THE ROLE OF AUDITORY CONTROL IN SPEECH MONITORING

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ABSTRACT

Auditory control is functionally significant in monitoring unskilled speech performance, while skilled performance is rather independent of the auditory sensorium information and is evidently monitored on a higher level than the level of motor or auditory control.

INTRODUCTION

Present-day work does not provide much data concerning self-monitoring of on-going speech. The present study is an attempt to analyse the functional significance of auditory control in speech.

Experimental observations of the effects of delayed auditory feedback point out the critical role of auditory control in monitoring vocal intensity /3/, rhythm and speaking rate /5/ and articulation accuracy /4/.

These and some other findings have been concerned with the importance of audition in monitoring speech automatisms; the experiments were run with adult subjects speaking their native language. However, some investigators of the effects of delayed auditory feedback on non-speech behaviours take the view that the role of auditory control is functionally changeable and depends on the operator's skill. It has been shown that during music performance /1/ and Morse transmission /7/ complex tasks were more greatly disturbed than easier tasks by the delay. The observation is also supported by the experimental data received by J.E.Waters /6/. His subjects from the age of 10 to 18 read outloud under delayed auditory feedback conditions. The older subjects were less affected by the interference and made fewer mistakes than younger subjects. The results may be interpreted in terms of less (younger readers) or more automatized reading skills (older readers). That calls for a closer investigation of the role of auditory control in the period of skill acquisition.

A study of the functional significance of auditory control in monitoring unskilled, semi-skilled and skilled speech performance can provide additional information which speech automatisms obscure. The purpose of the study reported herein is to investigate the problem through experiment.

METHOD

64 college undergraduates (aged 18-24) served as subjects. All of them learned English as a foreign language, with language experience varying from one year (32 subjects, hereafter referred to as beginners) to four years (32 subjects, hereafter referred to as advanced learners). Each of the subjects was required to describe a series of pictures under three conditions:

1) neutral (absence of experimentally induced disturbances),

2) binaural masking (white noise transmitted through earphones),

3) absolute silence (sound-proof earplugs fastened on the head of the subject).

Throughout the session the order of the series within the groups varied and was as follows: 1-2-3, 2-1-3, 2-3-1, 3-2-1,3-1-2. The descriptions were recorded on magnetic tape for later statistical analysis. The samples were analysed for the presence of error performances and the number of self-corrected errors (statistical units totalling 5702).

RESULTS AND DISCUSSION

Our findings support some of the data received under delayed auditory feedback: 1) subjects monitored loudness of speaking (it increased under white noise and decreased under quiet), 2) for both groups speaking rate changed as the result of longer pauses and word or syllable repetitions.

Monitoring of on-going speech proved to be much dependent on the conditions of auditory control. Of the two experimental conditions, absolute silence was more disturbing than white noise.

Beginners were more dramatically affected by auditory disturbances than advanced learners. The interfering influence of their native language (Russian) was felt much stronger under the experimental conditions. First, their articulatory accuracy was seriously impaired. They tended to use Russian substitutes of English sounds, but seemed to be unaware of the fact, as there were no corrections of the errors. Another striking observation is that 7.4% of their sentences under white noise and 5.3% under silence were meaningless in English, but could be traced structurally to analogous sentence patterns in Russian. For example, "She tried to keep the room in tide (tidy)", "They had to live him in their room (let him live)", "They lived in four (there were four of them). Mistakes of the kind

were also uncorrected by the speakers. Though the subjects were free to use patterns they knew best, they failed to avoid grammar and lexical errors. The most common classes of grammar errors were articles, tenses, verb forms, and those of lexical - prepositions, choice of words and word-blending. The number of those errors grew in the beginners' speech output from 13% to 27% under white noise and 15% under silence[x]. In the interpretation of the third figure we have to take into account that the subjects were most reluctant to talk under absolute silence. They tried to escape the situation by making their descriptions very short and by using a limited stock of words and grammar structures.

The subjects' ability to detect and correct errors was significantly affected by the experimental conditions. The percentage of self-corrected errors decreased from 24% in neutral conditions to 18% under white noise and to 12% under quiet.

The overall observation is that the speakers much depended on audition in monitoring their speech performance.

Advanced learners were less affected by the experimental conditions. There was also an increase of errors in their performance, but it was less significant: 8% in neutral conditions, 11% under white noise and 11.2% under absolute silence. Articulatory deviations were few and mainly concerned with full devoicing of final voiced consonants (Russian influence). The mistakes were not corrected either.

The subjects' grammar and lexical errors fall into the same classes as those of the beginners, but they are of different nature. Thus, there were no article omissions but articles were often inadequately used; tense mistakes occured not in isolated sentences but inside the sequence-of-tenses paradigm. While beginners used forms, like "feeled", "lucky to got", advanced learners occasionally produced forms that could be taken for blended, e.g. "introduceded", "they got marriaged". The errors of word choice were more numerous in the speech of advanced learners, which is probably due to a higher level of lexical programming. For example: "She was over hair (head) and ears in work", "Ted and Ann were a newly-made (married) couple".

Enigmatically, their number decreased under experimental conditions.

Unlike beginners, the advanced learners were not at all reluctant to talk under absolute silence. They even tried to make their descriptions more "beautiful" which resulted in quite a number of bookish, unnatural expressions. For example, "He came into their view with a girl", "He changed his figure into a stout one", "His thought gave result".

Error-correction of advanced learners was less effective under experimental conditions. The corresponding percentage was 17% for neutral conditions, 13.8% under white noise and 12% under absolute silence.

On the basis of data received we assumed that semi-skilled speech performance is rather independent of the auditory sensory alterations.

In an attempt to support the assumption we asked 10 college teachers with a perfect command of English to give their descriptions of the pictures under white noise and absolute silence. Neither of the conditions had any consistent effect upon their speech performance. The only alterations were longer pauses and an increased number of word repetitions. The subjects were fully able to monitor their performance without the benefit of auditory control. In fact, there were only two slips, and these were immediately corrected.

CONCLUSIONS

The results of the study show that the functional significance of auditory control in monitoring unskilled, semi-skilled and skilled speech performance is different.

It is the greatest in monitoring unskilled performance, significantly reduced in monitoring semi-skilled performance and is minimal in monitoring skilled speech performance.

This seems to be well related to N.Bernstein's idea of a multi-level natur of control /2/. In reference to speech it can mean that unskilled speech performance is monitored on the basis of current sensorium information, while skilled performance is monitored on a higher level (hypothetically, sense-level) which is independent of the afferent information received by the ear.

In the period of deranged speech automatisms restoration auditory control may even become a hindrance. We observed two brain-damaged patients during their rehabilitation period. They showed much better speech performance when talking with the ear plugs than when they were aware of the acoustic effect of their performance.

This may turn out true in cases of stutters.

Altering audition may serve as an effective means of checking the degree of speech habit formation. When formed, they remain intact.

The way we see it, the results of the findings may be applied in language teaching and logopedics.

x) These and other figures are statistically significant.

References

1. Ansell, S.D. Delayed auditory feedback and human skill. "Dissertation Abstracts", v.26, No.5554. USA, 1965.
2. Bernstein, N.A. The coordination and regulation of movements, Moscow: Medgiz 1947.
3. Black, J.W. The effect of delayed side-tone upon vocal rate and intensity "Journal of speech and hearing disorders". 16, 1951.
4. Fairbanks, G., Guttman, N. Effects of delayed auditory feedback upon articulation. "Journal of speech and hearing disorders", v.I. No.I, 1958.
5. Kozhevnikov, V.A. and Chistovich, L.A. (eds.). Speech: Articulation and Perception, Moscow: Nauka, 1965.
6. Waters, J.E. A theoretical and developmental investigation of delayed speech feedback. "Genetic psychology monographs". 78 (I), 1968.
7. Yates, A.J. Effects of delayed auditory feedback on Morse transmission by skilled operators. "Journal of experimental psychology". 69 (5), 1965.