Assimilative Processing of Controversial Science Texts

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Abstract. When learning with multiple texts about controversial scientific issues, learners are faced with the task to construct a coherent situation model of the issue on the basis of conflicting information. We propose that learners handle this task by routinely judging the plausibility of incoming information with regard to their current situation model and prior knowledge (epistemic monitoring). If learners lack the ability or motivation to process information in an elaborative way, epistemic monitoring leads to a default rejection of conflicting information (assimilative processing). In the present experiment, we focus on situational and learner-based characteristics that support assimilative processing. Students read four conflicting texts about scientific issues. Afterwards, comprehension, source identification, and the ability to justify one´s own point of view, were assessed. In line with the idea of assimilative processing, results indicate that the order and mode in which conflicting texts are presented as well as learners' initial position on the issue affect situation model construction.

Keywords: assimilative mode of processing; epistemic validation; situation model; multiple texts.

When learners research scientific information in the web, they normally study more than one text about the same topic. This raises the questions how people comprehend multiple texts and under what conditions learning with multiple texts is successful (Perfetti, Rouet & Britt, 1999). In their theory of multiple document representation, Perfetti and colleagues have proposed a theoretical framework describing the structure of mental representations formed in multiple text comprehension. According to them, one of the specific challenges involved in multiple text comprehension is that learners have to construct a coherent referential representation (situation model) on the basis of multiple perspectives and evidence. Still, the extant theories on text comprehension are largely mute about the cognitive processes involved in knowledge acquisition with multiple texts that contain conflicting information. The goal of our research is to fill this gap by developing a cognitive model of processing conflicting information. The present experiment focuses on determinants and consequences of *assimilative processing*, which we assume to be the default mode of processing conflicting information in multiple texts.

Processing of conflicting information in multiple texts

When studying multiple texts with conflicting arguments, learners need to actively judge whether or not the information communicated by the various texts is true and plausible. This kind of judgment may be termed epistemic validation (Richter, 2003). We assume that epistemic validation is based on two processes: epistemic monitoring and epistemic elaboration.

Epistemic monitoring and assimilative processing

Epistemic monitoring encompasses the automatic and efficient evaluation of newly incoming text information for its consistency with the current situation model of the content domain and accessible prior knowledge (Richter, Schroeder & Wöhrmann, 2009). Epistemic monitoring serves the important purpose of protecting the mental system from being contaminated by false information. However, in learning with multiple texts, the automatic and efficient character of epistemic monitoring can lead to an assimilative processing of conflicting information if a learner is not motivated or able to engage in further epistemic elaborative processing. Thus, by default, only information that is consistent with previously acquired knowlege will be integrated into the situation model, whereas inconsistent information will be rejected and not processed any further.

Epistemic elaboration

In contrast to epistemic monitoring, epistemic elaboration is a strategic process, which learners may use if they become aware of a cognitive conflict detected by epistemic monitoring (Richter, 2003). Epistemic elaboration involves an active resolution of the cognitive conflict by a searching for critical arguments for and against both sides of the conflicting issue. Thereby it will result in a more balanced and rich situation model. However, in contrast to assimilative processing, elaborative processing is resource-demanding and goal-dependent. Thus, learners will go beyond assimilative processing of conflicting information only if they possess relevant cognitive resources (prior knowledge and working memory capacity) and are motivated during reading to form a well-justified own point of view (epistemic learning goal, Richter & Schmid, 2010).

Rationale

Our main goal in the present experiment was to investigate whether and in which way the construction of a referential text representation (situation model) and the memory for the text itself (propositional textbase) depend on the sequence in which multiple texts concerning a scientific controversy were read, and on learners' initial beliefs. According to our theory, both factors may be regarded as major determinants of assimilative processing of conflicting information.

Method

We conducted an experiment with a 2(*text order*: pro-contra vs. contra-pro)*2(*mode of presentation*: blocked vs. alternating)*2(*argumentative position*: pro vs. contra) design, with the first two variables varied between-subjects and the latter variable varied within-subject. Psychology students (N=82) read four texts that represented divergent positions on one of two issues (climate change /regular vaccinations). After each text, comprehension was assessed on the level of the propositional textbase and on the level of the situation model using a recognition/verification task). In this task participants decided for three types of test items (paraphrases, inferences, and distractors) whether they represented information explicitly provided by the text or information matching its content. After having read all four texts, participants judged for the same set of items whether they found them plausible and which text they came from (source memory). Finally, they were asked to justify their own standpoint on the issue. Relevant learner characteristics (initial position in the issue, prior knowledge, epistemological beliefs) were measured four weeks prior to the experiment.

Results and Discussion

We report results from ANCOVAs (by subject) on paraphrase items (memory for text) and inference items (situation model). Prior knowlegde, epistemic reading goal and epistemological beliefs were included as covariates.

Situation model

The assumption of an assimilative mode of processing implies that a blocked mode of presentation should lead to a stronger situation model for texts supporting learners' initial beliefs compared to the situation model for the opposing texts. In contrast, an alternating mode of presentation should level out these differences. In accordance with this assumption, we found a significant interaction of the texts' argumentative position and the mode of presentation, $F(1, 73) = 4.92$, $p < .05$, $\eta^2 = .06$. When the texts

were presented in a blocked mode, the situation model for the pro-texts (which supported participants' initial beliefs) was stronger than the situation model for the contra-texts (which ran counter participants' beliefs). When the texts were presented in an alternating mode, the situation models for pro- and contra-texts were equally strong (Figure 1). One interpretation of this finding is that the alternating presentation stimulated elaborative processing by making learners aware of conflicting information due to coactivation (similar to effects of refutational texts, van den Broek & Kendeou, 2008).

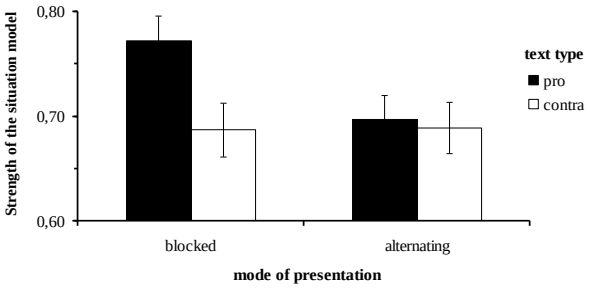

Figure 1. Strength of the situation model (measured by the proportion of inferences misjudged as coming from the text) by text type and mode of presentation.

Memory for text (propositional textbase)

Epistemic monitoring is involved in situation model construction but it might also affect memory for information explicitly provided by the text. In line with this possibility, we found a significant three-way interaction of argumentative position, text order and mode of presentation, $F(1, 73) = 5.07$, $p < .05$, $\eta^2 = .07$. In a blocked mode of presentation, memory was stronger for pro- or for contra-texts, whichever type of text was presented first. When the texts were presented in an alternating sequence, the interaction of argumentative position and text order disappeared. Again, one possible explanation of this effect is that the alternating presentation might have increased attention to the arguments presented in the texts, including those texts that run counter participants' initial beliefs.

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