

**Cognitive Hearing Science (CHS):
Three memory systems,
two approaches, and one model**

Rönnerberg, J *#., Holmer, E., & Rudner, M.

Linnaeus Centre HEAD, Swedish Institute for Disability Research,
Linköping University, Sweden

CHS is about the subtle balancing act between auditory input and cognitive priming of future input, prediction, to achieve understanding of communicated content. When understanding fails reconstructive postdiction is initiated. To conceptualize these two overarching functions, we have distinguished between *three memory systems*, assumed to play important roles in the ease with which language can be understood: Working memory (WM), episodic long-term memory (ELTM), and semantic long-term memory (SLTM). In the early formulations of the *Ease of Language Understanding (ELU) model* (Rönnerberg, 2003; Rudner et al., 2008, 2009; Rönnerberg et al., 2008), the basic expectation was that explicit, WM resources would be invoked by a mismatch between auditory input - in the form of rapid automatic multimodal binding of phonology (RAMBPHO) - and phonological and lexical representations in SLTM. However, if there was a match between RAMBPHO input and SLTM representations, language processing would continue rapidly and implicitly. Given this theoretical *approach*, we focused on experimental manipulations of different kinds of signal processing in hearing aids causing a mismatch with acclimatized or habitual use of other kinds of signal processing. Manipulations of background noise were yet another example where the use of speech babble distractors, engaging SLTM, produced the most pronounced distractions, and where WM dependence increased. WM capacity is also an important predictor of ELTM in such circumstances. The other *approach* focuses on the relative effects of age-related hearing loss (ARHL) on the three memory systems. Here, the ELU model predicts that WM will be constantly occupied to reconstruct what was actually heard, leaving less activation of LTM systems, that is, fewer words will be encoded in ELTM, and hence, fewer words will be retrieved. In other words, there is a relative disuse of LTM compared to WM. Important to note is that the prediction is not dependent on the test modality per se but rather on the memory system as such. These predictions will be illustrated by recent studies on the effects of ARHL (see Rönnerberg et al., 2011, 2013, 2014, 2019).

Acknowledgement: The Linnaeus Centre HEAD is a long-term excellence Centre, financed by the Swedish Research Council, which has funded the research reported for the [Humes Keynote Opening Lecture](#).