

# Assessment of speech intelligibility in preschoolers

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## INTRODUCTION

**Background.** Speech testing in a free field is one of the most effective methods for assessing the speech competence of hearing-impaired children who use hearing aids/implants in everyday life. In recent years, the Russian-language battery of speech tests for children has been supplemented with new phonetically and perceptually balanced lists of monosyllabic words [Boboshko, Riekhakaynen 2019] and a sentence test developed in Oldenburg University and known as the Russian Matrix test (RuMatrix test) or the Simplified RuMatrix test. The RuMatrix test evaluates sentence recognition in both quiet and noisy environments, utilizing an adaptive algorithm to determine a certain level of speech intelligibility [Warzybok, 2015; Garbaruk et al., 2020]. Whereas both tests have been successfully approbated there are no normative data available for these tests in a free field condition which is of current interest for speech testing of hearing-impaired children. Speech assessment in children with hearing aids or implants requires the stimulus to be presented in a free field through loudspeakers that allows to quantify the degree of speech intelligibility in conditions close to child's natural communication environment.

**The aim of the current study** is to assess speech intelligibility of monosyllabic words and sentences in free field in normal-hearing preschoolers.

## MATERIALS AND METHODS

**Participants:** 20 normal-hearing children 6-7 years old (mean age 6,53±0,51 years).

### Including criteria:

- ▷ age of 6-7 years old
- ▷ monolingual native Russian speakers
- ▷ no history of speech and language delay
- ▷ no peripheral hearing loss:
  - normal pure tone thresholds (equal or less 15dB nHL)
  - normal impedancemetry
- ▷ no signs of APD (Auditory Processing Disorders):
  - normal score (more than 87 points) of Fisher's Auditory Problems Checklist
  - all APD tests in normal range

### Audiological procedures:

- ▷ pure tone audiometry (125-8000 Hz)
- ▷ impedancemetry (tympanometry and acoustic reflex registration)

### Testing for APD (through headphones):

- ▷ binaural fusion test
- ▷ dichotic digits test
- ▷ random gap detection test

**Assessment of speech intelligibility** (free field condition: through one loudspeaker placed in front of a head 1 meter away):

- ▷ monosyllabic words recognition in quiet and in noise: speech level was 65dB SPL and SNR=0dB for measurement in noise
- ▷ sentence recognition using the Simplified RuMatrix test in quiet and in noise: speech recognition thresholds were measured with an adaptive procedure, speech level was adjustable for achieving of 50% speech recognition; noise level was equal 65dB SPL for measurement in noise

## RESULTS

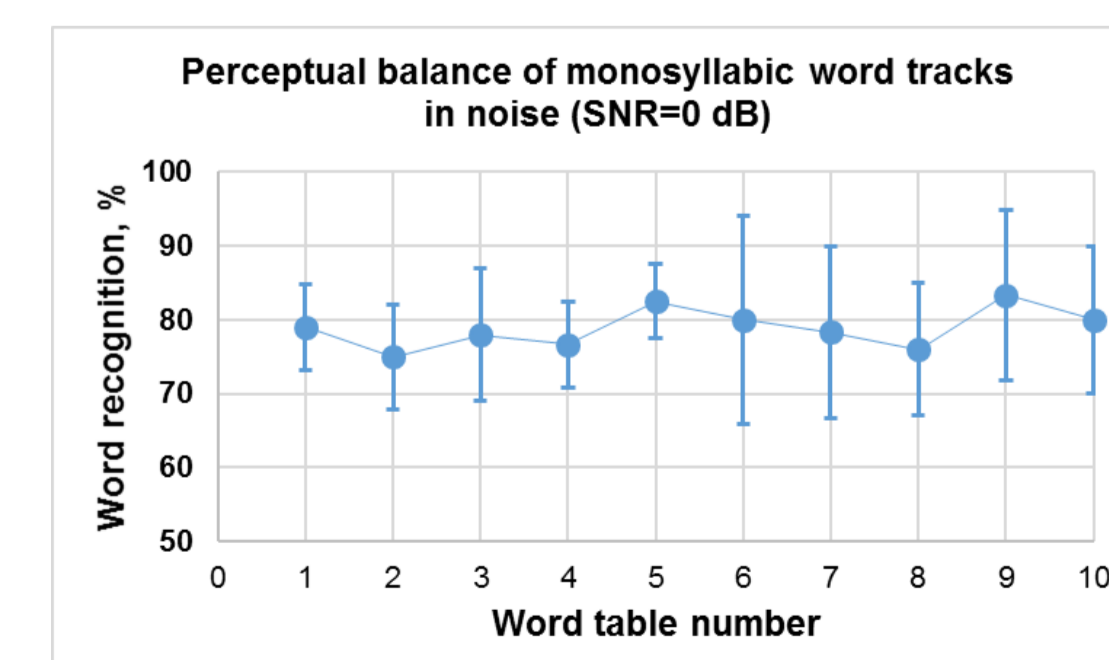
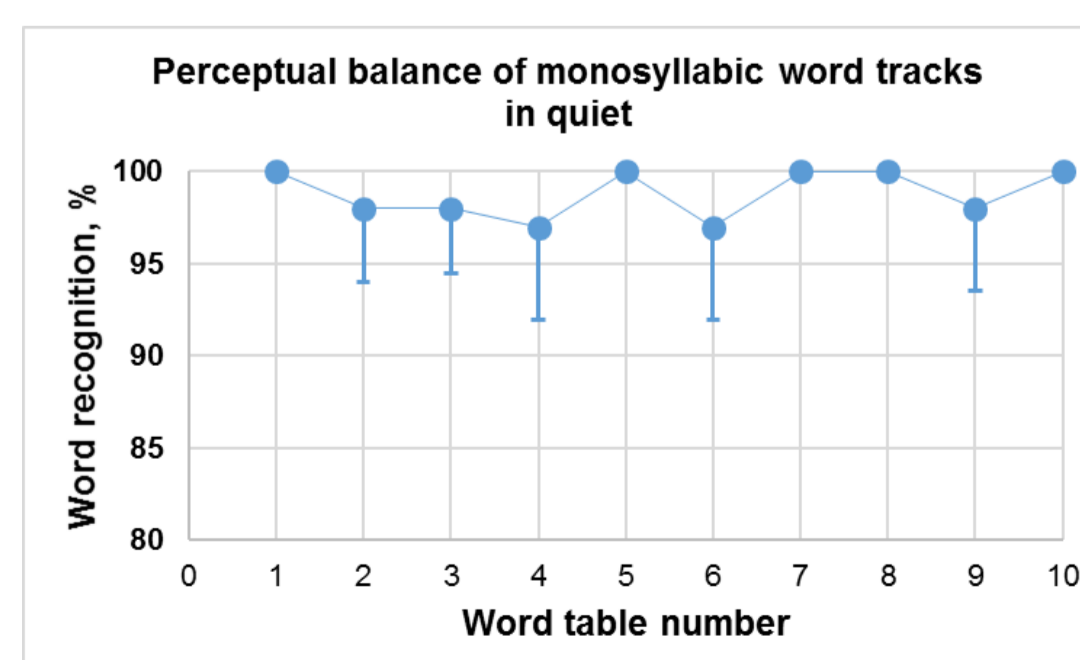
Scores of **Fisher's Auditory Problems Checklist** for all children exceeded 87 points with the mean value of 92,5±4,2 points. All children demonstrated normal scores in all APD tests. The mean values were:

**Binaural Fusion Test:** 94,6±4,1%; **Dichotic Digits Test:** 90,9±9,1%; **Random Gap Detection Test:** 14,6±6,1 ms.

Normative data obtained for speech recognition in free field for preschool children:

	Intelligibility of monosyllabic words		Speech recognition threshold in Simplified RuMatrix test	
	in quiet, %	in noise, %	in quiet, dB SPL	in noise, dB SNR
Range	90 ÷ 100	60 ÷ 100	14,3 ÷ 26,4	-6,8 ÷ -10,6
Averaged value	98.8 ± 3	78.7 ± 10.3	22.2 ± 3.8	-7.9 ± 1.1

Monosyllabic words were presented in ten tables with ten words each. The perceptual balance of monosyllabic word tables was assessed for listening in both quiet and noisy environments (see Graphs).



The data obtained indicate the speech tables are homogeneous, and each word table can be used equally in testing.

## CONCLUSION

The data obtained can be used in the free field testing of hearing-impaired children of 6-7 years old with hearing aids or implants.