RELATIVE IMPORTANCE OF ACOUSTIC FEATURES FOR PERCEPTION OF LITHUANIAN STRESS

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AESTRACT

The relative importance of acoustic features for perception of word stress in Standard Lithuanian has been studied by method of artificial substitution using a computer.

Like in most languages, in Standard Lithuanian word stress is based on a number of acoustic features of sounds, i. e. duration (T), fundamental frequency (Fo), intensity (I), spectrum (S). Direct instrumental analysis of speech, however, is unable to reveal relative importance of the above features. In our opinion, the relative importance of acoustic features for perception of word stress may be effectively studied by method of artificial substitution. The method suggested may be defined as intersubstitution of acoustic features between members of an accentual opposition. Such modification of words makes it possible to reveal a certain competition of features.

To this aim the words kitas ("other" nom. sing. masc.) and kitàs ("others", acc.pl. fem.) pronounced as statements by male speaker were fed into a BESM-6 computer via a digital converter (sampling frequency-50,000 cps). The prosodic features of both vowels in the word kitas were modified according to the model of the word kitàs and vice versa. The features were substituted one by one, in pairs and all the three together. In addition, the vowels of kitas were transferred to the word kitàs and vice versa. The variants of natural and modified words were recorded in random order and presented to 45 listeners. These were asked to find which of the two words (kìtas or kitàs) is heard and which of two intonations (statement or question) was used.

The results of auditory experiments are presented in Table 1. The data obtained show that the feeding of the words into the computer followed by a reproduction do not distort the word stress: non-modified words (kìtas 1, kitàs 1) were perceived adequately. When the stressed and unstressed natural syllable nuclei of the quasi-homonyms were replaced paradigmatically, the perception of stress underwent a radical change:the listeners heard kitàs instead of kìtas and vice versa. Consequently, we believe the main carrier of information on word stress to be the syllable nucleus.

Having changed the acoustic features of vowels, the perception of stress varies to some degree.The percentage of auditory responses (i.e. in how many cases one or another feature is helpful in perceiving word stress) can be considered an indi-

Table 1

Perception of stress and intonation (%, N=90). Variants of stimuli: 1 - (T,Fo,I, S/-), 2 - (Fo,I,S/T), 3 - (T,I,S/Fo), 4 - (T,Fo,S/I), 5 - (I,S/T,Fo), 6 - (Fo,S/T, I), 7 - (T,S/Fo,I), 8 - (S/T,Fo,I), 9 - (-/T,Fo,I,S), where in brackets unchanged features are presented before a slash (/) while the modified features are given after it. Statement is marked by a point (.) and question - (?).

Stimuli	Perception				Adequate stress perception
	kìtas		kitàs		
	.	?	.	?	
kìtas 1	97.8	2.2	-	-	100.0
kitàs 1	-	-	93.3	6.7	
kìtas 2	97.8	1.1	1.1	-	97.8
kitàs 2	1.1	2.2	92.2	4.4	
kìtas 3	6.7	78.9	10.0	4.4	86.7
kitàs 3	7.8	4.4	71.1	16.7	
kìtas 4	46.7	5.6	44.4	3.3	63.3
kitàs 4	6.7	18.9	50.0	24.4	
kìtas 5	11.1	44.4	36.7	7.8	44.4
kitàs 5	58.9	7.8	27.8	5.6	
kìtas 6	25.6	7.8	61.1	5.6	37.2
kitàs 6	1.1	57.8	27.8	13.3	
kìtas 7	-	18.9	57.8	23.3	11.1
kitàs 7	92.2	4.4	1.1	2.2	
kìtas 8	1.1	3.3	88.9	6.7	2.8
kitàs 8	91.1	7.8	1.1	-	
kìtas 9	1.1	1.1	93.3	4.4	1.1
kitàs 9	80.0	20.0	-	-	

cator of relative importance of those features. Thus, the decreasing sequence of separate features was found to be:

I > Fo > S > T
36.7% 13.3% 2.8% 2.2%

As in changing any separate feature the words were preceived adequately in more than 50% of cases, no individual feature can be considered as a relevant one since it is unable to rival the complex of other features. Much more effective are combinations of two features whose relative importance for perception of stress is as follows:

(Fo,I)>(T,I)>(T,Fo)>(I,S)>(Fo,S)>(T,S)
88.9% 72.8% 55.6% 44.4% 37.2% 11.1%

Especially effective are complexes of three features:

(T,Fo,I)=(Fo,I,S)>(T,I,S)>(T,Fo,S)
97.8% 97.8% 86.7% 63.3%

The data presented in Table 1 also show that stress perception is related to perception of intonation. When listening to the stimulus kitas 3, for instance, most subjects basing on the non-modified features (T,I,S) heard the first syllable stressed while the contour of the fundamental frequency(Fo) transferred from the word kitàs was evaluated as the indicator of interrogative (rising) intonation.
The present experiment shows that it is combination of acoustic features with a different degree of relevance that makes a phonetic basis of Standard Lithuanian word stress. It has been also found that in the process of perception a distribution of features between word stress and intonation does take place.