PERMUTATE SPEECH LISTS
CLINICAL VALIDATION OF
AUDIQUEEN'S PERMUTATION FUNCTION

Introduction

In Audiqueen, there are two important features available in a speech audiometry test. These are 1) shuffling and 2) permutation. Shuffling means that the original order of speech lists or items within a list is randomly changed by Audiqueen. Permutation means that Audiqueen creates new speech lists by randomly picking items from all lists and recombining them into a new list. Theoretically, permutation can cause less reliable results since the new lists are no longer phonetically or otherwise balanced.

The main goal of this study was to see whether the permutation function causes a significant differences in speech audiometry scores.

Materials and Methods

Subjects entry criteria

The validation was performed on hearing-impaired people regardless of the aided condition. Furthermore, all subjects were at least 16 years of age and willing and able to perform a psychoacoustic test twice.

The subject group size target was n=30 for each presentation level, namely 40, 55, 70, and 85 dB SPL.

Test procedure

Speech audiometry was performed with three speech lists (12 words each) at a randomly chosen presentation level. Two original lists (List 1 and List 2) were randomly selected from the NVA and one new list was constructed by Audiqueen (Permutated list). All tests were performed using the Flemish monosyllable word lists NVA (Wouters et al, 1994).

All repeated tests were performed in soundproof rooms and in the same condition, either with headphones or in free field condition by means of Audiqueen psychoacoustic test suite (Otoconsult NV, Antwerp, Belgium). Phoneme scores were registered.

Statistics

Parametric statistics were used for the analysis of data. Standard error of the mean graphs were used for the presentation of data.

Tests for normality are performed with the Shapiro-Wilk test statistic. The statistical significance level used was 5%.

The paired-samples t-test was used to detect significant within-subject differences for the following comparisons:

- List 1 and List 2,
- List 1 and permutated list,

- List 2 and permutated list,
- The average of List 1&List 2 and permutated list.

Results

The absolute values of within-subject differences are presented in Table 1 and Figures (1-4).

Paired- samples t-test did not reveal significant differences in any comparisons performed ($p > 0,05$).

Table 1. Within-subject differences (absolute values) between the lists

	List 2 – List 1	Permutated – List 2	Permutated – List 1	Permutated – Average
40 dB SPL	11,6% ±1,4	9,1% ±1,4	10,2% ±1,4	7,7% ±1,2
55 dB SPL	7,9% ±1,3	8,8% ±1,3	8,7% ±1,4	7,9% ±1,2
70 dB SPL	6,8% ±1,3	6,7% ±1	8,9% ±1,4	7,2% ±1
85 dB SPL	8% ±1,3	7,3% ±0,9	6,7% ±1	5,2% ±0,8

Mean values are given ± standard error of the mean.
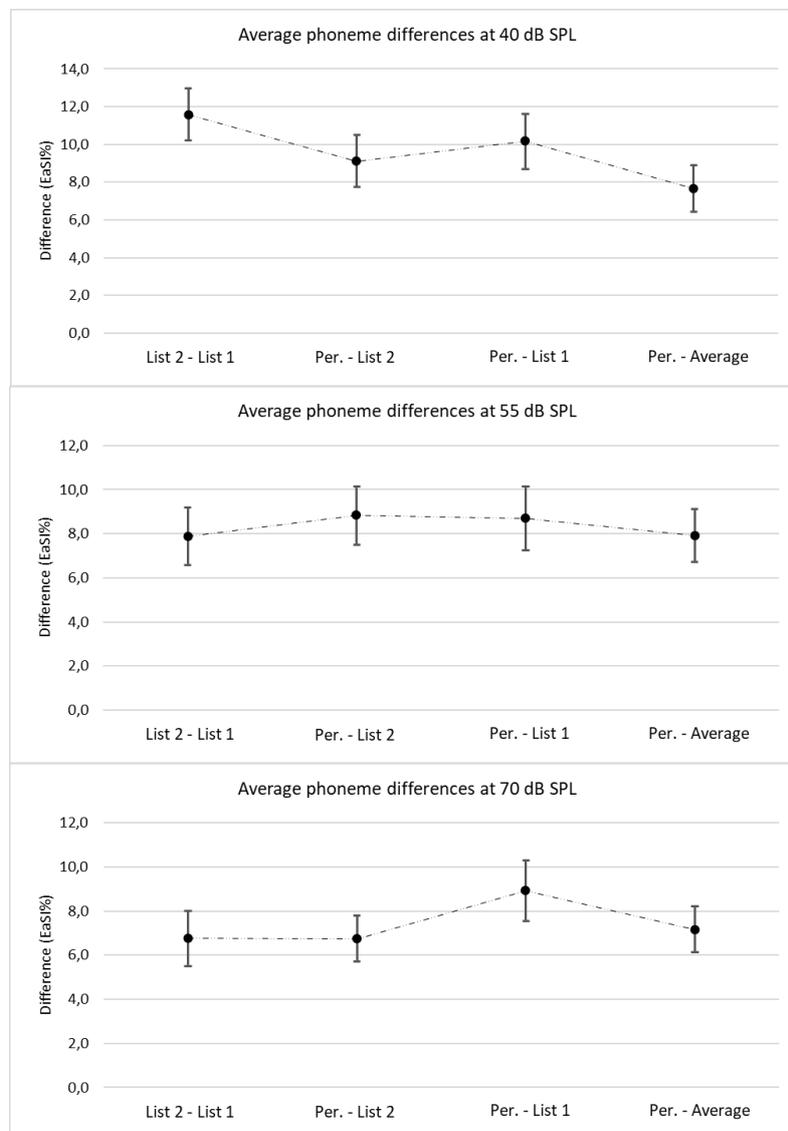
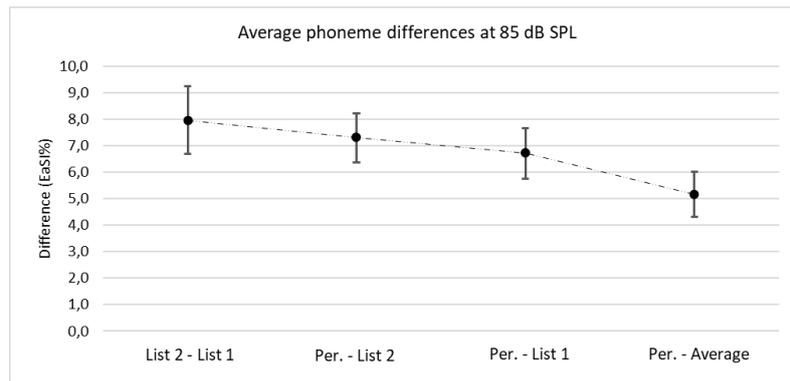*Figure. Average within-subject differences (± standard error of the mean) in phoneme scores obtained at 40, 55, 70 and 85 dB SPL presentation level.*

Discussion

When two monosyllabic speech lists are presented consecutively to listeners with hearing loss, the test-retest variability is on average 7 to 12%. It is important for audiologists to realise this because it puts the interpretation of phoneme scores in the right perspective. This test-retest variability decreases when more words are presented. That is why we offer 2 lists per presentation level as standard in our daily clinical protocols.

Creating new word lists by randomly sampling words from all other NVA-lists, produces lists that turn out to be equivalent to the original NVA-lists. Creating new lists also has the advantage that such lists reduce the risk of learning effects.

Conclusion

This study confirms that the new lists generated by Audiqueen's 'permutate' function can be used interchangeably with the original NVA lists. **However, it is worth remembering that only NVA Vlaams speech materials (Wouters et al., 1994) have been used in this study.** Therefore, it is recommended to carry out a similar study for other speech materials too before starting to use the permutation function in the A§E Speech Audiometry test.

References

Wouters, J., Damman, W., & Bosman, A. J. (1994). Vlaamse opname van woordenlijsten voor spraakaudiometrie. *Logopedie: informatiemedium van de Vlaamse vereniging voor logopedisten*, *7*(6), 28-34.