

Mental models in recognizing verbally described spatial arrangements:

Towards the interaction of schemata and text representation

Dutke, Stephan

First published in:

The German Journal of Psychology, Vol. 18, S. 19 - 20, Seattle 1994, ISSN 0705-5870

Münstersches Informations- und Archivsystem multimedialer Inhalte (MIAMI)

URN: urn:nbn:de:hbz:6-69329470737

Experimental and Physiological Psychology

No. 001 **Dutke, S.** (1993). Mental models in recognizing verbally described spatial arrangements: Towards the interaction of schemata and text representation. [Mentale Modelle beim Erinnern sprachlich beschriebener räumlicher Anordnungen: Zur Interaktion von Gedächtnisschemata und Textrepräsentation.] *Zeitschrift für Experimentelle und Angewandte Psychologie*, 40, 44–71. (29 Ref., 5 Fig.)

S. Dutke, Freie Universität Berlin, Institut für Psychologie, Habelschwerdter Allee 45, 14195 Berlin, Germany.

Introduction: The “mental model” is a theoretical construct used to explain text comprehension and text recognition. A mental model represents the reference to a text and is distinguished from the representation of the text itself. Mani and Johnson-Laird (1982) hypothesized a temporal succession of both representations during text comprehension: The propositional text representation precedes an integrated, partially image-like mental model of the reference. Their experiments indicated (1) that the propositional representation is a necessary prerequisite for the construction of a mental model which decays immediately after the model is built and (2) that indeterminate descriptions of spatial arrangements hinder the model construction leading to solely the propositional representation remaining available. This theory is elaborated in two aspects: Memory schemata may support the construction of a mental model. The use of long-term schematic knowledge may compensate the hindrance caused by indeterminate description. Secondly, the distinction between schemata as long-term memory constructs and mental models as temporary working memory constructs leads to the conclusion that mental models do not only depend on input but also on recognition demands.

Method: The following three experiments were based on the experimental paradigm by Mani and Johnson-Laird (1982). Eight descriptions of spatial arrangements (5 objects each) were constructed according to two orthogonal factors: determinate vs. indeterminate description and schematic vs. non-schematic object arrangement. The material was identical in all three experiments. In Experiment 1, 18 adult subjects read all descriptions in randomized order. After each description they were shown a diagram which had to be judged with respect to its compatibility with the verbal description. Immediately following, an unexpected recognition test was administered. For each of the 8 descriptions a set of four alternatives was presented comprising the original, a compatible, but differently worded alternative, and two incorrect descriptions. The subjects had to rate the four alternatives according to their similarity to the initially presented description. The same procedure, except the instruction, was used in Experiment 2: Sixteen adults were instructed to rate the alternatives in the recognition test according to their similarity to the initial object arrangement, not to its verbal description. In Experiment 3 both instructions were tested against each other in a two-group design.

Results: These can be summarized as follows: (1) Schemata render a mental model representation, even if the verbal description is indeterminate. Indeterminate/non-schematic items are less easily recognized than all other items, but indeterminate/schematic and determinate items are recognized equally well. (2) The text representation does not decay immediately after building a mental model: Mani and Johnson-Laird assumed that in the indeterminate/non-schematic items no mental model is constructed. Therefore the original should be clearly preferred to the compatible alternative. However, these experiments failed to provide unequivocal evidence for this hypothesis. Additionally, the absolute values revealed that a text representation is available even in items for which a decay of the text representation was predicted. (3) Despite identical encoding procedures mental models support performance in different recognition tasks: The original-to-compatible preference relies on the recognition instruction. The instruction to rate the similarity between the alternatives and the initially described object arrangement yields a smaller original-to-compatible preference than the instruction to rate the similarity to the initial verbal description. This result supports the interpretation that mental models are temporarily constructed in the working memory, closely related to recognition demands. (4) Mental models support recognition differentially depending on the interaction of their components and recognition demands: A mental model of an indeterminate/schematic item is assumed to base mainly on long-term schematic knowledge. Such items are more effectively recognized when the similarity to the object arrangement has to be rated. In contrast, a mental model of a determinate/non-schematic item is assumed to be based mainly on the text representation. The results indicate that it supports recognition more powerfully when the similarity to the verbal description is rated.

References

- Mani, K. & Johnson-Laird, P.N. (1982). The mental representation of spatial descriptions. *Memory and Cognition*, 10, 181–187.