

# Phono-articulatory Stereotypes in Deaf Children

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## 1. Analysis

Analysis of the acoustic features of the syllable, as a context-defined phono-articulatory act, was made in a group of 30 children, aged 8-13 years with impaired hearing, residual hearing and deafness. The range of their hearing is illustrated by the collective audiograms (Fig. 1). The control group was identical as to the age and number of children. Each of the examined children uttered by heart an interrogative and affirmative sentence that differed only by the grammatical form of the first word and the purpose indicated by the intonation characteristic of this kind of sentence. Each sentence consisted of three bisyllabic words.

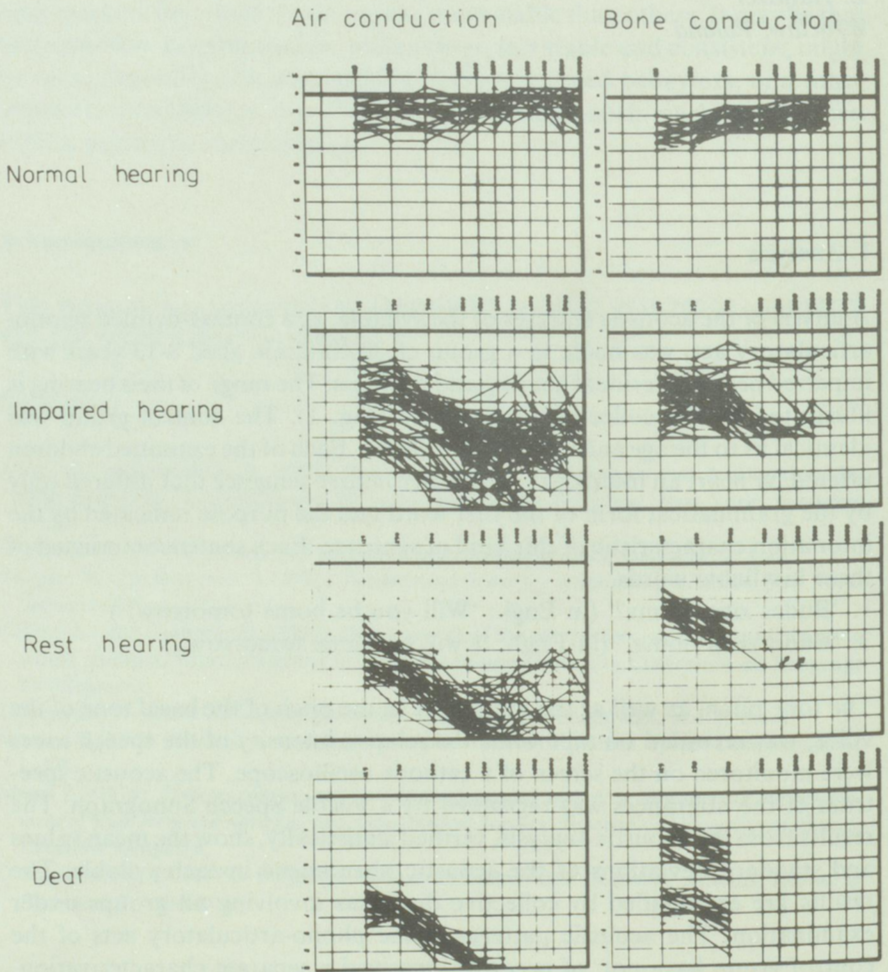
1. 'Budes zitra doma?' (in Engl.: 'Will you be home tomorrow?')
2. 'Budu zitra doma.' (in Engl.: 'I will be home tomorrow.')

The tone pitch, as well as the variability in the pitch of the basal tone of the voice, was recorded on tape while the relative intensity of the speech tones were monitored on the screen of a cathode oscilloscope. The acoustic spectrum of the utterances was registered by a Visible Speech Sonograph. The results from the acoustic analysis, verified statistically, show the mean values and standard deviations of the acoustic phenomena in each syllable. The results are exemplified by collective diagrams involving all groups under examination. The acoustic patterns in the phono-articulatory acts of the control group have not, of necessity, received a separate characterization, having served only as a point of reference for the groups with hearing pathology, Fig. 2.

In children with impaired hearing the tone pitch of the basal voice is characterized by alternating descending and ascending courses, with interrogative utterances showing a typical elevation in the first syllable of the sentence; only by its flattening does it differ from that of children with normal hearing. There is also a difference in the standard deviation within the hearing-impaired group, i.e. a range of 6 tones as compared with a  $\frac{1}{2}$  tone range in normal hearing. In children with residual hearing and deafness, such regularity is indeed lacking; instead, there is always a higher tonal pitch in the first syllable of each word, Fig. 3.

By analogy to the patterns of the basal tone in children with impaired

## Collective audiogram of children

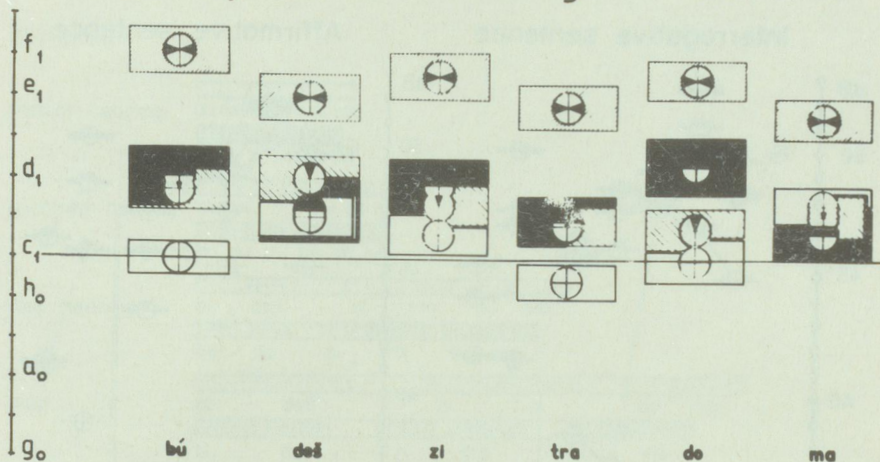


*Fig. 1.* Audiograms of 4 groups of children: with normal, impaired and residual hearing and deaf children.

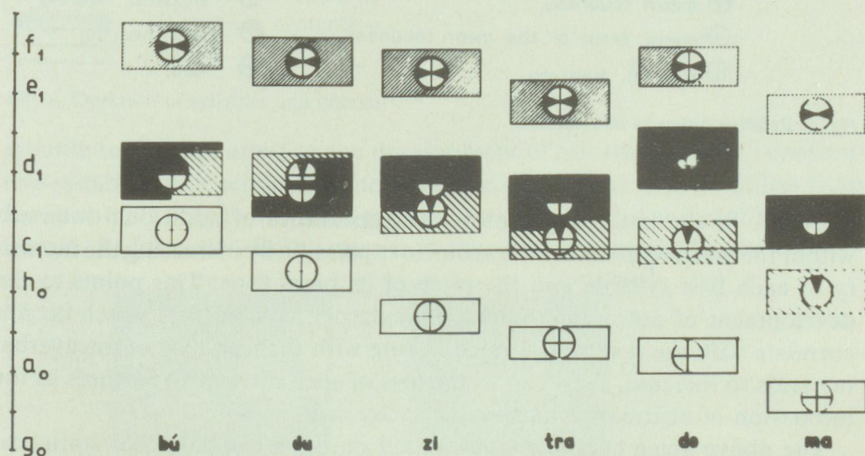
hearing, the values of the mean intensity of individual syllables show fewer differences as compared with those for normal hearing. In children with hearing rests and deafness, the higher position of the basal tone of each first syllable is accompanied by an increase in intensity. This is also true for the next to last syllable.

The obviously fluent passage from one syllable to another, as observed in children with normal hearing, is disturbed in children with impaired hearing by the appearance of short intervals between the words. The intervals show higher values in children with impaired hearing, the highest ones occurring in

### Pitch of syllables in interrogative sentence



### Pitch of syllables in affirmative sentence



Legend :

The mean and the mean error of the mean

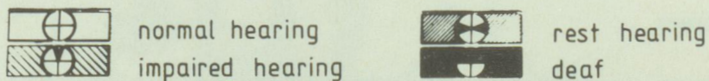


Fig. 2. Tone pitch of the basal voice.



Loudness of syllables

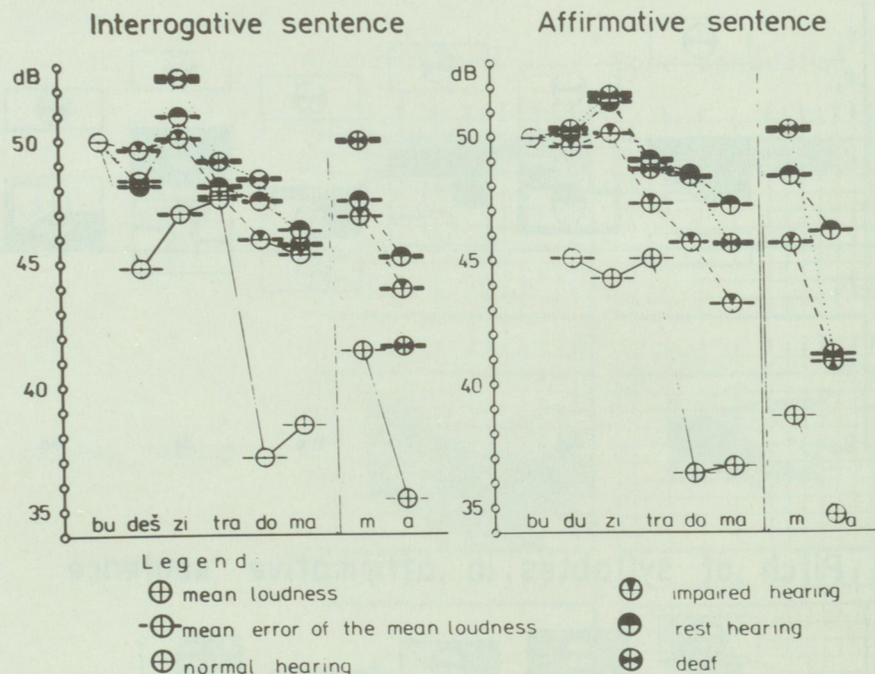


Fig. 3. Relative intensity of syllables.

the deaf. In the latter two groups the appearance of additional intervals within the word emphasizes the acoustic expression by increasing the intensity of each first syllable and the pitch of its basal tone. This points to the development of autonomic phono-articulatory syllabic acts which do not correlate with the text of utterance. Along with the tendency of intraverbal intervals to increase, they lead to the loss of such distinctive features as the intonation of affirmative and interrogative sentences.

The above given characteristics, based on the mean values of statistical analysis, depict a certain phono-articulatory stereotype of an entire utterance as illustrated in Fig. 5a for children with normal hearing and Fig. 5b for the deaf. In the latter, certain variants can be distinguished, the most typical being:

2. Stereotypes

2.1. *Monotono-monodynamo-monorhythmic stereotype.*

Here two variants can be singled out: In Fig. 7a, the striking feature is the repetition of the same pitch of the basal tone, the intensity and duration of consecutive syllables. The clear-cut, equal articulatory passages from one

Mean duration time of syllables and intervals

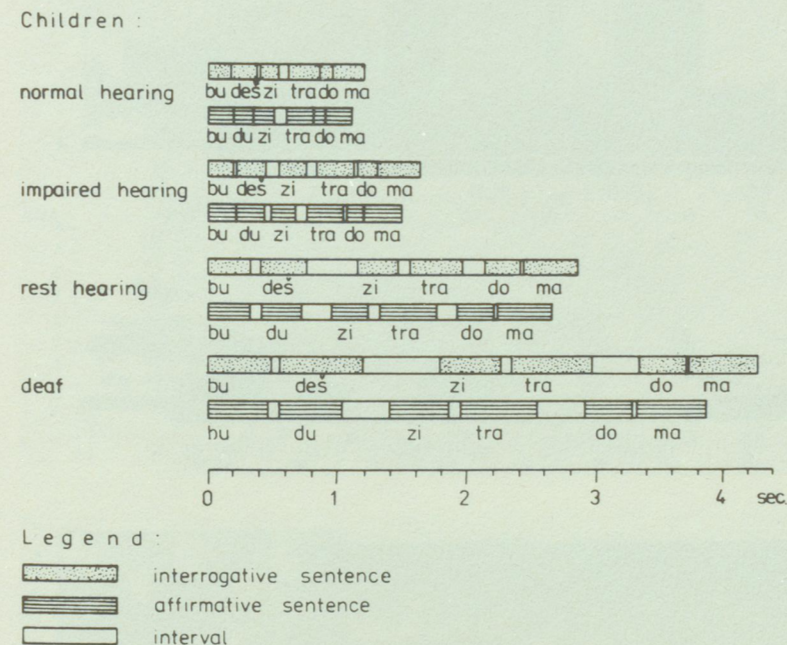


Fig. 4. Duration of syllables and intervals.

syllable to another attest to the development of one stereotype for consecutive syllables, independent of the syllabic composition. Fig. 7b differs from the variant 7a only by the smaller articulatory handicaps and smaller distortion in the formants. Both variants of the monotono-monodynamo-mono-

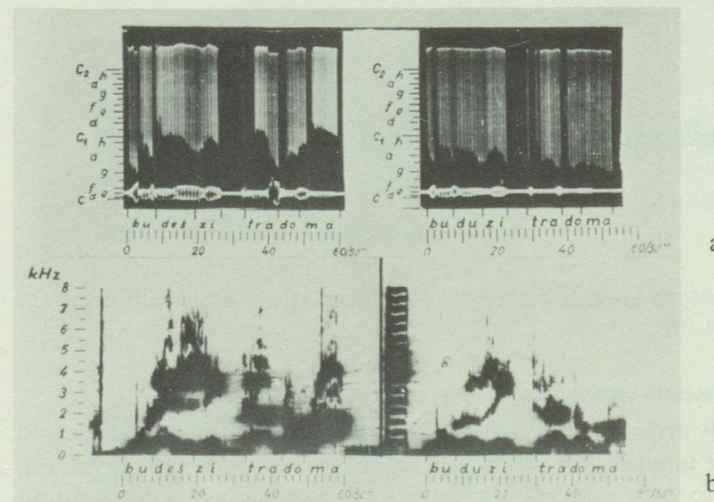


Fig. 5.



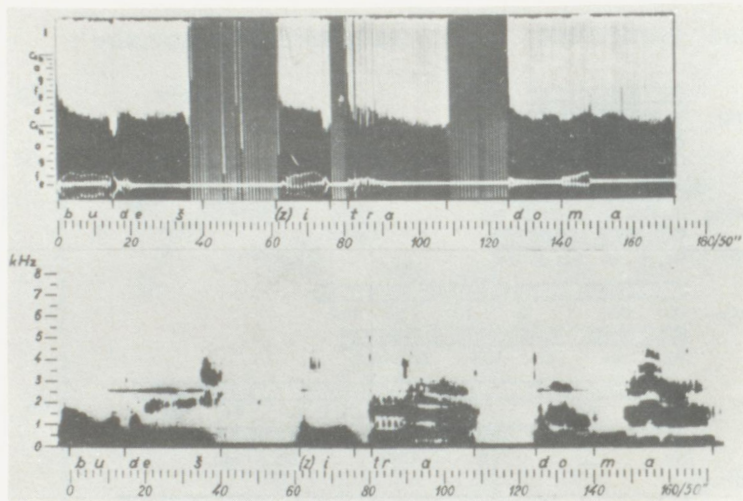


Fig. 6.

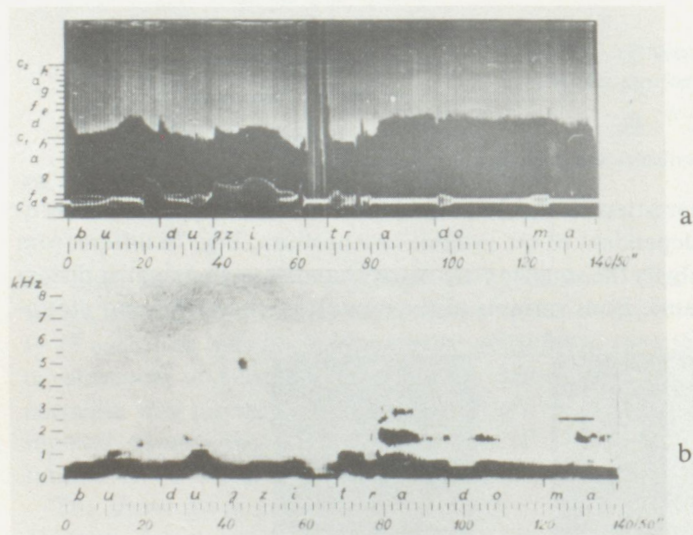


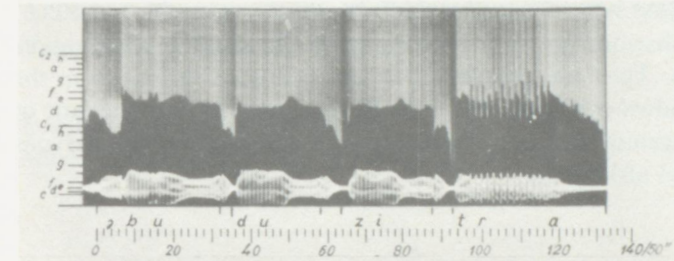
Fig. 7.

rhythmic stereotype are characteristic of children affected by deafness in the first months of life.

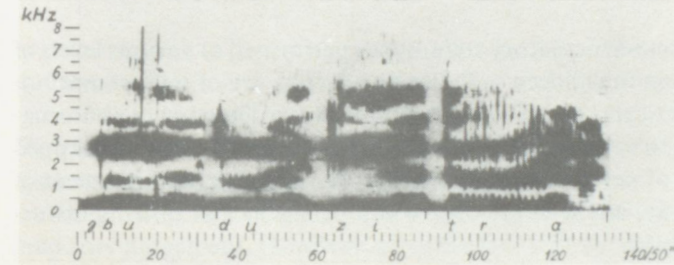
2.2. *Quasi-monotono-monodynamo-monorhythmic stereotype.*

While the badly articulated syllables merge, the pitch of the basal tone and the level of the intensity for individual syllables remains at the same level. Usually, there is only one formant with a pitch and range similar for all vowels (Fig. 6). The quasi-monotono-monodynamo-monorhythmic stereotype is typical of children with congenital deafness.

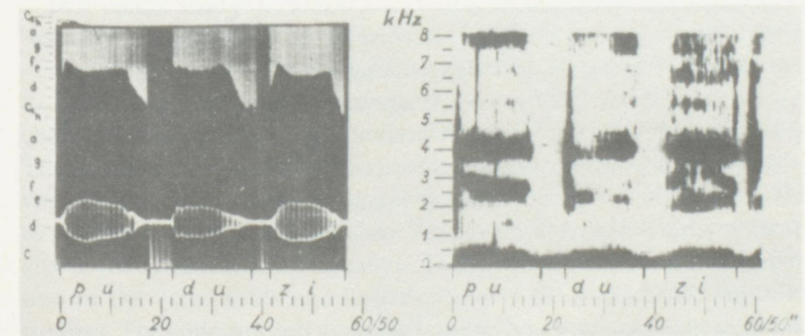
a



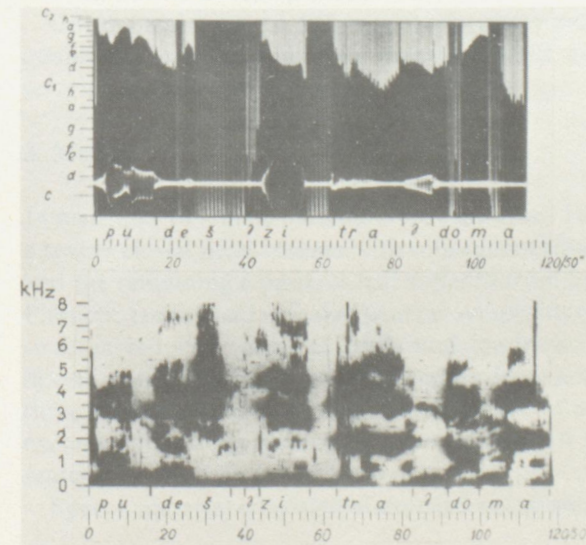
b



a



b



*2.3. Disruption of the phono-articulatory structure.*

Conspicuous oscillations up to one octave of the basal tone pitch can be observed (Fig. 8). They are paralleled by considerable variations in the intensity of individual syllables. This type of disruption is characteristic of children with congenital deafness coexisting with pathology of the nervous system and mental afflictions.

**3. Conclusion**

Studies on the phono-articulatory stereotypes performed at various levels of the language system in children with hearing defects are of importance not only from a theoretical point of view, they also lead to detection of abnormalities and thereby to selection of appropriate treatment of the handicapped and development of new rehabilitation methods. This means enrichment of the diagnostic array, as far as the degree and persistence of hearing disturbances are concerned.