COMPUTER-ASSISTED EXAMINATION OF THE PHONETIC VARIANCY OF SPONTANEOUS SPEECH /A PRELIMINARY REPORT/

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ABSTRACT

Tape- recorded texts have been transcribed by means of the sequential transcription of phonetic variancy. The transcription, adjusted to the computer keyboard, includes information on: 1. a phonetic transcription of a tape-recorded textes, 2. the pronunciation model adopted for the purposes of this work, 3. certain orthographic phenomena, 4. some other paralinguistic phenomena.

On the basis of the adopted transcription and assisted by the IBM compatible we have been able to develop a dictionary of phonetic realizations of all the text words and tables of phonetic realizations of allophones and allophonic clusters.

DESCRIPTION OF THE MATERIAL

The material examined consisted of tape recordings of spontaneous, casual conversations with students at Adam Mickiewicz University. The recordings were made under good acoustic conditions. Texts of conversations with 30 speakers were analysed. Each text was about 2000 words long. In total, over 66 000 words were analysed.

PHONETIC TRANSCRIPTION

All the material to be analysed was transcribed phonetically. The accuracy of the transcription of particular realizations depended on the auditory sensitivity of the transcribers. In our transcriptions we used over 100 different signs /symbols, letters/ to denote allophones discriminated in the speakers pronunciation.

The term allophone as used here means a set of homophonic sounds; i.e. they differ only with respect to insignificant phonetic features. With respect to specific phonetic realizations, allophones are at the first level of abstraction, and phonemes are at the second level of abstraction. We are aware of the fact that even the most accurate phonetic transcription cannot truly reflect the reality but only interpret it. The interpretation depends not only on the predispositions of the phonetician, his/her hearing habits, but also on the adopted manner of notation - this is mentioned by numerous linguists(D.Abercrombie/1/)In the texts under analysis we came across fragments which differed with respect to distinctness - sometimes entire phrases were pronounced very indistinctly, rapidly, "mumblingly" - hence it was not possible to transcribe all the material by means of typical phonetic symbols. Only fragments which were pronounced in a relatively careful manner were included in the analysis of phonetic variancy. In the remainder of the analysed material two degrees of "obliteration" or articulatory carelessness were distinguished. Such fragments /1. indistinct, 2. incomprehensible/ were also analysed, yet since they were treated as separate entities they will not be discussed here.

The generally accepted principles of phonetic transcription were used to account for fragments considered distinct.

THE PRONUNCIATION MODEL

By "phonetic variancy" we mean different phonetic realizations that occur in phonetic phrase (e.g. between phonetic pauses;M.Steffen-Batogowa/4,p. 27 /).

In order to examine phonetic variancy, it appeared necessary to adopt a uniform pronunciation model as a point of departure for the description of specific pronunciations of the informants. /In principle, it agrees with the Polish orthophonic norm, cf. Madejowa, M./3/. When different realizations are possible, however, only one had to be selected.

The model is uniform within phonetic phrases; therefore particular words can have some collaterant forms, that agree with the pronunciation model e.g. [jɛst sam] but [jɛzd̪ gɔ̃a] or [jɛst; irɛk]. The source of "differentness" is a specific phonetic position. Such realisations, compatible with the model, are not regarded as indications of phonetic variancy.

THE SEQUENTIAL TRANSCRIPTION

Before the computer could be used for phonetic analysis, the phonetic transcription had to be modified to suit the QWERTY

keyboard. We used letters and other symbols occuring in the EBCDIC code, the standard code of all computers.

Some of the following principles were observed while developing the sequential transcription:

1. Letters and diacritical marks occur in one line of the text.
2. Since the letters available on the keyboard are fewer than the number of allophones used in the transcriptions of phonetic realizations, it was necessary to introduce certain diacritical marks.
3. One allophone is represented by one symbol; the symbol begins with a letter of the alphabet followed by diacritical marks.
4. The transcription we propose whenever possible resembles the Slavonic, international or orthographic transcriptions so that it is easy to read the text.
5. For technical reasons only upper case letter are used.
6. Other symbols used denote paralinguistic and other phenomena /features/ which accompany pronunciation such as laughter, stuttering, indistinct pronunciation, incomprehensible pronunciation. These phenomena will not be discussed in this article.

Table 1 includes the set of 70 allophones of the pronunciation model transcribed both in the international alphabet and the sequential alphabet.

The phonemes are marked by numbers that indicate the alphabetical order, adopted in "The Dictionary ..." and "The Tables of phonetic realization ...".

TABLE 1. The international and the sequential transcription of allophones of pronunciation model.

	/API/	{seq.}	
1.	ə	A	
2.	b	B	
	bʲ	B,	
3.	t͡s	C	
	t͡sʲ	C,	
4.	t͡ɕ	C"	
5.	t͡ʃ	C.	
	t͡ʃʲ	C.,	1
6.	d	D	
	dʲ	D,	
	d	D.	
7.	d͡z	Z1	
	d͡zʲ	Z1,	
8.	d͡ʑ	Z1"	
9.	d͡ʒ	Z1.	
	d͡ʒʲ	Z1.,	
10.	ɛ	E	
11.	-ɛ	E-	2
12.	f	F	
	fʲ	F,	
13.	g	G	
	ɟ	G,	
14.	x	X	
	ɕ	X,	
	ɦ	H	
	ɦʲ	H,	
15.	i	I	
16.	j	J	
17.	ɲ	J=	
18.	k	K	
	c	K,	
19.	l	L	
	ɫ	L*	
	ʎ	L,	
20.	w	W	
	ʷ	W*	
21.	ẘ	W=	3
22.	m	M	
	mˠ	M*	
	mʲ	M,	
23.	n	N	
	nˠ	N*	
	nʲ	N,	
	n	N.	
24.	ŋ	N4	4
25.	ɲ	N"	
	ɲ̟	N"*	
26.	o	O	
27.	p	P	
	pʲ	P,	
28.	r	R	
	rˠ	R*	
	rʲ	R,	
29.	s	S	
	sʲ	S,	
30.	ɕ	S"	
31.	ʃ	S.	
	ʃʲ	S.,	
32.	t	T	
	tˠ	T*	
	tʲ	T,	
33.	u	U	
34.	v	V	
	vʲ	V,	
35.	ɫ	Y	
36.	z	Z	
	zʲ	Z,	
37.	ʑ	Z"	
38.	ʒ	Z.	
	ʒʲ	Z.,	

Remarks on Table 1.

1. Some allophones, e.g. [t͡ʲ], [d͡ʒʲ] could occur in between words or in words of foreign origin, e.g. [d͡ʒʲi͡ʃsy].
2. The oral pronunciation of {E-}, e.g. "idę"-{IDĘ-} has been adopted as an equivalent of the orthographic final "-ę". The "minus" sign after {E} signals merely that we have an allophone, an equivalent of the orthographic "-ę". Thanks to this notation it was easy to calculate whether in this position we had the oral or nasal pronunciation. This also permitted the discrimination of such pairs as e.g. "chce" and "chcę" in the "Dictionary ...".
3. Since in the transcriptions of phonetic realizations nasal vowels were written asynchronically, making a distinction between hard and soft nasal resonance, the symbol {W=} was introduced into the phonological system to denote a hard nasal element and the symbol {J=} to denote a soft nasal element, e.g. "koński" was transcribed as {KOJ=SK,I} and "kąski" as {KOW=SK,I}.
4. The retention of phonemes [n] and [ŋ] in the system permits discriminating between such pairs as "błonka"-[bwɔnka] and "błąka"-[bwɔŋka].

DIACRITICAL MARKS WHICH EXPAND THE ALPHABET OF THE PRONUNCIATION MODEL

The number of allophones in the pronunciation model was strictly defined while the number of allophones which occurred in the transcriptions of specific phonetic realizations was much greater and could not be predicted. For example, while transcribing our test material we heard several times a sound described as bilabial "w" - this articulation does not belong to the pronunciation model and is rarely described in works devoted to the phonetics of modern Polish. On the other hand, we have reserved a symbol for [ʔ] - yet no occurrence of this allophone has been detected. In Table 2 we give a set of diacritical marks /with examples of their use/ which permit expanding the alphabet of the pronunciation model. They denote certain phenomena or phonetic features and with the exception of [ə] and [ʔ] constitute a complete whole together with the preceding letter. Owing to this solution we get an open set of symbols which can be freely modified to serve various purposes.

TABLE 2. Symbols expanding the alphabet of the pronunciation model.

Symbol	Meaning
ə	shwa
ʔ	laryngeal occlusion,
+	nasalplosion
4	a change of the place of articulation, e.g. {V4} - a bilabial fricative /the typical Polish [v] is labio-dental/
-	minus after a consonant denotes aspiration, e.g. {T-AKA}
:	prolonged articulation, e.g. {TA:KA}
;	an element of geminate, e.g. {POT; TYM}
%	a vocalic consonant/related to the elision of a vowel/
?	weakened articulation, e.g. {XC"AW?A}
,	softening, e.g. {M,JAW, IS"C"}
#	devoicing, e.g. {FS.YSTKO#}
5	equivalent of "complex" notation; combines two preceding symbols, thus expanding the vowel set, e.g. [ɛ̯̃] - {AE5}.

SEQUENTIAL TRANSCRIPTION INCORPORATING PHONETIC VARIANCY

Texts transcribed phonetically were entered in the computer memory by means of the sequential transcription incorporating phenomena of phonetic variancy. Thanks to their incorporation all differences between phonetic realizations and the adopted pronunciation model were indicated. Three types of phonetic changes were taken into account: 1. the disappearance /elision/ of allophones or allophonic clusters, which was denoted with a slant following the letter, 2. the addition of allophones which was denoted by figure "6", 3. qualitative changes which were denoted by means of angle brackets. The "<...>" brackets embrace the pronunciation model and the ">...>" brackets embrace the phonetic realization. This can be illustrated as follows:

a/ Phonetic transcription: [t͡ʃɛã̯ ɕɛ nawut͡ʃɨt͡ɕ]
b/ Pronunciation model: [t͡ʃɛba ɕɛ- naut͡ʃɨt͡ɕ]
c/ Sequential transcription of phonetic variancy /denoted by braces/:
{<T.S.>C.>EB/A S"E- NAW6UC.YC"}

Depending on the aim of work the manner of sequential transcription proposed here can be easily modified, e.g. by changing the combination of symbols or by assigning them a different meaning. With a few modifications introduced into the program it is possible to analyse dialectal pronunciation, progress in the mastery of foreign language phonetics, development of child s speech and numerous other phonetic problems.

The symbols used to denote disappearance /elision/, addition and substitution of allophones as well as other symbols used in the transcription of phonetic variancy helped to compare phonetic transcriptions of the realizations with the adopted pronunciation model. Those other symbols for comparing the pronunciation model and the phonetic realization will not be discussed.

THE PHONOLOGICAL SYSTEM

The pronunciation model was uniform for a speech sequence and not for words pronounced in isolation. Therefore, particular word entries could have several optional forms compatible with the model. In order to arrange the material for the sake of the computer program we introduced a phonological system developed for the purposes of this work. Phoneme is treated as an element representing a class of allophones, and it is capable of discriminating meanings - hence we adopted a semantic definition of the phoneme. Thus, both in the "Dictionary of phonetic realizations" and "Tables of phonetic realizations of allophones and allophonic clusters" we got an adequate classification of the texts under analysis /adequate = meeting the expectations/. It is worth adding here that over 100 allophones occurred in the transcriptions of specific realisations, 70 allophones were present in the adopted pronunciation model, and 38 phonemes constituted the phonological system. Thus, the adopted phonological system proved very economical at different stages of data processing.

DICTIONARY OF PHONETIC REALIZATIONS

On the basis of the texts we have developed a "Dictionary of phonetic realizations". In the transcriptions cited in the previous part of this paper, words are separated by a space. We have adopted the graphic definition of the word, and segmented the text in accordance with the principles of Polish orthography. Hence, a word as it appears in the text and not merely its base form is the basic unit. Texts 66 398 words long produced 8 720 different entries. Entries written phonologically are arranged alphabetically /cf. Table 1/. /Unfortunately, the orthographic forms of the words had to be handwritten/. The structure of entries is illustrated below:

Phonological transcription	Orthographic transcription		
Allophonic transcription of specific realization in the rank order within the entry		b	c
/VJEZ1"AWAM/	"wiedziałam"	26	100.0
1. V,JEZ1"AAM		21	80.8
2* V,JEZ1"AWAM		2	7.7
3. V,IZ1"AAM		1	3.8
4. V,JEZ1"AAW=		1	3.8
5. V,JEZ1"AAM,		1	3.8

Remarks on the structure of entries.

a/ Asterisk denotes optional forms, compatible with the pronunciation model and different with respect to the phonetic context.

b/ The number of occurrences of a given realization in the texts analyzed.

c/ The percentage of occurrences of a given realization within a given entry.

The "Dictionary ..." is supplemented with the "Rank index". Entries transcribed phonologically have been arranged in their rank order; their rank number and the number of occurrences in the material tested have been given.

TABLES OF PHONETIC REALIZATIONS OF ALLOPHONES AND ALLOPHONIC CLUSTERS

In linguistic investigations, depending on the aim of the work or the researchers interests, morpheme or syllable are regarded as units whose order is higher than that of the phoneme. In some phonetic works a cluster of phonemes is a unit whose order is higher than that of the phoneme. For example, in B. Dunaj s monograph[2] the phonetic variancy in the pronunciation of consonant clusters of modern spoken Polish is studied. Text segmentation into consonants and consonant clusters and, by analogy, into vowels and vowel clusters /diphthongs and triphthongs/ proved very useful for our purposes. Below we illustrate the segmentation of a text prepared for the sake of the "Tables" transcribed phonologically by means of the sequential transcription /the phonetic variancy was not taken into account to avoid complicating the notation/. The unit-boundaries are marked by vertical lines:

{|J|E|ZD V; V,J|EJ=|Z"|E|N"|U|}

The "Tables of phonetic realizations" are arranged similarly to the "Dictionary of phonetic realizations". The entry consists of a speech sound or a cluster written phonologically, the rank order and the number of occurrences in the material analysed. Next, in the rank order, the following information is given: 1. phonetic transcription of specific realizations, 2. the number of their occurrences in the text, 3. percentage of occurrences of a given realization in relation to the entire group.

CONCLUDING REMARKS

An analysis of the "Tables" permits formulating conclusions on the phonetic variancy occurring in the analysed texts. Comparing data in the "Tables ..." and those in the "Dictionary of phonetic realizations" we can evaluate which of the phonetic changes are phonetically conditioned and which are lexically motivated. For example we have observed that the elision of [w] in the intervocalic position occurs most frequently in the third person of verb forms in the past tense, e.g. "chciała"-[xtɕaa̯], "myślała"- [mɨɕlaa]. In other word forms, in a similar phonetic surrounding, e.g. [mama], [kɔwo] elision is also present but much less frequent.

On the basis of the sequential transcription of phonetic variancy developed with the help of a computer program we can examine numerous phenomena which have not been mentioned here. Apart from typical phonostylistic examinations we can also obtain data on the distinctness of pronunciation of various speakers, paralinguistic phenomena etc.

It is purposeful to use the proposed method for analyses of a large set of texts and when we want to analyse various phonetic phenomena simultaneously. If short texts are available or if only certain phonetic problems are examined, there is no point in using the computer.

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