Editorial

Special Issue: Working Memory and Cognition

Erich Schröger, Axel Mecklinger, and Stefan Pollmann

Over the past ten years the topic of human working memory has become the focus of interest for psychologists working in various domains like experimental psychology, psycholinguistics, cognitive psychophysiology, or functional neuroimaging.

Working memory refers to a collection of cognitive systems that function as a work space in which sensory information and information from long-term memory are flexibly processed for further action. A large variety of models have been proposed since the initial three component model of Baddeley and Hitch (1974). A consistent feature of most of these models is that they assume multiple subsystems for temporary storage and higher order processing (executive) functions, as well as modality-specific processing systems. The high relevance of working memory for a large variety of mental functions raises the issue of how working memory is related to other cognitive processes such as attentional selection, language comprehension, or storage in long-term memory. Are working-memory storage modules different from other (sensory or long-term) storage modules? How does working memory interact with earlier stages of visual and auditory analysis? Is attentional control required to maintain information in working memory? How are ongoing operations shielded from interfering processes? What is the contribution of working memory to language comprehension?

Research on working memory and its relation to other cognitive processes can benefit from integrating neurocognitive methodologies with more traditional methodologies from experimental psychology. Event-related brain potentials can provide important insights into the temporal characteristics of brain systems involved in working memory processes. EEG frequency and EEG coherence analyses may help in understanding the neuronal mechanisms (e.g., oscillations) mediating working-memory storage and control processes. Functional magnetic resonance imaging (fMRI) allows the identification of the brain systems underlying these processes with high spatial resolution.

The aim of the Special Issue *Working Memory and Cognition* is to provide an overview of contemporary neurocognitive research on working memory and its relation to other cognitive processes. The Special Issue contains contributions from nine projects of a research group entitled *Working Memory: Input, Rehearsal and Retrieval Processes*, funded by the German Research Foundation, which was implemented at Leipzig University. The work of the first period between 1997 and 2000 has been summarized in an edited volume entitled *Working on Working Memory*. Part of the work from the second and final period between 2001 and 2004 is documented in this Special Issue. The research group intensively cooperated with many groups from other European countries and from overseas investigating related topics. A few of them were invited to contribute to this Special Issue. Due to space limitations, these contributions from Brumback, Low, Gratton, and Fabiani (in press; Urbana-Champaign, USA), Klimesch, Schack, and Sauseng (in press; Salzburg, Austria), Rushworth, Passingham, and Nobre (in press; Oxford, England), and Winkler and Cowan (in press; Budapest, Hungary, and Missouri, USA) will appear in regular issues of *Experimental Psychology* in the near future.

The papers investigating working memory functioning may be arranged along four lines. Three contributions (Jacobsen & Schröger, 2004; Kaernbach, 2004; Berti, Roeber, & Schröger, 2004) examine auditory working memory processes, their relation to sensory and long-term memory, their relevance for sound and speech processing, and the distinction between categorical and sensory auditory information. Two other contributions (Mecklinger, Gruenewald, Weiskopf, & Döller, 2004; Pollmann, 2004) investigate how working memory and attentional control are related to each other. The role of the prefrontal cortex in mediating these processes is of special in-

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terest in this context. Two papers (Conci, Elliott, Müller, Wendt & Becker, 2004; Herrmann, Senkowski & Röttger, 2004) are devoted to the functional role of oscillatory EEG activity in the theta, alpha, and gamma frequency range for sensory and storage processes in the visual domain. Finally, two papers (Bornkessel, Fiebach, Friederici, & Schlesewski, 2004; Wagner & Gunter, 2004) elaborate on the role of working memory for language comprehension. Using different methodologies, these latter reports argue that working-memory capacity is highly related to the efficiency of inhibitory control processes. They also refer to the important role of individual differences in working memory capacity for the examination of language comprehension. However, taking another look raises alternative ways of categorizing the papers. For example, attentional control and the potential significance of the prefrontal cortex is at issue in almost every paper. On the other hand, taking into account bottom-up flow of information is mandatory to understand attentional control processes. Thus, the papers could have been sorted in other ways as well.

Most contributions to this special issue demonstrate the high relevance of using different neurocognitive methodologies (oscillatory EEG activity, ERPs, fMRI) for understanding working memory functioning. In our opinion, the application of these methodologies is an important and promising step in working-memory research, as they address the same level of description as the purely behavioral approach. However, the benefit of these methodological approaches has just started to be exploited. For example, there is still a lack of the combined use of different methodologies in the same experimental set-up. Therefore, considerable progress is to be expected in the near future. Yet, we hope that the present studies will be of interest for the reader and stimulate new studies on working memory functioning.

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