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Commentary

On the Inclusion of Cognitive Aspects within the European Project HearCom

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HearCom" is an acronym for the European-funded research project "Hearing in the Communication Society." It is a so-called Integrated Project within the Sixth EU Framework Programme for Research and Technological Development. It runs from 2004 to 2009, with a budget of approximately 9 million Euros, and includes about 28 partners from 12 EU-countries. The project is coordinated by T. Houtgast and M.S.M.G. Vlaming of the VU University Medical Center (see also www.hearcom.eu). In some respects the project reflects the present state-of-the-art, the orientation and the priorities in the European RandD on hearing and communication. Interestingly, research on cognitive measures is also included in this project. It will be argued that this was not self-evident. We feel that this signals an interesting development in the orientation of the research on hearing impairment and speech communication, at least for some of the researchers in Europe.

When we drafted the plans for this research proposal, in mid-2003, we sat down with a brainstorming group of European senior researchers, most of whom had also been involved in preceding EU-funded projects on hearing (of which none included cognitive aspects). This group was predominantly oriented to the physical aspects of hearing, rather than the psychological (or the medical, for that matter), in accordance with the traditions of audiological research in many European countries. Within the broader HearCom program, an important part is concerned with measuring an individual's functional disabilities (such as the hearing loss for speech in noise), and to relate this to specific auditory impairments (the individual's auditory profile). We had already established a strong tradition of measuring the Speech Reception Threshold in noise (Plomp, 1986). Many studies have shown that for older persons the Speech Reception Threshold in noise (SRTn), especially in fluctuating noise, can be up to 10 dB worse than for younger normal-hearing persons. For most members of the group whose research had a physical orientation, the common approach was to try to relate the inter-individual differences in SRTn to peripheral factors: the so-called supra-threshold deficits such as a reduced spectral or temporal acuity, or loss of cochlear compression. In the discussions within the brain-storming group about what tests to include in the auditory profile underlying an elevated SRTn, cognitive tests were considered only reluctantly. However, the group had to acknowledge that it had become clear now from many experimental studies that at best 60% of the variance in SRTn can be explained by such peripheral factors. (For a recent overview, see Houtgast and Festen, 2007.) This strongly promoted interest in cognitive factors in relation to speech reception in noise: which factors are involved and how can inter-individual differences in these cognitive factors be measured and quantified? Thus, after some intensive discussions, it was decided to include cognition as part of the auditory profile to be studied and defined within HearCom.

In retrospect, it is rather surprising that it took so long for the traditional European hearing researcher to recognize the relevance of studying cognitive aspects in relation to speech reception in noise. (Perhaps, rather than generalizing, I should as first author speak for myself.) The indications, also in Europe, were ubiquitous. Already in 1990, a study by van Rooij and Plomp indicated that about one-third of the variance in the SRTn for

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elderly subjects is explained by what was called "reduced mental efficiency," i.e., a general slowing of performance and a reduced memory capacity. Another interesting example is a study of Smoorenburg (1992) showing that for a group with noise-induced hearing losses (aged under 55), the analysis of the covariance of the SRTn for left and right ears clearly indicates the significance of a non-peripheral source of variance, e.g., differences in the cognitive skill involved in speech perception. More recently, Gatehouse and co-workers have reported on the interaction between audiometric and cognitive characteristics of listeners in word identification (e.g., Gatehouse et al., 2003). Also various studies originating from Linköping University have identified cognitive functions that are important for speech processing (e.g., Larsby et al, 2005).

Finally, we were further encouraged to pursue this line of thinking by a recent study performed at our laboratory. Zekveld et al. (2007) devised a visual analogue of the SRT test in noise: the same sentences as used in the SRT test are presented as text on a screen, partially obscured by a masking grid. The task of the subject is to correctly reproduce the whole sentence. Depending on the response, the density of the grid (i.e., the on-off ratio) is adapted from trial to trial, much like the procedure used in the original SRT test when adapting the SNR. The outcome of this TRT test (Text Reception Threshold) is an estimate of the percentage of unmasked text required for a 50% correct score. It is hypothesized that this visual test of comprehending partially obscured text-sentences draws, at least partly, upon the same cognitive skills as those involved in understanding partially masked spoken sentences. Results obtained by George et al. (2007) do confirm this: for a group of normal-hearing listeners, there is a strong correlation between the SRT and the TRT. For hearing-impaired listeners, the correlation is weakened by the effects of the auditory deficits on the SRT; still, in the step-wise regression model, the inclusion of the TRT plays an essential role in explaining the variance in the SRT.

The examples given above do underline that the understanding of all aspects of speech reception in noise requires the inclusion of cognitive aspects. This was recognized in drafting the plans for the HearCom project, and has found its way in the current research program.

REFERENCES

Gatehouse S, Naylor G, Elberling C. (2003) Benefits from hearing aids in relation to the interaction between the user and the environment. *Int J Audiol* 42(Suppl. 1):S77–85.

George E, Zekveld A, Kramer S, Goverts S, Festen J, Houtgast T. (2007) Auditory and nonauditory factors affecting speech reception in noise by older listeners. *J Acoust Soc Am* 121(4):2362–2375.

Houtgast T, Festen JM. (2007) On the auditory and cognitive functions that may explain an individual's elevation of the speech reception threshold in noise.

Larsby B, Hallgren M, Lyxell B, Arlinger S. (2005) Cognitive performance and perceived effort in speech processing tasks: effects of different noise backgrounds in normal-hearing and hearing-impaired subjects. *Int J Audiol* 44:131–143.

Plomp R. (1986) A signal-to-noise ratio model for the speech-reception threshold of the hearing impaired. *J Speech Hear Res* 29:146–154.

Smoorenburg GF. (1992) Speech reception in quiet and in noisy conditions by individuals with noise-induced hearing loss in relation to their tone audiogram. *J Acoust Soc Am* 91:421–437.

Van Rooij JC, Plomp R. (1990) Auditive and cognitive factors in speech perception by elderly listeners. *Acta Otolaryngol Suppl* 476:177–181.

Zekveld A, George E, Kramer S, Goverts S, Houtgast T. (2007) The development of the Text Reception Threshold test: a visual analogue of the Speech Reception Threshold test. *J Speech Lang Hear Res* 50(3):576–584.