Cognitive inhibition, WMC, and speech-recognition-in-noise

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Introduction

- Cognitive inhibition and WMC are important for speech processing, especially under adverse listening conditions.
- In order to assess different difficulties that can arise in every day listening situations, solid methods for measuring cognitive abilities are of great importance.

Purpose

- The purpose of this study was to examine how individual cognitive inhibition, and WMC relate to each other, and to speech-recognition-in-noise.

Participants

- Forty-six individuals participated with mean age of 25 years (SD= 4.8) with normal hearing (better than 20 dB HL on both ears).

Test Materials

Tests of cognitive abilities:

- **The Swedish Hayling task** - Predictable sentences, divided in to three lists, where the last word is omitted are to be completed by either a logical word or a semantically unrelated word. The test assesses the individuals' ability to fast lexical access and initiation speed, and the ability to inhibit logical responses, yielding measures of response suppression ability and thinking time.
- **Reading Span** - simultaneous explicit processing and short-term storage. Sets of 2-5 sentences, each with 3 words are presented on a computer screen. The participant is asked to decide if the sentence is a meaningful sentence or an implausible sentence, and to remember either the first or the last word in each sentence. After each set of sentences the participant is asked to report either the first or the last word back.
- **Lexical decision** - The participant is to decide if a presented three-letter word is a real Swedish word, or a non-word.

Auditory test:

- **The Hagerman speech-in-noise test** - targeting 50% and 80% word recognition. Presented in slightly modulated (10%) speech-shaped noise.

Results

Test	Speech-in-noise 50%	Speech-in-noise 80%	WMC
The Hayling Task 2	.003**	.331	.044*
The Hayling Task 3	.03*	.056	.046*
WMC	.779	.258	/

Pearson's correlations, **= p<.01, *= p<.05

Conclusion

- Individuals with short response time in the Hayling Task perform better in more difficult signal-to-noise-ratios on the Hagerman test when targeting 50% word recognition. This indicates that cognitive inhibition is important when the listening task is difficult. A reason why cognitive inhibition is important for 50% word recognition could be that much information is obscured due to interfering noise, and to be able to decipher the message one needs to suppress the masking noise. In 80% word recognition, the listening task is relatively simple for young normally-hearing individuals, and less cognitive capacity needs to be allocated to solve the task.
- High WMC is related to shorter response times in the Hayling Task. An explanation could be that being able to resist semantic interference, and being able to maintain goals active in memory aids when performing the task. Another explanation could be that a well employed strategy aids word retrieval in the inhibition condition.
- No correlation was found between speech-recognition-in-noise and WMC. An explanation could be that the participants are a young, homogenous group. Another possibility is that WMC is of little use for the participating young individuals because of the stylized nature of the Hagerman speech-in-noise-test. Inspite of the lack of correlations between WMC and speech-recognition-in-noise, there is a relation between cognitive inhibition and speech-recognition-in-noise.

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