

THE VARIATIONS IN THE WORD PHONETIC STRUCTURE CAUSED BY
SPEECH TEMPO VARIATION

LILIA VYGONNAYA

Dept. of Experimental Phonetics
Institute of Linguistics
Minsk, Byelorussia, USSR 220000

ABSTRACT

Observations of the changes of word phonetic structure show that the constitutional language features are less changeable as compared to the intonationally relevant speech characteristics. It is confirmed experimentally that speech tempo evaluation is based not only on length but on other prosodic parameters.

It is important to ascertain the nature of the changes in the phonetical structure of a word in the light of essential dependence of a word phonetics on a phrase prosody and a speech tempo in particular / 1,2,3/.

Changes of the phonetical structure of a word within the bounds of narrative sentences of various length caused by quickening or slowing down a speech tempo were analysed. Speech recordings of the Byelorussian literary language speakers from different dialectal zones served as a base material for the research. The speakers reproduced the experimental text containing 21 phrases, 1981 sounds at a normal, fast and slow tempo. The text included phrases of the type: Невысокі хударлявы чалавек размерана роўна хадом ідзе лесам. Лес, ахінуўшы свае плечы белым накідкам, урачыста захоўвае цішыню і спакой. Такі лагодны спакой бывае толькі ў мінуты мудрага разважання. Зоркай іншага сусвету бліснуў кляновы ліст, што раптам з'явіўся перад вачыма на дарозе. Навальніца -- атмасферная з'ява, пры якой у магутных кучава-дажджавых воблаках і паміж воблакамі і зямлёй пры вялікай напружанасці атмасфернай электрычнасці ўнікаюць моцныя электрычныя разрады -- маланкі. Зімяня навальніцы бываюць вельмі рэдка. Агульны зарад асобнай маланкі невялікі.

The selected material was recorded in a studio. It was subjected to the acoustic and instrumental analysis and the data were subsequently processed mathematically. The transcription of the text was carried out with the help of a segmenting apparatus (a tape recorder with rotating heads) which permitted to hear repeatedly word segments from 10 to 900 ms long as well as a whole word with extracted segments. The text transcription was controlled visually with the help of the oscillograph. Duration of phrases, pauses, word groups pronounced without pauses as well as of sounds and open syllables was defined. Errors in phrase duration did not exceed $\pm 0,5$ s and could be perceived ($\approx 15\%$) only when analysing definite short phrases uttered at a normal and fast tempo.

In experiment the text was read by 29 men and 11 women at the age of 25-30 years. They were representatives from the north-eastern (14), south-western (16) and mid-Byelorussian dialects. (10).

Determination of the mean tempo of speakers pronunciation showed that they uttered at mean, slow and fast tempo individually /4/.

14 speakers pronounced the text with the mean sound duration from 69 to 80 ms, 18 speakers uttered with the mean duration from 82 to 88 ms. In 8 cases this magnitude exceeded 92 ms.

The comparison of the figures obtained with the data characterizing Russian speakers shows, that the Byelorussian speech tempo is slower, than Russian / 5, 6/.

Regular qualitative and quantitative sound variations due to the changes of speech tempo were analysed. There is no doubt that speeding up or slowing down of articulation causes certain qualitative sound changes. Nevertheless no delimitation of phonetical phenomena caused mainly by the changes in speech tempo or caused by some other reasons in different languages was made although it is of a typological nature. It is obvious that even a considerable quickening and slowing down of speech tempo (by 1,5 - 2 times) does not cause a loss of speech

perceptibility and its categorical language features.

The analysis of the transcribed material was carried out with regard to syntagmal division of a phrase, sandhi vocal and consonant speech errors such as false starts, word substitutions, word omissions, hesitation pauses were taken into account and their number of various speeds of utterance was registered. It was defined that the character of speech errors was not directly connected with a certain type of changes in speech tempo. Word omissions, substitutions of short words for long ones were observed at a slow tempo (рэльеф ~ рэльеф, процілеглага ~ працяглага). Word transpositions (яркае свячэнне ~ свячэнне яркае; моцна разграе ~ разграе моцна; забяспечвае зямлю ~ зямлю забяспечвае; лідэр даходзіць ~ даходзіць лідэр; у адваротным кірунку ~ у кірунку адваротным; ударную гукавую хвалю -- пярун -- пярун -- хвалю), repetitions (што -- што, свячэнне -- свячэнне) and insertions (гэта, яны, ён, той), substitution of long words for short ones (палове дня ~ палавіне дня) were observed at fast tempo. Hesitation pauses were more frequent at a slow tempo, false starts of words (mainly of phrase initial words) were more frequent at a fast tempo (лес ~ леса, села; такі ~ які; цэлы ~ малы; зоркай ~ за зоркай, зойкай, сузодкай; большасць ~ больш; пры гэтым ~ гэтым, пры тым). In the overwhelming majority of instances a considerable change in a speech tempo caused certain phenomena which are to be found in the speech of announcers while in the state of emotional stress /7/.

The degree of speech segments fusions, quantity, quality and localization of pauses depended on a tempo (mean tempo: Невысокі хударлявы чалавек /120 ms/ размерана роўна хадом /190 ms/ ідзе лесам /810 ms/ Лес ахінуўшы свае плечы /450 ms/ і спакой /520 ms/. Fast tempo: Невысокі хударлявы чалавек размерана роўна хадом /80 ms/ ідзе лесам Лес ахінуўшы свае плечы белым накідкам /60 ms/ урачыста захоўвае цішыню і спакой /100 ms/ урачыста захоўвае цішыню і спакой /100 ms/). Intonational structure of phrases changed considerably with quickening or slowing down of the speech tempo. At a slow tempo the role of a word stress and separability of each word increased as well as the number of words having a strong stress and the number of cases of laying a secondary stress increased (Невысокі, хударлявы, чалавек, старасвецкіх, асірацеля, атмасфернай, распрацаваў, дажджавы, ледавіковае, размерана, роўна, з павышаных). Laying of independent stress on dynamically unstable words was observed as well, (на дарозе, не варушачы, на дарозе, пры якой, і паміж воблакамі, на Беларусі, над узвышанымі, да вясеннаццаці, на зям-

лём, каля ста, за адну, і дадатныя, да зямнога, са слабым, па якім, да зямлі, ад зямлі, пры гэтым, цякуць у распрацаваных, на інтэнсіўнасць). At a quick tempo the number of word stresses and separable units reduced (свае плечы, такі лагодны, цэлы гэты, калі лясы, што забяспечвае, што моцна, так што, палове дня, больш моцны), the loudness increased. Melodic structure of phrases was also subjected to changes dependent on tempo variations.

An increasing significance of speech flow vocalic elements was registered among the most important interword phonetics phenomena, observed in low speed. Their weakening was observed when a speech tempo quickened, the alternations of syllabic and asyllabic elements уу, іі, existing in the Byelorussian language, at a slow tempo were mainly in favour of syllabic elements, while at a fast tempo they were in favour of asyllabic ones (Slow tempo: толькі ў мінуты; дубы у чорных шапках; купалі у сонцы; размешчаныя у басейне; накідкаў урачыста; паміж воблакамі і зямлёй; высечкамі і прасекамі, азёры і балоты. Fast tempo: толькі ў мінуты; дубы ў чорных шапках; купалі ў сонцы; размешчаныя ў басейне; накідкаў урачыста; паміж воблакамі і зямлёй; высечкамі і прасекамі; азёры і балоты).

In the sphere of vocalism a change in vowel correlation according to their duration was fixed. It depended on a tempo change direction and was more significant in regard to low and mid vowels. At a slow tempo the vowels became longer, at a fast tempo they became shorter. Qualitative vowel changes at a fast tempo did not exceed the limits of phenomena observed in the case of reduction (воблака ~ воб/ль/ка; у воблаках ~ у воб/ль/ках; дажджавых ~ даж/дж/вых; найчасцей ~ най/ч/сцей; чалавек ~ ча/ль/век; урачыста ~ у/р/чч/ста; разважання ~ /р/зв/жання; асірацеля ~ асі/р/целя; асі/р/целя/ы/; палове/нь/) /8/. Tempo variations did not influence the phenomena of "jakanje" and "akanje".

Changes in duration of consonants are less essential as compared to those typical for vowels. A number of phonetic changes affecting consonants were not connected with tempo variations. For instance the simplification of consonant groups accompanied by weakening or loss of plosive and omission of sonants were observed mainly at a fast tempo (старыя ~ стар/нь/; атмасферная ~ атмасфер/аа/; адмоўныя ~ адмоў/нь/; дадатныя ~ дадатн/нь/; найчасцей ~ начасцей; участкамі ~ учаскамі; частцы ~ часцы; электрычнасці ~ элетрычнасці). At the same time the simplification of consonant clusters caused by vocal insertions and the loss of a word final consonant was registered at all the three speech tempo gradations (мачы-

масць ~ магчымась; лясістасць ~ лясістасць; напружанасць ~ напружанасць; дваццаць ~ /дзв'аццаць; стварэння ~ /сът/варэння; папярэдніцае ~ папярэ- /днн/іцае). The speech tempo did not influence the hardness and softness of correlation of consonants. In some cases residual ties of speakers with certain dialectal zones were reflected (раскінуўся ~ ра/с'к'/інуўся; іншы ~ і/н'ш/н; вясечкамі ~ вісечкамі; выклікае ~ віклікае, ліпень ~ ліпен).

The data obtained permit to draw a conclusion that the constitutional features of a language (a dialect) are better presented with the tempo variations than those having predominantly intonational significance. They conform to the existing notion about the stability of certain phonetical features at various speeds of pronunciation and about the absence of direct ties between changes in a speech tempo and word phonetics /9,10,11/.

A series of perceptual experiments, in which 20 persons evaluated a tempo of sound segments of various length (one to twenty syllables) was carried out. Identical lexical sound units (phrases, word groups, separate words), pronounced by one and the same person at three various tempi were extracted from the experimental text, then assembled in pairs and in triads (the distance between the segments was 0,2; between the pairs and triads - 2s) and was produced to the auditors to identify the tempo of each speech fragment. Each speed stimulus produced was repeated 72 times.

The analysis of the speakers ability to identify various prosodic qualities of a phrase and its parts is necessary, because objective characteristics of speed signal and prosodic markers do not correspond to each other directly. While it is easy to single out objectively certain acoustic parametres of a speech signal, it is impossible to state definitely how their perception and evaluation are carried out. The obtained experimental data made it possible to see to what degree the auditors are able to compare different speech segments according to their intonation pattern using mainly one of its acoustic parametres - a tempo.

It is found out that the tempo of a whole phrase was identified better, than the tempo of its separate fragments. The full tempo was evaluated better, than the articulatory one. The degree of deviation of speed segments duration in quick and slow tempo from the same units pronounced at an average tempo was compared to the identification level of the produced segments. The comparison showed that identification was better when the segments produced to the auditors at a fast tempo were 4-7% times shorter and at a slow tempo 10-12% longer than the corresponding segments.

Such improvement of tempo identification was observed when segments consisting of 6 to 18 syllables were identified. The auditors identified better those segments pronounced at a fast tempo which not only differed temporally, but were also characterised by slightly increased loudness and more expressive melodic patterns. A phrase, pronounced in fast tempo was characterised by a special marking of the first word, which didn't change the melodic frame of the whole phrase. Stressed syllables of other words were shaped independently. A considerable rising-falling tone movement was observed even in a post-stressed syllable, marked out in a special way. The total quantity of melodic peaks was greater than in slow pronunciation of the phrase. The perception of a tempo by the auditors was based not only on the evaluation of duration but on other prosodic parametres as well /12/. It provides the grounds to state that the language phenomena defined by the term "Speech tempo" is a complex one from the point of view of a language speaker and duration is one of its constituents.

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