

Cognition, Communication and Disability

The basic premise of this paper is that disability research – as a problem-based domain with high interdisciplinary demands – needs at least two types of knowledge integration for its future development of methods and concepts: vertical and horizontal.

A meta-theoretical choice which has been fruitfully applied within the Swedish Institute of Disability Research (SIDR) is what is called a critical realist perspective (cf. Bunge/Harré/Bhaskar). One important feature of critical realism is that it supposes that reality is stratified in different levels of description and explanation, none of which can easily be reduced to any other. The ontological premise thereby deviates from an empiricist view which advocates a more direct, one-to-one truth correspondence between reality and concept; it also deviates from a too one-sided social constructivist conception of disability-related phenomena, where the status of the relation between concept and reality is constructed and relativistic (Danermark, 2003).

Professor Jerker Rönnerberg,
Department of behavioural sciences,
University of Linköping, Sweden.
CAS Fellow 2003/04.



Although this is true, the critical realist perspective adopted within SIDR includes some features of both extremes: the SIDR-perspective focuses on theory-driven explanations of what causal *mechanisms* may underlie phenomena and behaviour in different contexts and under different conditions. Theoretical integration among levels of explanation therefore becomes one important feature of the research endeavour within the SIDR. This especially applies to phenomena in everyday life and to research on participation in everyday activities. A further consequence of this general approach is that greater interdisciplinary cooperation across faculty borders will be required in order to generate satisfactory descriptions of disability and ability. New concepts and new methods, and re-combinations of existing concepts and methods, will have to be advanced to provide concepts that have the potential of connecting different levels of explanation. This kind of *vertical knowledge integration* is one means of proceeding in disability research. *Horizontal knowledge integration* is complementary to vertical knowledge integration and proceeds by attempting to test the generality or precision of concepts across disabilities and social contexts. The notion of working memory was proposed as one example of a concept that has proven useful in both the “vertical” and “horizontal” senses.

Complex working memory capacity, that is, the ability to maintain and process several pieces of information “on-line” for purposes of problem-solving or language understanding, represents a crucial cognitive resource in many cases of communicative disability. The example of GS was intro-

duced. GS is a deaf person who has developed a method for speech understanding that we call *tactiling* (Rönnerberg, 1993). Tactiling denotes that GS uses his hand to pick up vibrations from the collarbone and neck of the speaker, which he combines with what he can visually extract from lip movements and facial expression. When GS became deaf (after having meningitis at the age of 8), he spontaneously learned that when he held his hand on the *throat* of his mother, he suddenly understood her lip movements when she read stories to him. Subsequently, he made the social adjustment of placing his hand on the *shoulder/neck* of the person he is communicating with.

What is remarkable about GS is that he is able to communicate at a nearly normal speed by means of tactiling. This kind of expertise is in part explained by his highly capacious working memory – a feature of his cognitive profile that he has in common with two other experts from our database on cognitive descriptions of individuals who vary in speech understanding skills (Lyxell, 1994; Rönnerberg et al., 1999). Working memory resources are assumed to aid in retrospectively resolving ambiguities in a dialogue that are due to information being misperceived or simply missed due to the hearing loss, a process which is achieved by mentally filling in missing pieces of information on-line, and to serve as a basis for predictions of future exchanges in the dialogue. To be able to achieve that with efficiency, a large simultaneous processing and storage capacity is demanded. GS is extremely well equipped in this respect.

In vertical terms, GS happened to discover a method by which he could optimize the perceptual qualities of speech understanding. However, the *perceptual level of description and explanation*, i.e., the relative efficiency of the combination of tactilely and visually perceived phonemes, is not sufficient. When perceptual efficiency is combined with high working memory capacity, spoken elements can be processed even more effectively, given the functional role of working memory in dialogue comprehension suggested above. Still, this *cognitive explanation* is not sufficient to grasp the way GS communicates via tactiling. At a *social level of explanation*, it is easy to observe that GS has a well-developed strategy of approaching the talker, starting to communicate with him or her, while rather unobtrusively placing his hand on the speaker. Rarely do people understand that GS is deaf until after a several encounters. His way of behaving demands social competence, otherwise he risks being misunderstood. Again, it may be the case that he is supported by his capacious working memory, allowing him to be strategic, minimizing the number of repetitions and clarifications needed, and perhaps also minimizing what is needed in terms of “hands-on” tactiling. Thus, there are several levels of description and explanation of the tactiling method used by GS. A tremendous general working memory capacity has the potential of providing an explanatory mechanism that connects several levels of description and explanation.

Horizontally, it can be stated that this general mechanism serves to characterize and generalize to other expert speech-readers with other communicative habits and backgrounds: Case MM (Rönnerberg et al., 1999), who is a native bilingual, and Case SJ (Lyxell, 1994), who is a pure visual speech-reader. GS and SJ have post-lingual onsets of deafness (at 8 and 13 years, respectively), while MM has a congenital moderate hearing impairment.

We know that the concept of working memory capacity has been successfully used as a compensatory mechanism that can be trained in children with attention-deficit hyperactivity disorders (Klingberg et al., 2002). Training of working memory and its components has also been used for intervention in children with dyslexia and children with cerebral palsy. Working memory is a central concept when it comes to comparative studies of speech, sign and script understanding, both neuro-physiologically and cognitively (Rönnerberg, 2003a,b), and it has been applied and generalized to other conditions such as Parkinson's disease and multiple sclerosis.

In a similar vein, other concepts, such as theory of mind (ToM) (Peterson & Siegel, 2001), have been used successfully in horizontal and vertical senses. The ability to grasp other peoples' intentions and reasons for communication and behaviour is fundamental to all role-taking in dialogues, and the lack of this ability has traditionally been one of the diagnostic features of children with autism. However, the study of ToM capabilities in deaf children and children with cerebral palsy has shown that a lack of ToM capabilities is due not to a kind of neurally defective module situated in the frontal lobes, but to a lack of opportunity to take part in meaningful social exchanges. Deaf children who use sign language as a native language do not have problems with ToM tasks, but children with cerebral palsy who do not have an intelligible articulation of speech, do show problems. Without true communicative opportunities, lack of feedback to one's own thoughts and emotions will in the long run also jeopardize one's ability to "read" and understand other persons' thoughts and emotions.

Many other examples exist in the current interdisciplinary development of disability-related concepts. It is ventured that a continuous interplay of vertical and horizontal explanatory mechanisms will help develop disability research towards a more mature knowledge domain. This is also the long-term goal of the SIDR.

References

- Danermark, B. (2003). Different approaches in assessment of audiological rehabilitation: a metatheoretical perspective. *International Journal of Audiology*, 42, S112–S117.
- Klingberg, T., Forssberg, H., & Westerberg, H. (2002). Training of working memory in children with ADHD. *Journal of Clinical and Experimental Neuropsychology*, 24, 781–791.
- Lyxell, B. (1994). Skilled speechreading – a single case study. *Scandinavian Journal of Psychology*, 35, 212–219.
- Petersen, C.C., & Siegal, M. (1999). Representing inner worlds: Theory of mind in autistic, deaf, and normal hearing children. *Psychological Science*, 10, 126–129.
- Klingberg, T., Forssberg, H., & Westerberg, H. (2002). Training of working memory in children with ADHD. *Journal of Clinical and Experimental Neuropsychology*, 24, 781–791.
- Rönnerberg, J. (1993). Cognitive characteristics of skilled Tactiling: The case of GS. *European Journal of Cognitive Psychology*, 5, 19–33.
- Rönnerberg, J., Andersson, J., Samuelsson, S., Söderfeldt, B., Lyxell, B., Risberg, J. (1999). A speechreading expert: The case of MM. *Journal of Speech, Language and Hearing Research*, 42, 5–20.
- Rönnerberg, J. (2003a). Working memory, neuroscience and language: Evidence from the deaf and hard of hearing. In M. Marschark & P. Spencer (Eds). *Oxford Handbook of Deaf Studies, Language, and Education*: Oxford University Press.
- Rönnerberg, J. (2003b). Cognition in the hearing impaired and deaf as a bridge between signal and dialogue: A framework and a model. *International Journal of Audiology*, 42: S68–S76.