

Auditory Evaluation of the Speech of Deaf Children

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1. Introduction

An important aspect of the successful socialization of hard-of-hearing or deaf persons is the quality of their speech. The hearing environment which deaf adolescents enter after finishing school judges the quality of their speech not only from the point of view of its intelligibility, but also from the more complex point of view of 'social acceptability' or 'general acceptability' of their speech as a means of communication. The striking departure of their speech from the orthoepic norm, its unnaturalness and decreased intelligibility are caused not only by deviations in articulation, but to a great extent by an abnormal use of suprasegmentals as well; this may lead to difficulties in communication with normally hearing people not used to the peculiar character of the speech of the deaf and consequently to impaired social contact or even isolation.

2. Procedure

The question has arisen whether the term 'social acceptability' or 'general acceptability' could be used as an efficient criterion for judgments on the quality of speech. Therefore a listening test was prepared in which the task of the listeners was to give their judgments using this term on 50 speech samples of hard-of-hearing and profoundly deaf Czech children, pupils of the fourth (9-10 years) and ninth (14-15 years) forms of several special schools for children with impaired hearing. All the speech samples were recorded within a period of several months and the same technical equipment was used. The samples were extracts of an identical text: several short sentences were worked out to be sufficiently easy for the children to understand; additionally these sentences contained all the Czech vowels, a representative sample of Czech consonants, several examples of assimilation, consonant clusters, various forms of intonation, etc. The samples were used without repetition, i.e. they contained the speech of 50 different children; the duration of the test was 19 minutes.

The whole test was presented to several groups of listeners - in the first part of the investigation these were 30 students of Czech from the Charles University Philosophical Faculty, 40 students of special pedagogy from the

Charles University Pedagogical Faculty and a special group of 30 teachers of the deaf. The first two groups were thus 'naive listeners' - none of them was in regular contact with the speech of the deaf, whereas the third group consisted of expert listeners, very well acquainted with the speech of the deaf and of hard-of-hearing children through daily contact with them.

The task of the listeners was to evaluate the social acceptability of speech in the items of the test. The criterion was described shortly as 'the acceptability of speech: (1) as a means of communication with normally hearing people, (2) its general quality, (3) its special character and (4) its deviation from normal speech, in addition to its intelligibility.'

The listeners were asked to mark the items by means of normal rating scale 1-5, currently used in Czech schools. The use of the scale values was not prescribed or explained, but before the test the participants listened to six additional items for orientation and as a minimum training.

3. Results

The computations of the results showed very good agreement of judgments (chi-square tested) within the two students groups and within the group of teachers. But there was a clean-cut and significant difference in the judgments of students vs. teachers: the teachers were less rigorous in judging the speech samples. This result could be expected - experienced teachers are able to estimate the degree of hearing loss of the speakers and they can better appreciate the child's effort. This may also explain a slightly greater dispersion in the ratings of teachers compared with those of students. A more important finding, however, becomes evident when both the teachers' and the students' judgments are arranged according to their ranks: the rank order of both arrays is nearly identical (Spearman's rank correlation coefficient $R = 0.99$), i.e. though the teachers were less strict in their ratings, there are nearly no ordinal differences in comparison with the students' ratings.

It is evident that there is a causal relation between hearing loss and quality of speech. Therefore the hearing loss was calculated in dB as the average value of losses for the better ear on the speech frequencies in pure-tone audiograms, and then these calculated losses were correlated with the ranking assigned to each individual sample. A correlation coefficient $R = 0.65$ was found; thus the correlation was positive and significant, but rather weak. In other words: quality of speech is not rigidly determined by hearing loss, a child with a certain amount of hearing loss can develop better or worse speech within considerably broad limits. Indeed, among the speech samples several examples can be found where in spite of identical ratings of social acceptability the differences in hearing loss amount to 30 dB and vice versa. Besides, the correlation analysis yields data, by means of which several cases can be singled out in which the quality of speech deviates significantly from the expected value, i.e. children needing special attention.

In the second part of the investigation the identical test procedure was extended to more qualities of speech of the deaf: besides general acceptability', four other aspects of speech were tested: articulation, rhythm, intonation and pitch aberration from what would be expected as normal. The listeners, two other groups (71 total) of students with elementary knowledge of phonetics but without any experience with the speech of the deaf, were asked to concentrate on these particular aspects of the speech samples and to try to ascribe values on the rating scale to them. Again this task proved feasible, with very good agreement (chi-square tested) within and between groups of listeners. In addition these results were in good agreement (chi-square tested) with the results of the first stage of investigation.

The main aim of this test, however, was an analysis of the relation between the investigated aspects and especially the correlation of these aspects with social acceptability as well as their relation to hearing loss. All the essential coefficients of correlation are summed up in Table I and Table II.

Table I. Matrix of coefficients of rank order correlation R between aspects: articulation, rhythm, pitch aberration, intonation and social acceptability

	Accept.	Inton.	Pitch	Rhythm
Articulation	0.98	0.90	0.77	0.89
Rhythm	0.93	0.96	0.80	
Pitch	0.83	0.86		
Intonation	0.95			

Table II. Matrix of coefficients of rank order correlation R between aspects: articulation, rhythm, pitch aberration, intonation, social acceptability and hearing loss

	Articul.	Rhythm	Pitch	Inton.	Accept.
Hearing loss	0.72	0.66	0.63	0.67	0.73

4. Discussion

All the coefficients are positive, significant and have rather high values. The strongest correlation is found, as can be expected, between social acceptability and articulation (0.98), but immediately after this value comes the coefficient for intonation (0.95) and the only slightly lower value for rhythm (0.93). These data demonstrate the considerable importance of good intonation and rhythm for a sufficient acceptability of speech. Here again a rather weak (0.73) correlation, though somewhat stronger than in the previous experiments, can be found between hearing loss and social acceptability.

Besides the general tendencies of the experimental group stated above, the data thus obtained may be used to characterize particular deaf individuals.

First, the values of correlation between hearing loss and social acceptability of speech may be used to identify those deaf children whose quality of speech is either considerably better or considerably worse than might be expected on the basis of their degree of hearing loss.

Second, the speech of each child can be characterized by the numerical values for the five evaluated aspects of his or her speech. These individual data may be expressed in the form of simple graphs in which the relative value of each aspect is apparent.

5. Conclusions

The results of the described test have shown that

1. the aspect 'social acceptability' is a usable criterion in evaluating the quality of the speech of the deaf;
2. the aspects 'articulation,' 'rhythm,' 'intonation,' and 'pitch aberration' can be tested by the same procedure;
3. the auditory evaluation of these aspects allows us to show experimentally, among other things, the close relation between the social acceptability of speech and its intonation and rhythm;
4. this kind of test may be performed with groups of listeners without any special training.

In addition, it is hoped that the described tests may add to the knowledge of the attitudes of non-expert listeners toward the speech of the deaf; these attitudes are to be respected in the education of the deaf.