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Getting a picture that is both accurate and stable: Situation models and epistemic validation ☆

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ABSTRACT

Text comprehension entails the construction of a situation model that prepares individuals for situated action. In order to meet this function, situation model representations are required to be both accurate and stable. We propose a framework according to which comprehenders rely on epistemic validation to prevent inaccurate information from entering the situation model. Once information has been integrated in the current situation model, it serves as part of the epistemic background for validating new information, leading to a stable representation. We present evidence for this view from an experiment in which participants responded to paraphrase and inference items after reading expository texts. Multinomial model analyses of the responses and multilevel analyses of the response latencies revealed that plausible information is more likely to be integrated into the situation model while information that is part of the situation model is more likely to be judged as plausible. This pattern of results suggests a close bi-directional relationship between situation models and epistemic validation.

The assumption that readers construct a situation model as a referential representation of the state of affairs described in a text in a quick und effortless way is now a commonplace assumption in the psychology of language (Zwaan & Radvansky, 1998). However, the ultimate goal of situation model construction and its consequences for comprehension are still a point of contention. In this article, we start from the assumption that situation models serve the extra-linguistic purpose to enable comprehenders to interact with the world (Glenberg, 1997). In order to fulfill this function, situation models are required to be both accurate and stable representations of the actual state of affairs. We will suggest that comprehenders achieve accurate representations by using their world knowledge to validate text ideas before integrating them into their situation model of the text content. Stable representations are achieved by using the situation model itself to validate incoming text information. This framework implies that the likelihood for a particular piece of information to become part of the situation model depends on its plausibility. Moreover, integration of information into the situation model may be expected to increase its subjective plausibility. We will present results from an experiment that tested the hypothesized relationships of situation models and plausibility. Participants read extensive expository texts, and multinomial models were applied to comprehension and plausibility judgments collected with a modified version of the recognition method proposed by Schmalhofer and Glavanov (1986). The multinomial model results were cross-validated by an analysis of response times.

Situation models need to be accurate and stable

From the perspective of grounded language comprehension, it is plausible to assume that the ultimate goal of comprehension is not to acquire a coherent meaning

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representation (e.g. Kintsch, 1988) but to prepare individuals for situated action (e.g., Glenberg, 1997). According to this view, situation models are representations that enable comprehenders to use communicated information to interact with the world (e.g., Zwaan, 1999). In order to meet this function, a situation model needs to have at least two important properties that seem to be partially incompatible at first sight. First, a situation model needs to represent the state of affairs described in a text as accurately as possible (criterion of truth). Second, situation models need to be sufficiently stable in order to allow successful interactions with the world (criterion of stability). We will discuss these two criteria in turn.

The relevance of the *criterion of truth* for comprehension can be illustrated by looking at everyday comprehension situations. In most of these situations, comprehension is not an end in itself, but part of more broadly defined actions that require adequate representations of real-world situations. Consider, for example, a situation model that an individual constructs while reading a user's manual of a technical appliance. This situation model will be useful to the extent that it adequately reflects the functionality of the appliance. More generally, informational or expository texts are usually read with the proximal goal of knowledge acquisition, i.e. the construction of internal representations that approximate the criterion of truth. Knowledge in terms of accurate representations, in turn, is an important prerequisite of goal-directed action.

The idea that comprehension critically depends on the acquisition of accurate representations may seem commonplace but it provides a perspective that is largely new to the psychology of language and text comprehension. Starting with the pioneering work of Kintsch and van Dijk (1978), most of the theories developed in the area of text comprehension, for example, have put their focus on coherence relations. Consequently, these theories have posited the construction of an internally coherent representation as the ultimate goal of comprehension. Compared to coherence, the correspondence of text ideas to states of affairs in the world and its role in comprehension have received relatively little attention (Long & Lea, 2005). A related problem is the way how theories of text comprehension have conceptualized the use of knowledge in comprehension. Across the board, bottom-up, text-driven models such as the Construction-Integration model (Kintsch, 1988) as well as top-down models such as schema theory (Bransford & Johnson, 1972) or the constructionist theory of inferences (Graesser, Singer, & Trabasso, 1994) assume the primary function of knowledge to be a supplement to the information explicitly provided by a text. In particular, it has been suggested that knowledge aids the interpretation of incoming information and provides a scaffold for its integration or a knowledge base for inferences. In contrast, the idea that knowledge might be used to validate text information in order to construct a situational representation that approximates the criterion of truth is not covered by major theories of language and text comprehension. One notable exception is the theory of mental models. This theory assumes that new information is checked for consistency with other elements and relations in the current mental model before it is integrated into the model (Johnson-Laird, 1983, p. 249). So far, however, this aspect of the theory of mental models has not attracted any systematic research in the area of text comprehension. To conclude, the question whether situation models are accurate representations of the actual state of affairs and the related question of the role of knowledge-based validation are relevant in everyday comprehension situations. They are also reminiscent in many studies on text comprehension on inconsistency effects, which will be reviewed later. Nonetheless, these questions have largely been ignored by the dominant theoretical proposals in the area.

The relevance of the *criterion of stability* for comprehension also becomes apparent when the potential use of situation models for action is taken into account. If new information constantly prompted individuals to change their worldview, they would be unable to engage in goal-directed action (Dreisbach & Goschke, 2004). The stability of representations is not a new topic in the psychology of language. Traditionally, it has been solved either by assuming that stability is achieved by relatively inflexible knowledge structures such as schemata that guide comprehension (Bransford & Johnson, 1972). Alternatively, it has been suggested that new propositions are being integrated into a large and therefore inert associative network with existing link strengths (Kintsch, 1988). Here, we take a different approach by assuming that both the criterion of truth and the criterion of stability are tied to the validation of incoming information.

A framework for epistemic validation processes

How do comprehenders manage to achieve both accurate and stable representations? We suggest that they carry out epistemic validation processes that monitor whether incoming information is consistent with other ideas provided in the text, with the current state of the situation model, and with general world knowledge. We assume that these validation processes are routinely carried out when situation models are updated and that they are a major determinant of whether a particular piece of information is integrated into the situation model, with the potential consequence of altering a comprehender's world view. It seems plausible to assume that epistemic validation rests on two component processes that may be termed epistemic monitoring and epistemic elaboration. These two types of processes are linked to the distinction of memory-based and explanation-based processes in comprehension.

Epistemic monitoring processes check for inconsistencies between incoming text information on the one hand and elements of the current situation model or world knowledge retrieved from long-term memory on the other hand. We expect that epistemic monitoring processes are carried out routinely and require relatively little cognitive effort. This is because they refer to information that is already part of working memory, such as elements of the currently active situation model, or to elements of long-term memory that can easily be made available by memory-based processes (e.g., McKoon & Ratcliff, 1995; Myers & O'Brien, 1998; O'Brien & Albrecht, 1992). Thus, in normal reading