The myriad functions and metaphors of memory

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Abstract: Glenberg provides a new and exciting view that is especially useful for capturing some functional aspects of memory. However, memory and its functions are too multifarious to be handled by any one **Conceptualization,** We suggest that Glenberg's proposal be restricted to its own "focus of convenience." In addition, its value will ultimately depend on its success in generating detailed and testable theories.

Glenberg proposes a new approach to memory that is predicated on certain assumptions about the function of memory. He states that his proposal "is not a fully testable theory" (sect. 1.3, para. 7). but evaluates it in light of empirical findings in a post-hoc manner. Overall, 23 different phenomena of memory, language, and thought are addressed (as summarized in sect. 7.1), ranging from the symbol grounding problem to the effects of expertise.

We believe that Glenberg's proposal is best viewed as a meta-theoretical rather than a theoretical contribution. What he is offering is more a metaphor (or set of metaphors) for thinking about memory than an articulated and testable theory. As metaphors, the concepts of "embodiment," "mesh," "trajectory," and so forth allow certain aspects of memory to be construed in terms of the physical analogs of these concepts. They can help guide our thinking about memory and perhaps inspire the development of a new genre of memory theories. However, as currently formulated, the concepts and auxiliary assumptions are too underspecified to constitute such a theory in themselves.

Metaphors play an essential role in science (Koriat & Goldsmith 1996a). They are cognitive tools that help in abstracting the critical aspects of the phenomena, in defining the questions of interest, and in guiding the research approach. Moreover, they provide a general conceptual framework that serves that development of specific theories and models. Unlike the theories that they breed, however, metaphors are neither right nor wrong: They can be judged only in terms of their usefulness. This applies to Glenberg's proposal as well. Three main conclusions follow from this viewpoint.

First, a major benefit of Glenberg's conceptualization is that it brings to the fore certain neglected aspects of memory. As he points out (sect. 7.4), traditional memory research has generally-focused on the study of item memorization. Behind this preoccupation lies the storehouse metaphor of memory, which has shaped much of the history of memory research (Koriat & Goldsmith 1996a; Roediger 1980). In recent years, however, many-important memory phenomena that have attracted experimental attention - such as procedural memory, implicit or indirect memory, and priming effects - do not yield readily to conceptualization in terms of the storage and retrieval of discrete memory traces. To accommodate these and other phenomena, several alternative conceptualizations have been put forward, including Bransford et al.'s (1977) "stage-setting" metaphor, the "proceduralistic" or "skill" view of memory (e.g., Crowder 1993; Kolers & Roediger 1984), and the "tool versus object" distinction offered by Jacoby and Kelley (1987).

Such efforts notwithstanding, we are still lacking convenient metaphors to guide our thinking about the effects of past experience on perception and action. Glenberg's view focuses attention on precisely this aspect of memory and offers a rich vocabulary for construing the working of memory within the functional context of an organism's active interaction with the environment (cf. Bruce 1985; Neisser 1988). Hence, one could find the view useful even if it had no predictive power beyond other existing formulations.

Second, however, metaphors fulfill a critical function by serving as stepping stones toward testable theories. Here we see Glenberg's proposal as mainly a promissory note. Our feeling is that there is a jump from a metatheoretical, metaphorical level of

analysis to the empirical level (as but one example, consider the argument regarding the need for cyclical activity in rehearsal, put forward in sect. 4.3, para. 4). Although a metaphor both guides and constrains the types of theories that can be developed, different theories - and hence predictions - can be derived from the same metaphor. Ultimately, then, the value of the proposal will depend on its success in breeding detailed theories from which testable predictions can be derived.

A third observation also stems from our view of the function of conceptual metaphors. As a cognitive tool, each metaphor has its own "focus of convenience" (Kelly 1955), that is, a domain of phenomena or processes for which it is best suited. The focus of convenience of Glenberg's proposal seems to be the implicit and procedural aspects of memory that support a major portion of our daily interaction with the environment. These phenomena are salient in many of the examples used to introduce the basic core of the proposal (sect. 2).

Glenberg, however, makes a great effort to stretch his conceptualization to other areas that seem to be well beyond its natural focus of convenience. Although his desire to provide a comprehensive and integrative conceptual framework is understandable, we feel that by going too far afield he does a disservice to his proposal. Some of the extensions of his framework seem to be rather forced and unconvincing. For example, the idea that explicit, episodic remembering is effortful because it requires suppression of "clamped" impinging stimuli (sect. 5.2) adds little to existing explanations and fails to address many of the essential aspects of such remembering that seem to be captured better by other metaphors.

In our opinion, one should not attempt to achieve too much with any single metaphor. Glenberg began his proposal by asking "what is memory for?" and his answer led him to a particular view of memory with a particular focus of convenience (see also Alterman 1996; Kam & Zelinsky 1996). Others, focusing on different functions and aspects of memory, have been led to rather different views. For example, emphasizing the role of memory in providing a faithful account of past events, we proposed a "correspondence" metaphor (Koriat & Goldsmith 1996a) that is useful in such domains as autobiographical memory, eyewitness testimony, and metamemory (Koriat & Goldsmith 1994; 1996b). Neisser (1996) stressing the social functions of memory in everyday life (e.g., impression management), proposed to view memory as a form of "doing" (see also Winograd 1996). Anderson (1996), stressing the contribution of memory to the formation of value judgments (e.g., attitude formation), opted for a "value metaphor," in which memory involves the "on-line construction of values and integration thereof."

How should one treat such differences of opinion regarding the essential nature of memory? Clearly, each view entails its own unique framework for memory research and theorizing. Nevertheless, they can all live together peacefully and contribute to the study of memory in their respective domains. As we have argued previously (Koriat & Goldsmith 1996c), memory is not monolithic, and any attempt to characterize it in terms of a single conception or function will certainly not do justice to its inherent heterogeneity. Thus, in line with our call for "metaphorical pluralism," we applaud Glenberg's proposal as a stimulating new addition to our arsenal of conceptual tools for understanding memory. However, no approach can claim to have a monopoly on the myriad facets and functions of memory.

What working memory is for

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Abstract: Glenberg focuses on conceptualizations that change from moment to moment, yet he dismisses the concept of working memory (sect. 4.3), which offers an account of temporary storage and on-line cognition. This commentary questions whether Glenberg's account adequately caters for observations of consistent data patterns in temporary storage of verbal and visuospatial information in healthy adults and in brain-damaged patients with deficits in temporary retention.

If I close my eyes and then try to pick up the pen on the desk in front of me, it is immediately apparent that we humans have temporary representations of our immediate environment. These representations survive the offset of visual perception and support our interactions with the environment that we have recently perceived. Memory then offers a means to support this interaction, but are the temporary representations products of how memory works or do they arise from emergent properties of the cognitive apparatus for temporary retention (Logie 1995; Richardson et al. 1996)?

Consider another observation. There are individuals who, following brain damage, are unable to retain simple verbal sequences, and who fail to show a range of phenomena linked with temporary retention of words by healthy brains (e.g., Vallar & Baddeley 1984; for a review, see Delia Sala & Logie 1993). Yet these same individuals can hold normal conversations and seem to have little difficulty in finding their way around in the world. A different kind of brain damage can result in individuals who have no difficulty retaining verbal sequences or describing a scene while viewing it, yet cannot adequately access information from parts of the scene once it has been removed (Beschin et al., in press; Guariglia et al. 1993).

The current representations of scenes or words in each of the above scenarios might be likened to Glenberg's notion of meshing or conceptualization. But in his analysis there is little to account for those aspects of memory that, in the absence of the external physical stimulus, might allow the conceptualizations to be maintained moment to moment, or to be updated and manipulated. Various theories of cognition have attributed these lands of cognitive functions to what is often referred to as working memory. There appears to be no place for this breed of theory in Glenberg's view, yet he argues that on-line conceptualization is the reason that we have memory. His arguments fail to consider the reports of patients with specific deficits of temporary storage. However, the contrasting data patterns from amnesics and from patients with short-term retention deficits offer strong evidence for functional dissociations between modules of working memory and a cumulative collation of knowledge and experiences.

The demonstration of long-term as well as short-term recency effects (sect. 4.3, para. 1) does little to erode the case for a separate working memory. The time scales over which these different forms of recency appear are dramatically different, and I have yet to see evidence of suffix effects or effects of delayed recall in a study of long-term recency. Moreover, the demonstration of semantic coding in temporary storage tasks simply indicates that short-term storage is not limited to the traditional view of a short-term verbal memory. The finding is entirely consistent with working memory as a bailiwick of specialized cognitive functions that support temporary storage and on-line manipulation of representations. Other counterarguments can be offered for the remaining examples given in this section of Glenberg's target article.

The notion of working memory offers a framework within which to account for on-line semantic processing (e.g., Just & Carpenter 1992), for temporary storage of visual and spatial properties of the environment (Logie 1995), and for temporary storage of verbal material. In particular, the concept of the phonological loop has been singularly successful in providing a coherent account of a