Theoretical perspectives on impairments in spoken language processing

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Motivation

The primary goal of this symposium is to foster greater collaboration between theoretical research on language processing and research on impairments of spoken language processing. Such collaboration has great potential to be mutually beneficial for researchers on both sides. The study of language delays and deficits provides a rich source of data on language processing, thus providing novel constraints on proposed theories of language processing. Indeed, the study of language impairments has been critical to the development of theories of reading, semantic processing, grammatical processing, and other domains. However, there has been comparatively little cross-talk between research on impairments of spoken language and theories of spoken language processing. This symposium aims to close this gap by bringing a diverse set of experts on impairments of spoken language processing to the Cognitive Science Society audience, which has been a strong source of development of theories of spoken language processing.

Conversely, development of language processing theories that connect with data from impaired populations has the potential to improve rehabilitation strategies. For example, computational models of reading that account for impairments of reading also provide models of remediation in the case of developmental dyslexia (e.g., Harm, McCandliss, & Seidenberg, 2003) and rehabilitation in the case of acquired dyslexia (e.g., Welbourne & Lambon Ralph, 2005). In contrast, models of spoken language processing have not been systematically applied to the domain of impairments and rehabilitation (with the notable exception of Dell et al., 1997).

The talks in this symposium focus on empirical findings from a diverse set of impairments of spoken language processing and their possible theoretical implications. It is hoped that the symposium will spur development of theories of spoken language processing that can account for such empirical findings and provide new insights into the nature of these impairments, which can improve remediation and rehabilitation strategies.

Response selectivity and aphasic spoken word recognition

Daniel Mirman*, Eiling Yee, James Magnuson, Sheila Blumstein

Neuromodulatory and cognitive control mechanisms have been proposed to account for refractory/access semantic deficits and sentence comprehension deficits in aphasia (e.g., Gotts & Plaut, 2002). This talk will describe eye-tracking data on the time course of spoken word recognition in eight aphasic patients and 12 age-matched controls and efforts to understand the underlying aphasic deficit using simulations of variations of the TRACE model of speech perception. A computational implementation of response selectivity accounted for the pattern of differences. This result suggests that variations in cognitive dynamics (i.e., neuromodulatory deficits) may account for a broader range of individual differences than previously proposed.

Naming pictures and repeating words: Analysis of aphasic production errors and predictions from computational models

Gary S. Dell, Nazbanou Nozari, Audrey K. Kittredge*, Myrna F. Schwartz

Aphasic individuals invariably have difficulty producing words from meaning (e.g. the picture-naming task), but are often better word producers when the imperative stimulus is the auditory form of the word (the word repetition task). This talk will review a model of lexical retrieval in production, the interactive two-step model, and use the model to generate predictions regarding the relation between performance in picture naming and auditory word repetition by impaired speakers. The predictions are tested with a case-series analysis of patient naming and repetition error

patterns; specifically focusing on the effects of word frequency. The effect of frequency on phonological errors in repetition was at least as strong as in naming, demonstrating that the lexical-to-phonological mapping, required for naming, is equally influential in repetition.

Basic processes in short-term memory and their role in language comprehension and production

Randi Martin*, L. Robert Slevc, Loan Vuong

The critical relation between working memory and sentence processing can be examined using evidence from brain-damaged patients to draw inferences about normal cognitive processing. This talk will focus on the contribution of retention of item vs. order information to sentence comprehension and the role of interference in sentence comprehension. Findings from neurally intact individuals suggest that the retention of item, but not order, information is crucial to sentence processing and that interference is the primary source of difficulty in comprehending or producing sentences with long-distance dependencies. If so, then patients with deficits in item retention, but not those with deficits in order retention should have difficulty with sentence comprehension. Also, the patients' degree of difficulty in resolving interference should relate to the processing of long-distance dependencies. Data relevant to these claims will be presented.

Why is nonword repetition deficient in specific language impairment?

Dorothy V. M. Bishop

Children with specific language impairment (SLI) have problems with oral language acquisition despite otherwise normal development. One of the most reliable deficits seen in children with SLI is difficulty in repeating polysyllabic nonwords such as "blonterstaping". Gathercole and Baddeley (1990) argued that this was evidence of a impairment in phonological short-term memory that had downstream effects on language learning. This talk will present data from an electrophysiological paradigm in which the participant listens passively to nonword sequences, where a repeated standard such as "ba-bi-bu-be" is occasionally replaced by a deviant sequence where the /b/ changes to /d/ on one syllable. The profile of mismatch responses differs for people with good and poor nonword repetition skills, but it is argued that the pattern of results is not consistent with limited memory storage or rapid decay of representations. Rather, the problem appears to be one of encoding phonological information when successive syllables occur at a rapid rate. This interpretation is more in tune with theories that attribute SLI to difficulties in rapid processing of auditory input than with classic short-term memory accounts.

Language development and mental representation in autism spectrum disorders

Inge-Marie Eigsti

Individuals with autism spectrum disorders have systematic impairments in language production and comprehension, both early (e.g., 1-2-year delays in acquisition) and late (e.g., grammatical judgment deficits in school-age individuals) in development. This talk will describe on-line assessments in two related studies of language in autism spectrum disorders. First, to better understand the interaction of executive processes such as working memory, and an individual's ability to comprehend spoken utterances, we describe a "common ground" study during which participants' eye movements are tracked as they work with a partner on a Tangram-style problem-solving task. Second, we assessed individual representations of nonverbal information, and how those representations inform or are informed by a participant's own spoken language, in study of co-speech gestures in discourse. Both the comprehension and production studies share a common goal of informing us about how the world is represented in spoken language, and language itself can influence our representations of the world.

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