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SCREENING AND DIAGNOSTIC

The Effects of Attention Mode and Stimulus Complexity on Dichotic Digit Listening in Noise

Hyunsook Jang, Songha Ryu, Hyunju Lee, Hongsub Yang, Yoonpyo Lee & Heonui Lee

Division of Speech Pathology & Audiology, Research Institute of Audiology & Speech Pathology, Hallym University, Chuncheon, Republic of Korea

Objects

The Dichotic Digit Test (DDT) assesses the ability to process auditory inputs from each ear and is recognized for its accuracy in detecting central auditory dysfunctions. However, its effectiveness is limited by a ceiling effect, which can obscure subtler issues. To address this limitation, introducing noise has been suggested as a method to reduce the ceiling effect. This study aims to determine the optimal noise level for administering the DDT in noisy conditions within a Korean population and to investigate how different attention modes and levels of stimulus complexity impact test performance.

Methodes and Materiels

- The study involved 43 adults in their 20s, comprising 21 men and 22 women. All participants had normal hearing and were native speakers of Korean.
- Experiment I: This experiment assessed the performance of the DDT under different noise levels: -10 dB, -5 dB, 0 dB, +5 dB signal-to-noise ratios (SNR), and a Quiet condition. Psychometric analysis was used to determine the noise levels at which participants achieved 50% and 80% correct responses.
- Experiment II: In the second experiment, dichotic listening performance was assessed at the 80% performance noise level. The analysis focused on different attentional modes—Free Recall, Precued-Right, and Precued-Left—as well as stimulus complexities (2-digit and 3-digit). A laterality formula was applied to investigate the Right Ear Advantage (REA) phenomenon under noisy conditions.

Results

Experiment I. Performance of DDT Across Different Noise Levels

As noise levels increased (from +5 dB to -10 dB SNR), performance dropped for all ear conditions, with no significant differences between ears. The SNR values for 50% performance were -6.249 dB for the right ear, -6.127 dB for the left ear, and -1.876 dB for both ears combined. For 80% correct responses, the SNRs were -0.415 dB for the right ear, -0.320 dB for the left ear, and -1.873 dB for both ears combined.

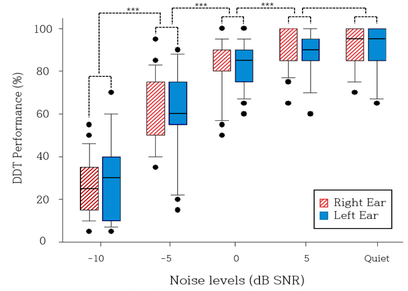


Figure 1. Comparison of DDT performance across ears and noise levels (p < .001***)

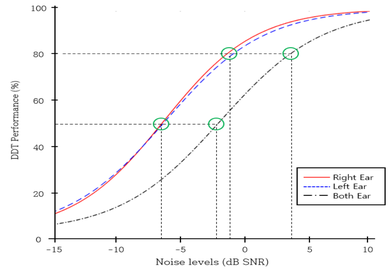
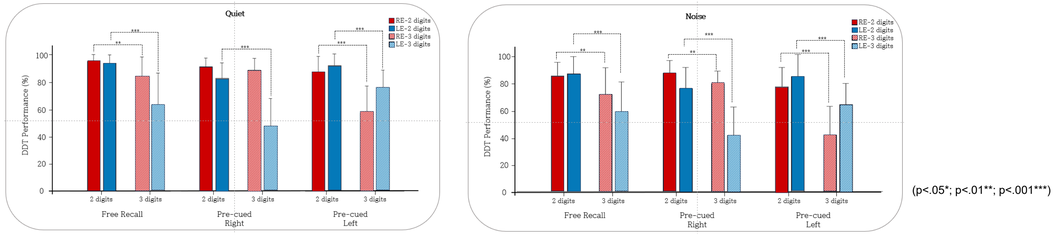


Figure 2. Psychometric function for DDT performance: Noise levels achieving 50% and 80% correct responses

Results

Experiment II. Performance of DDT in Noise by Attention Modes and Stimulus Complexity

In Experiment II, DDT performance was assessed under two conditions: quiet and 0 dB SNR. The focus was on different attention modes and varying stimulus complexities. Significant performance differences between ears were observed in all attention modes, except in the 2-digit Free Recall condition. Performance was consistently higher in the attended ear during Pre-cued conditions, with performance declining as stimulus complexity increased. This decline was especially pronounced under noisy conditions.



(p<.05*; p<.01**; p<.001***)

Figure 3. DDT performance in Quiet (Left) and Noise (Right) by attention modes and stimulus complexity

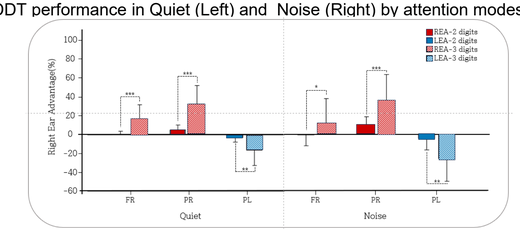


Figure 4. REA percentage across attention modes and digit sequences in Quiet and Noise

Conclusion

The findings indicate that the DDT remains effective at 0 dB SNR, regardless of stimulus complexity. This suggests that the DDT has significant potential for broader clinical use, particularly in evaluating auditory processing abilities. However, further research is needed to validate its effectiveness across different age groups and populations, particularly for individuals with central auditory processing disorders. Expanding the study in these areas will help reinforce the DDT's value as a diagnostic tool.

References

Clancy, C. A. M., Davidson, A., Borgstrom, M., Robinson, K., & Musiek, F. (2023). Effects of Adding Monaural and Binaural Noise to a Dichotic Listening Task. *Journal of the American Academy of Audiology*, 10.1055/a-2181-2398.

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