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Cognitive aspects of speech recognition in noise

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Background: When the auditory signal is limited and/or distorted, e.g. in difficult listening situations or because of a hearing impairment, speech comprehension becomes more cognitively demanding. Studies have shown a clear relationship between the individual's cognitive skills and many speech comprehension tasks. Three categories of skills that are critical; working-memory function, speed of verbal information processing, and phonological skill. The purpose of the present investigation is to find a simple cognitive test with high correlations to speech comprehension ability that can be used within the EU-project HearCom together with other hearing- and communication tests to define an individual's auditory profile.
Methods: In Linköping 21 subjects, aged 50-85 years and with bilateral sensorineural hearing impairments participated. In Amsterdam 28 subjects with ages between 44 and 83 years participated, of which 19 were normally hearing and 9 had bilateral sensorineural hearing impairments. Hagerman's speech test and the HINT were performed in Sweden using unmodulated and modulated speech-shaped noise. In the Netherlands, the VU98 speech tests using stationary and square-wave modulated noises were performed. A lexical-decision test, a reading-span task, and a text-reception task were also performed. Correlation analysis was carried out between speech recognition and the cognitive scores.
Results: Among the cognitive tests, the lexical-decision test, especially its recorded response times, showed the most significant correlations with speech recognition. This result will be further discussed in relation to age, degree of hearing impairment, noise type, and response criteria.
Conclusions: The lexical-decision test is recommended as a first choice for evaluation of cognitive abilities important for speech comprehension.

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