waveform zoom window
Right upper panel: amplitude spectrum window
Second panel: spectrogram
Third panel: Fundamental frequency contour
Bottom panel: waveform window

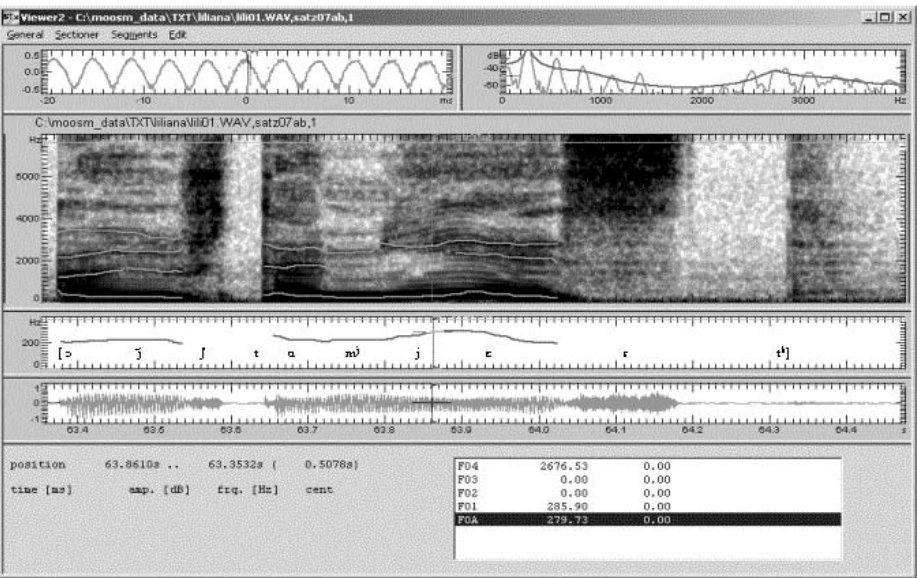


Diagramm 4: „on jui tam jest“ (He already there is)

Legend:
Left upper panel: waveform zoom window
Right upper panel: amplitude spectrum window
Second panel: spectrogram
Third panel: Fundamental frequency contour
Bottom panel: waveform window

spectrogram 07ab,1

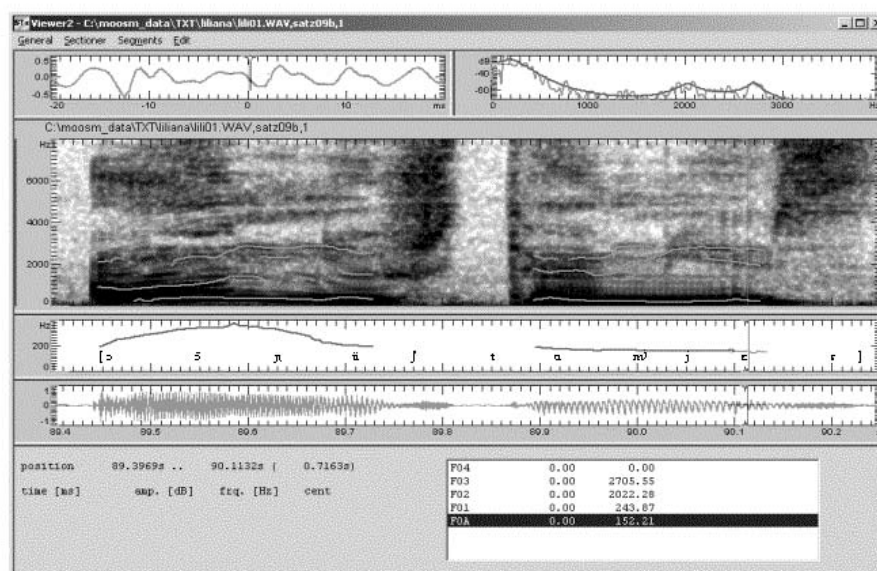
spectrogram 09b,1

Diagram 2: „on jui tam jest“ (He already there is)

Legend:
 Left upper panel: waveform zoom window
 Right upper panel: amplitude spectrum window
 Second panel: spectrogram
 Third panel: Fundamental frequency contour
 Bottom panel: waveform window

The phonetic transcriptions illustrate that the application of weakening processes leads to coarticulations and/or deletions in certain fragments of speech. The spectrograms of the utterances 4.a., 4.b., and 4.c. seem to be quite different at the first sight; it is difficult to guess that they represent one "sentence". Interesting is the interplay between the nasal /n/ and the glide /j/: either the closure of /n/ is not executed, but the nasalisation is transferred to the following glide (cf. 4.b.) or, if the closure remains, the tongue movement towards palatum transforms /n/ into [ʔ] (cf. 4.c.). In both cases the native speakers believe to perceive such sequences as [-n j-].

Speech can be perceived as a sequence of discrete entities, however, the speech signal is a continuous flow. There is no one-to-one correspondence between information contained in the acoustic signal and the segments derived from its linguistic analysis. The segmentation of unstressed fragments into separate units is especially difficult – certain phonetic features overlap, thus it is impossible to set clear-cut borders between given units. Looking for borders between speech units in spontaneous speech analysis not only seems to be difficult, but is also a futile task – even if thoroughly applied, it does not reflect directly either the speaker's intentions or the listener's perception. What goes on in between, that is, overlapping of features, strengthening of transitions, changes in duration and intensity are not accidental; they represent the very nature of spontaneous speech.

5. CONCLUSIONS

On the basis of my data it is easy to notice that frequent words containing consonant clusters are especially prone to variation; function words are more affected than lexical words¹⁴; phonetically complicated, long words are often pronounced according to the pronunciation model; phonetically similar groups vary more in sandhi position than word-internally; weakening processes occur especially in long phonetic phrases, etc., etc..

Such notions as *grammatical category*, *word frequency*, *unstressed position* and *speech tempo* are often treated as triggers of phonetic variation. Nevertheless, *fast speech*¹⁵ should not be treated as a synonym to spontaneous or casual speech. While reading or lecturing, speakers tend to keep a certain rhythm, whereas one of the main features of spontaneous speech is changes in tempo where in one and the same phonetic phrase certain parts can be prolonged, while others can be shortened dramatically. It is tempting to assume that the reduction processes are especially deep in the Polish word *jest* because it is a frequent lexical word and contains a word-final consonant cluster. Such an assumption seems to explain why in many realisations *jest* is nearly always weakened, but it does not predict the opposite, namely, *why* there are also cases with clear pronunciation, nor does it predict *where* to find them.

The distribution of spontaneous speech processes cannot be predicted on the basis of segmental analysis exclusively. The smallest unit enabling us to analyse the interaction between segmental and suprasegmental processes is a phonetic phrase. Including prosody to phonological analysis of speech variation does not infringe the coherence of the theory and allows one to predict not only where spontaneous speech processes may occur in a given text, but also where and why they are not to be expected.

Weakening processes (expressed by the interaction of the segmental and suprasegmental level) are not just obscurity processes; they serve as a background, allowing one to highlight these parts of an utterance which are important from the speaker's perspective.

If phonetics wants to deal with the investigations of a spoken language, precise measurements of the smallest possible units are welcome, but in order to make predictions what can occur in spontaneous speech one has to take into account grammatical categories (syntax, lexicon, morphology), socio- and dialectal- variation, eventually speech pathology, pragmatics, and certainly the intonational structure of speech.

14 Gulden (1985) goes so far as to postulate a separate phonological system for English proclitics.

15 cf. Bolozky (1977).

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