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Chapter 9: “The role of validation in multiple documents comprehension”
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Introduction and Purpose

Readers using the World Wide Web as a source for informal learning are often confronted with documents that provide partial and one-sided information supporting only one position in a controversy, or argue for divergent positions and viewpoints, or provide alternative and contradictory evidence for the same circumstance. This is especially true with topics of high social or individual relevance that are debated controversially in public (e.g., controversial political or socio-scientific issues). How do readers comprehend multiple documents with conflicting information? How do they achieve a coherent and consistent representation of controversially debated issues?

Ideally, readers would form a *documents model* that adequately represents the content of each text that they read, in addition to the semantic and argumentative relationships between texts (see Britt, Rouet, & Durik, this volume, Chapter 2; Perfetti et al., 1999; Rouet & Britt, 2011). As such, they would also integrate information from the various texts into a coherent mental model of the controversial issue and weigh this information according to the perceived trustworthiness of the sources. However, ample research shows that readers’ actual processing of multiple documents and the resulting mental representations seldom come close to this ideal model of multiple documents comprehension. Unless readers are explicitly trained in sourcing

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strategies, readers often fail to spontaneously pay attention to characteristics of the source (von der Mühlen, Richter, Schmid, Schmidt, & Berthold, 2016). As a consequence, they fail to consider this information in comprehending multiple documents about controversial topics (e.g., disputed historical topics, Wineburg, 1991). In many cases, readers also fail to reflect on and incorporate the information from divergent perspectives and argumentative stances (Rouet, 2006), resulting in the construction of a one-sided representation of controversial issues (Britt, Perfetti, Sandak, & Rouet, 1999).

It is now a commonplace assumption in text comprehension research that readers usually opt for an adequate representation of the linguistic message content that suits their given purpose, which minimizes cognitive effort during comprehension (Ferreira, Bailey, & Ferraro, 2002). It seems that multiple text comprehension is no exception to the rule. In this chapter, we advance the idea that readers rely on a general comprehension mechanism (interchangeably) called *validation* (Singer, 2013) or *epistemic monitoring* (Isberner & Richter, 2014a) to achieve a coherent, albeit one-sided representation of multiple documents containing controversial information. Validation means that readers use their knowledge and beliefs plus the linguistic context to monitor the validity (i.e., the truth, plausibility, or consistency) of text information (Singer, 2013). When readers possess strong and accessible beliefs about a controversial issue, this mechanism continually generates implicit assessments of plausibility that indicate the degree of fit between a given piece of information and readers' beliefs (for a similar definition of plausibility, see Connell & Keane, 2006, p. 98). We propose that these implicit plausibility assessments regulate comprehension and encoding of controversial issues in such a way that belief-consistent information has a processing advantage over belief-inconsistent information in comprehension and memory (text-belief consistency effect, e.g., Eagly & Chaiken, 1993;

Knobloch-Westerwick & Meng, 2011; Maier & Richter, 2013a; Wiley, 2005).

The remainder of this chapter is organized as follows: We will first discuss the concept of validation during comprehension that has been proposed as a general and routine comprehension mechanism. We will then sketch a simple two-step model of the cognitive processing of conflicting information in multiple documents (Richter, 2011; Richter & Maier, 2017) and discuss studies on multiple text comprehension through the lens of this model. The chapter ends with a discussion of the implications of validation for research on multiple text comprehension and educational practice.

Comprehension and Validation of Text Information

It is a commonplace assumption in text comprehension research that successful text comprehension involves not only the construction of a propositional text base that presents readers' memory for text as a network of propositions but also a situation model of the text content (Johnson-Laird, 1983; van Dijk & Kintsch, 1983). The situation model is often conceived as a referential representation of the state of affairs described in a text that integrates text information with prior knowledge (van Dijk & Kintsch, 1983; Zwaan & Radvansky, 1998). Knowledge activation during situation model construction is largely a passive, memory-based process. That is, knowledge is passively triggered by concepts and propositions in the text (e.g., Albrecht & O'Brien, 1993; O'Brien & Myers, 1999), and it becomes reactivated if it sufficiently resonates as a result of a signal from currently read information (memory-based text processing; O'Brien & Myers, 1999; O'Brien, Rizella, Albrecht, & Halleran, 1998).

Text comprehension research traditionally focused on the interplay of knowledge activation and integration during comprehension (e.g., Kintsch, 1988). However, several

researchers have proposed the validation of text information as a third type of cognitive process routinely involved in comprehension (Cook & O'Brien, 2015; Richter, 2015; Singer, 2006, 2013). The basic idea is that information from previously read text that is activated passively through memory-based processes is not only used to interpret and augment text information during comprehension, but also to assess its validity.

A growing body of literature from language and text comprehension research supports the assumption of a passive validation process during comprehension. Results from different experimental paradigms suggest that readers evaluate the consistency of text information with prior knowledge and beliefs non-strategically, that is, even without an evaluative reading goal and also early in comprehension. For example, reading time experiments based on the inconsistency paradigm have indicated that readers tacitly check whether text information is consistent with the linguistic context (including pertinent world knowledge) during reading. A number of reading time experiments based on the inconsistency paradigm also supports the assumption of routine validation processes (Albrecht & O'Brien, 1993; Kendeou, Smith, & O'Brien, 2013; Myers, O'Brien, Albrecht, & Mason, 1994; O'Brien et al., 1998). In several experiments based on this paradigm, participants read stories that include sentences about a protagonist's actions (e.g., *Mary ordered a cheeseburger*) that were consistent or inconsistent with character traits (e.g., Mary is a vegetarian or eats fast food) introduced earlier in the story. Such inconsistencies are routinely detected under conditions that cause the relevant information to be (re-)activated by memory-based processes. With similar textual manipulations, researchers have shown that readers are also sensitive to spatial, causal, temporal, logical, and other kinds of situational inconsistencies (Albrecht & Myers, 1995; Lea, Mulligan, & Walton, 2005; O'Brien & Albrecht, 1992; Rinck, Hähnel, & Becker, 2001; Singer, 1993; Singer, 2006; Singer, Halldorson,

Lear, & Andrusiak, 1992). Refining the results from reading time studies, eye-tracking experiments have shown that inconsistencies with readers' world knowledge affect early fixation measures (such as first fixation durations) when the described situations touch upon readers' typical experiences (Matsuki, Chow, Hare, Elman, Scheepers, & McRae, 2011; Staub, Rayner, Pollatsek, Hyönä, & Majewski, 2007). These findings support the idea that validation takes effect early in comprehension when readers possess strong and available knowledge and beliefs (for ERP studies supporting the same conclusion, see Ferretti, Singer, & Patterson, 2008; Hagoort, Hald, Bastiaansen, & Petersson, 2004).

A different approach that sheds light on the involuntary character of validation processes is the epistemic Stroop paradigm (Richter, Schroeder, & Wöhrmann, 2009). This paradigm affords opportunities to examine whether readers monitor violations of world knowledge in linguistic messages even when this activity hampers performance in their actual task. In an epistemic Stroop experiment, single words are presented at a fixed rate (e.g., 300 ms). The words successively form sentences. At some point, participants are prompted to make binary judgments unrelated to the sentence content. For example, participants judge the spelling of words (Richter et al., 2009), the font color (Isberner & Richter, 2013), or they respond to probe words (TRUE or FALSE) with different keys (Isberner & Richter, 2014b). These experiments have repeatedly shown that responses slow down when participants are required to give a positive response (e.g., YES or CORRECT) or respond to the TRUE probe after invalid sentences compared to the same responses to valid sentences. This epistemic Stroop effect was obtained for outright false sentences (e.g., *Computers have emotions*, Richter et al., 2009; Isberner & Richter, 2014b) but also for sentences that were merely implausible in the context of a preceding sentence (e.g., *Frank has a broken leg . . . He calls the plumber*, Isberner & Richter, 2013). These results have

advanced the findings from the reading time studies by showing that invalid sentences induce a negative response tendency. Readers not only experience comprehension problems when encountering implausible and inconsistent information but also implicitly judge the validity of the presented information.

Two aspects of validation require further elaboration because they are important in understanding the role of validation in the comprehension of controversial information. First, the distinction between (inter-subjectively shared) knowledge and (subjectively held) beliefs is sometimes important in psychology. Interestingly, this distinction is less important for validation, which can be based on knowledge and beliefs alike, provided that they are easily accessible and passively activated during comprehension. An experiment by Voss, Fincher-Kiefer, Wiley, and Silfies (1993, Experiment 1) is a case in point. These authors found that readers holding strong beliefs (indicated by strong agreement or disagreement) make evaluative judgments regarding sentences as fast as judgments of meaningfulness. Thus, validation keeps pace with comprehension when readers hold strong beliefs (for similar results on the immediacy of belief-based validation responses, see Wyer & Radvansky, 1999).

A second important point to keep in mind is that validation provides a shallow assessment of text information consistency with co-activated information at a given point during reading. The processing precludes a complete and thorough assessment of the epistemic status or the internal consistency of information. These statements are consistent with findings from metacomprehension research showing that comprehension monitoring during reading is often poor (for an overview see Baker, 1989). Most studies on metacomprehension used an error-detection paradigm to examine readers' evaluation of comprehension as an indicator of their sensitivity to inconsistencies and contradictions (e.g., Baker, 1985; Winograd & Johnston, 1982).

For example, Baker (1985) found that without specific instructions college students detected 68% of nonsense words but only 22% of prior knowledge violations and 12% of internal inconsistencies embedded in a text. At first glance, these and other similar results (e.g., Baker & Beall, 2009; Otero & Kintsch, 1992) seem to be at odds with the assumption that text comprehension entails the routine validation of text information and the supporting experimental evidence. However, one plausible interpretation that reconciles the seemingly discordant results is that participants in the metacomprehension studies might not have detected the inconsistencies because the inconsistent information was not co-activated when the relevant text information was processed. Moreover, the explicit (and often retrospective) judgments required in the error-detection paradigm are not identical to the implicit (and immediate) validity assessments that are assumed to be generated by passive validation processes. Grabe and colleagues illustrated this point well (Grabe, Antes, Kahn, & Kristjanson, 1991). In their study, participants reported less than half of the embedded internal and external errors. But Grabe et al. also observed readers' eye movements. Contrary to the fact that readers failed to verbally report the errors in the text, their reading behavior changed in response to world knowledge violations and internally inconsistent information. Readers not only spent more time fixating on critical sentences than non-critical sentences but also re-fixated on critical sentences longer.

A Two-Step Model of Validation in Multiple Texts

When readers process multiple texts on (socio-)scientific or political issues that are relevant to them, they are often inclined to endorse one argumentative position in the controversy more than others. For example, a person searching on the Internet for potential health risks of the electromagnetic radiation emitted by cell phones, the causes of climate change, the risks and

benefits of childhood vaccinations, or the value of educational reform is likely to have prior beliefs about the issue, despite having little knowledge about the topic. In this section, we outline a two-step model of validation in multiple text comprehension (see also Richter, 2011). In the first obligatory step of epistemic monitoring, readers validate text information based on their beliefs, which leads to better comprehension and memory for belief-consistent information. In the second optional and goal-dependent step, readers may attempt to resolve the inconsistency revealed by epistemic monitoring by elaborative processing. As a result, readers are able to construct a more balanced representation of controversial information. The two-step model of validation is summarized in Figure 1 and will be described in the following sections.

Step 1: Belief-based Epistemic Monitoring of Conflicting Information

According to theory and research on validation, the consistency of text information with readers' beliefs is checked—passively and involuntarily—when the beliefs are activated through concepts and propositions in the text. Thus, independent of their reading goal, readers implicitly judge the plausibility of the content when processing multiple texts on controversial issues. What is the psychological value of the plausibility judgments generated by epistemic monitoring?

One function might be that the perceived plausibility serves as a heuristic that helps readers to regulate their cognitive resources during reading. Being cognitive misers, readers process information more deeply when they encounter plausible information, but tend to spend less cognitive effort on information that they find less plausible. In normal reading situations, characterized by a receptive reading goal, limited cognitive resources, and possibly time to invest in comprehending multiple texts, this assumption implies a text-belief consistency bias in multiple documents comprehension (Maier & Richter, 2013a) and more generally a

comprehension and memory advantage for belief-consistent information and arguments. In essence, readers construct a stronger mental model for texts that align with their beliefs. This memory advantage may be regarded as an instance of a more general confirmation bias (Nickerson, 1998). However, going beyond previous work that focused mostly on the belief-stabilizing function of the confirmation bias, the two-step model makes the prediction of a text-belief consistency effect in comprehension and memory.

3.2 Step 2: Elaborative Processing of Conflicting Information

Although less intensive processing of belief-inconsistent information is the default, readers sometimes actively try to resolve inconsistencies that have arisen between text information and their knowledge and beliefs. For example, they might try to think about or search the text for alternative reasons that may support the implausible information. Unlike the first step of epistemic monitoring, these elaborative activities are under the strategic control of the reader. Only readers following an epistemic reading goal (Richter, 2003), that is, a reading goal that includes a justified and defensible point of view on a controversial issue will engage in elaborative processing of conflicting information. This condition might occur, for example, when readers want to defend their view in front of others (fear of invalidity, Kruglanski & Webster, 1996), when they want to actively discount alternative views (Edwards & Smith, 1996), or when they are epistemically curious (Richter & Schmid, 2010). Epistemological beliefs may play a role in these instances at the metacognitive level. A mature epistemological position (e.g., commitment within relativism, Perry, 1970, or reflective judgment, King & Strohm Kitchener, 1994) promotes epistemic reading goals and the engagement in the elaborative processing of belief-inconsistent information (Richter, 2011; Richter & Schmid, 2010).

Engaging in the elaborative processing of belief-inconsistent information will often strengthen the comprehension of especially belief-inconsistent information. For example, Wiley and Voss (1999) found that students wrote more coherent essays with stronger causal links and scored better in comprehension tasks when they had received the instruction to write an argumentative essay (i.e., an epistemic reading goal) compared to the instruction to write a summary or a narrative text. Of course, such beneficial effects of elaborative processing are not guaranteed. The literature on dealing with inconsistencies suggests that readers sometimes settle with suboptimal ways to resolve inconsistencies, i.e. by creating causal relationships between pieces of information that are actually inconsistent with one another (Blanc, Kendeou, van den Broek, & Brouillet, 2008) or by distorting inconsistent information to make it consistent (cf. as the findings by Hakala & O'Brien, 1995, Exp. 2, for locally inconsistent information). Overall, however, conditions that enhance elaborative processing of inconsistencies should also improve comprehension of the inconsistent information.

Consequences of Validation for Comprehension Outcomes

The two-step model of validation posits that readers use their prior knowledge and beliefs to validate incoming text information. The plausibility of new information, that is, its consistency with readers' prior knowledge, beliefs, and the current situation model is used as a heuristic for information selection and for the allocation of cognitive resources during reading. As a consequence, the model proposes that readers will evaluate information judged as consistent during epistemic monitoring as more plausible, will process it more deeply, and will achieve a stronger mental model for information that is consistent with their knowledge, beliefs, or current mental representation of the discourse. In this section, we will first review empirical results

investigating knowledge revision or situation model updating when readers are confronted with information challenging or discrediting their current mental representation or their prior knowledge and beliefs. Although most of this research was conducted with single texts, the reviewed experiments resemble multiple documents comprehension in relevant ways. In particular, the texts and tasks used in these experiments require readers to build and eventually update their mental representation of the discourse based on partially conflicting information. Afterwards, we discuss research on multiple documents comprehension that has investigated the extent that readers' prior beliefs lead to a biased processing of conflicting information and a one-sided mental model of controversial issues (i.e., the text-belief consistency effect). The important point to keep in mind is that although the studies reviewed focus on different types of inconsistencies – between knowledge and new text information, beliefs and new text information, or previously read texts and new text information – all of them can be explained by the same passive validation mechanism. This mechanism is based on the information that is activated at a given moment during comprehension, regardless of the type of information.

4.1 Continued Influence of Misinformation, False Knowledge, and Beliefs

Research on the continued influence of misinformation after explicit corrections aligns well with the two-step model of validation. Many studies have shown that readers continue to rely on previously learned information even when this information is discredited or corrected by subsequent information and even when readers notice and remember the correction (Ecker, Lewandowsky, & Tang, 2010; Ecker, Lewandowsky, Swire, & Chang, 2011; Fein, McCloskey, & Tomlinson, 1997; Johnson & Seifert, 1994, 1998; Rich & Zaragoza, 2016; van Oostendorp, 1996; van Oostendorp & Bonebakker, 1999; Wilkes & Leatherbarrow, 1988; Wilkes &

Reynolds, 1999; for review see Ecker, Swire, & Lewandowsky, 2014). For example, Wilkes and Leatherbarrow (1988) examined whether readers' inference generation was based on previously encoded information that was later discredited. Readers read a series of messages about a warehouse fire in which one cause of the fire (e.g., a closet contained volatile material) was later corrected (e.g., closet was empty). In comprehension questions posed after reading, more than 90% of participants still used the old invalid information for inferences. Johnson and Seifert (1994) used a similar series of messages about a warehouse fire and found that the misinformation continued to have an influence regardless of the time that had elapsed between the misinformation and the correcting information. In particular, readers continued to use the old invalidated information and to refer to false information when the correction was immediate (in the next message) or delayed (after five messages). In addition, a continuous influence of misinformation was found when readers received general warnings prior to reading (Ecker et al., 2010), which suggests a rather robust reliance on misinformation. An important result in both studies (Johnson & Seifert, 1994; Wilkes & Leatherbarrow, 1988) is that over 90% of participants recalled the correction when directly asked. In sum, readers have a tendency to hold fast to acquired beliefs (such as the cause of a warehouse fire) even when they are presented with discrediting information. According to the two-step model of validation, the validation of the discrediting information and its rejection may be one of the mechanisms underlying the continued influence of misinformation.

Several studies identified conditions that reduced the continued influence of the misinformation effect. For example, Johnson and Seifert (1994) found that the effect only occurred when the possible cause of the fire (e.g., volatile material) was later corrected in a causal context (e.g., volatile material in closet vs. in nearby store). In contrast, when readers

were offered an alternative explanation, the amount of inferences that was based on new rather than old invalidated information increased (van Oostendorp & Bonebakker, 1999). Similarly, a specific warning that made readers suspicious was able to reduce the impact of misinformation (Ecker et al., 2010). According to the two-step model presented in this chapter, both conditions, the presentation of an alternative explanation and a critical mindset, should foster elaborative processing, thus creating conditions in which readers are open to integrate conflicting information in their situation model of the text content.

A continued influence has also been found for beliefs that were explicitly corrected or discredited (Anderson, Lepper, & Ross, 1980; Ross, Lepper, & Hubbard, 1975) and misconceptions rooted more deeply in the learning history of individuals (Alvermann, Smith, & Readence, 1985; Chinn & Brewer, 1993; di Sessa, 1993; Kendeou & van den Broek, 2005; Limon & Carretero, 1997; Mason, 2001; Vosniadou, 1994; for an overview see Murphy & Mason, 2006). Participants in a study from Anderson et al. (1980) read case studies that suggested a relationship between risk-taking behavior and the professional ability of firefighters. Participants were then told that the initial information was false (debriefing condition), or they received no information after reading the case study (no-debriefing condition). Participants in both conditions used their (false) beliefs when making judgments about the relationship between the trait and the behavioral outcome of the firefighters when generalizing on new cases and test items. The false beliefs were particularly difficult to correct when participants had provided an explicit explanation for the relationship between the trait and behavior (Anderson et al., 1980; for an experiment suggesting similar conclusions, see Rich & Zaragoza, 2016).

In sum, information integrated into readers' situation model, as well as prior knowledge and beliefs reactivated during comprehension, are able to influence whether or not new

information is integrated into the evolving mental model. The influence of misinformation, false knowledge, and incorrect beliefs may be partly explained by memory processes, for example, the passive re-activation of discredited but nevertheless salient and easily accessible concepts (Ecker et al., 2014; Kendeou & O'Brien, 2014; see Richter & Singer, in press, for an overview).

Nevertheless, validation during comprehension, in particular the implicit plausibility judgments generated by this process, are likely to contribute to these effects (see also Lombardi, Nussbaum, & Sinatra, 2016).

Schroeder, Richter, and Hoever (2008) directly investigated the effects of perceived plausibility on the integration of information into readers' situation model of the text content. In their study, participants read single texts in their area of study (psychology) that contained plausible as well as implausible (faulty) information and then provided recognition and plausibility judgments on the same set of test items (paraphrases of text information and inferences that could be derived from the text). Multinomial models analysis revealed a close bi-directional relationship between perceived plausibility of information and comprehension. Specifically, information perceived as plausible was more often integrated into readers' situation model compared to information judged as implausible. However, after information had become part of the situation model, it was also perceived as more plausible—regardless of its objective plausibility. This plausibility effect occurred without readers following a specific reading goal. The results from the reviewed studies suggest that after information has become part of a reader's situation model of the text content, it is used for monitoring the validity of incoming information. When readers process partly conflicting multiple documents, the same mechanisms are expected to take effect unless readers are motivated and able to engage in elaborative processing of implausible or inconsistent information. Hence, readers are expected to concentrate

their cognitive resources on information that they find plausible (i.e., consistent with prior beliefs) and to construct only a sufficient rather than the best possible mental representation. In the next section, we review research that supports the idea that similar mechanisms apply to the comprehension of multiple documents.

Belief Consistency Effects in Multiple Documents Comprehension

Experiments on multiple documents comprehension have revealed that readers provide biased essays or concluding paragraphs after reading belief-consistent and belief-inconsistent information (Anmarkrud, Bråten, & Strømsø, 2014; Kardash & Scholes, 1996; van Strien, Brand-Gruwel, & Boshuizen, 2014; van Strien, Kammerer, Brand-Gruwel, & Boshuizen; 2016), have a better recognition for belief-consistent arguments or texts in recall or recognition tasks (Maier & Richter, 2013a, 2014; Wiley, 2005), and evaluate belief-consistent compared to belief-inconsistent information better in their evaluations of arguments (Kobayashi, 2010; Kobayashi, 2014; McCrudden & Barnes, 2016; McCrudden & Sparks, 2014). We view all of these findings as instances of text-belief consistency effects, which indicate a general preference for belief-consistent information in the comprehension and evaluation of information from multiple documents.

For example, in a study by van Strien et al. (2014), students read 13 documents (one neutral, six pro, and six contra) on the link between violent videogames and aggression. The authors found that participants were more likely to write essays that were consistent with their prior beliefs than essays that were at odds with their beliefs. Using a similar method, van Strien, Kammerer, et al. (2016) identified belief-strength as a moderator of the text-belief consistency effect in essay-writing tasks. Participants with strong prior beliefs used far more arguments from

belief-consistent web pages compared to belief-inconsistent web pages, whereas the effect was not found for participants with weak prior beliefs.

An experiment by Kobayashi (2014) is an example of text-belief consistency effects in the evaluation of information from multiple documents. In this study, undergraduates read two texts that took contrary stances on the question of whether a relationship between blood type and personality exists. Results revealed that participants holding prior beliefs in favor of this assumption evaluated the pro text as more acceptable than the con text. In addition, the way in which participants tried to resolve the debate also strongly depended on their beliefs. Participants who endorsed the view that a link between blood-type and personality exists were more likely to resolve the conflict in favor of such a link.

Maier and Richter (2013a) measured readers' recognition of belief-consistent and belief-inconsistent texts. In their study, participants read four texts on either climate change or vaccinations and then provided recognition judgments for different test items (paraphrases, inferences, and distracters). Readers had a stronger situation model (measured by participants' responses to inference items, corrected for response bias) for texts with an argumentative position that was in line with their beliefs compared to texts with an argumentative position that opposed their beliefs. Moreover, this study identified the mode of text presentation as a moderator for the text-belief consistency effect in recognition tasks (for similar findings see Wiley, 2005). Specifically, the text-belief consistency effect for situation model strength occurred only when two texts taking the same argumentative side of the controversy were presented in a blocked manner, whereas the effect was not found when texts with different stances were presented interleaved. This study also showed that the text-belief consistency effect in the blocked presentation mode became stronger when participants spent less time reading

belief-inconsistent texts. Hence, as suggested by the two-step model of validation, superficial processing supported a comprehension advantage for belief-consistent texts.

Research in multiple documents comprehension suggests some additional conditions that might be able to foster elaborative epistemic processing and to reduce the influence of beliefs. For example, several studies found that reader characteristics such as epistemological beliefs (Mason & Boscolo, 2004), belief strength (Kardash & Scholes, 1996; McCrudden & Barnes, 2016), prior knowledge, and level of education (Wiley, 2005) can moderate text-belief consistency effects. Moreover, rationale and evidence instructions (McCrudden & Sparks, 2014) as well as argument instructions (Maier & Richter, 2016a), which may all be regarded as epistemic reading goals, have been found to decrease text-belief consistency effects. Similarly, a study by McCrudden and Sparks (2014) suggests that a belief-reflection goal (i.e., being open to belief-inconsistent information and critically evaluating arguments and evidence from both sides) decreases text-belief consistency effects. These findings are in line with the two-step model of validation, which suggests that text-belief consistency effects result from cognitive processes inherent in comprehension (i.e., routine validation) but can be countered by elaborative processes that depend on epistemic reading goals.

The finding that text-belief consistency effects are accompanied by a relatively lower level of strategic elaborative processing of belief-inconsistent information further supports this proposition. In a study by Maier and Richter (2016a), readers either received a summary task that required receptive processing or an argument task that was expected to induce an epistemic reading goal. With these goals in mind, participants read one belief-consistent and one belief-inconsistent text about health risks caused by cell phone use. Consistent with the two-step model of validation, participants focused their cognitive resources on belief-consistent information

when they worked on the summary task. In contrast, when participants were given the argument task, no differences were found between reading times of both texts, and participants used more strategic, elaborative validation strategies when reading the belief-inconsistent text.

In sum, the research on the comprehension of multiple documents shows that readers' beliefs strongly influence the evaluation and comprehension of belief-relevant information. Readers holding prior beliefs about a given controversial issue evaluate belief-consistent arguments as more plausible, process belief-consistent information more deeply, and achieve a stronger mental model for documents that are consistent with their prior beliefs. These findings are fully in line with the two-step model of validation. A study by Maier and Richter (2013b) suggests that the perceived plausibility of information might contribute to these text-belief consistency effects, as proposed by the two-step model of validation. In these studies, participants judged the plausibility of paraphrased text sentences and inference sentences after reading a set of multiple texts on social science issues (e.g., interpretation of PISA results) and performed recognition judgments on the same set of items. For both topics, a strong relationship emerged between perceived plausibility and recognition judgments. Information (paraphrases or inferences) judged as plausible was more likely to be judged as coming from the text than information judged as implausible.

Implications for Theory, Research, and Practice

Understanding multiple documents often involves comprehending controversial and conflicting information. Based on research on validation in comprehension and the general finding of text-belief consistency effects in multiple text comprehension, the two-step model of validation in multiple text comprehension suggests that readers' prior knowledge and beliefs

serve as kind of epistemic gatekeeper (Schroeder et al., 2008). For multiple documents with conflicting information, the two-step model of validation suggests that readers make more cognitive resources available for the comprehension of information that they perceive as plausible. Moreover, the two-step model proposes that such biased processing is caused by passive and routine validation processes (epistemic monitoring) that are part of basic comprehension.

The concept of validation raises questions that should be clarified for future theoretical and empirical work. For example, it is still largely unknown how the basic processes advocated in the two-step model of validation are related to other component processes of comprehension. One first attempt to clarify the time course of knowledge activation, integration, and validation is proposed in the RI-Val model of comprehension (O'Brien & Cook, 2016). Similar to the two-step model of validation, the RI-Val model proposes that activation, integration, and validation are passive continuous processes that run to completion. Moreover, the RI-Val model specifies that the onsets of the three processes are asynchronous with activation starting first and validation occurring last. The RI-Val model allows for predicting the extent that these passive processes (i.e., spillover effects) influence comprehension when reading one sentence. The next step will be to investigate these effects on comprehension when reading an entire document or even multiple documents. Recent experiments by Beker, Jolles, Lorch, and van den Broek (2016) provide a first step in this direction. They extended the inconsistency paradigm to multiple texts and demonstrated that information encountered in a previous text slows down the reading of inconsistent sentences in a second text. This may be considered as evidence for passive activation of information across multiple texts; at the same time it provides evidence for validation of information encountered in the second text on the basis of the activated information

from the first text.

More theoretical work and empirical research are needed to explain when readers find that their mental representation resulting from passive processes are insufficient and start to engage in more strategic validation. One factor that influences whether readers rely on regular validation or engage in strategic validation might be the standards of coherence readers adopt during reading (van den Broek, Beker, & Oudega, 2015). In general, a higher standard of coherence should be associated with more elaborative processing, for example, investing more cognitive effort to search, retrieve, and validate relevant information strategically. In line with this assumption, readers' sensitivity to implausible information seems to depend on the goals (e.g., Rapp, Hinze, Kohlhepp, & Ryskin, 2014) and the mindset of readers (with possibly reduced validation when readers read narrative fiction, Appel & Richter, 2007).

The two-step model of validation can also be used as the basis for developing training of multiple documents comprehension. One promising avenue for such training is to strengthen metacognitive strategies that promote strategic elaborative processing of belief-inconsistent information and, importantly, promoting knowledge about passive validation processes and their consequences (Maier & Richter, 2014). Maier and Richter (2016b) found that a metacognitive training that made readers aware of potential biases resulting from routine validation, and to foster elaborative processing of belief-inconsistent information, reduced the belief consistency effect in comprehending multiple documents. The control group in this experiment received the PQ4R training (Thomas & Robinson, 1972), and this training was not effective in eliminating the text-belief consistency effect. Hence, training classical cognitive and metacognitive strategies (which is the focus of the PQ4R training) is insufficient. Instead, attention to passive and routine validation processes is needed for successful multiple documents comprehension.

The two-step model of validation also suggests some general principles that educational practitioners might use for designing instruction with multiple documents. First, the two-step model proposes that reading instruction requiring readers to take a neutral perspective is an ineffective approach to overcoming potential biases in the comprehension of controversial documents. A more promising strategy is to first become more aware of the non-strategic biases that can be caused by validation. Then, metacognitive knowledge about non-strategic and strategic validation should be integrated into teaching, including training for specific metacognitive strategies directed at such processes. Other means such as epistemic reading goals (e.g., argument tasks or belief-reflection tasks) can enhance critical thinking and minimize biased processing as a result of non-strategic validation when processing multiple documents.

Conclusion

Validation during comprehension enables readers to establish and monitor local and global coherence, and it can protect readers from processing false and implausible information (see Richter, 2015). However, when readers comprehend multiple documents with conflicting information, non-strategic validation processes can lead to processing and comprehending difficulties, to the persistence of misconceptions and false beliefs, and to a rather one-sided mental representation of the discourse such as text-belief consistency effects. Acknowledging the concept of validation in research, theory, and practice can broaden and enrich the understanding of multiple documents comprehension, and can assist researchers and practitioners in understanding the challenges readers are confronted with during multiple document comprehension.

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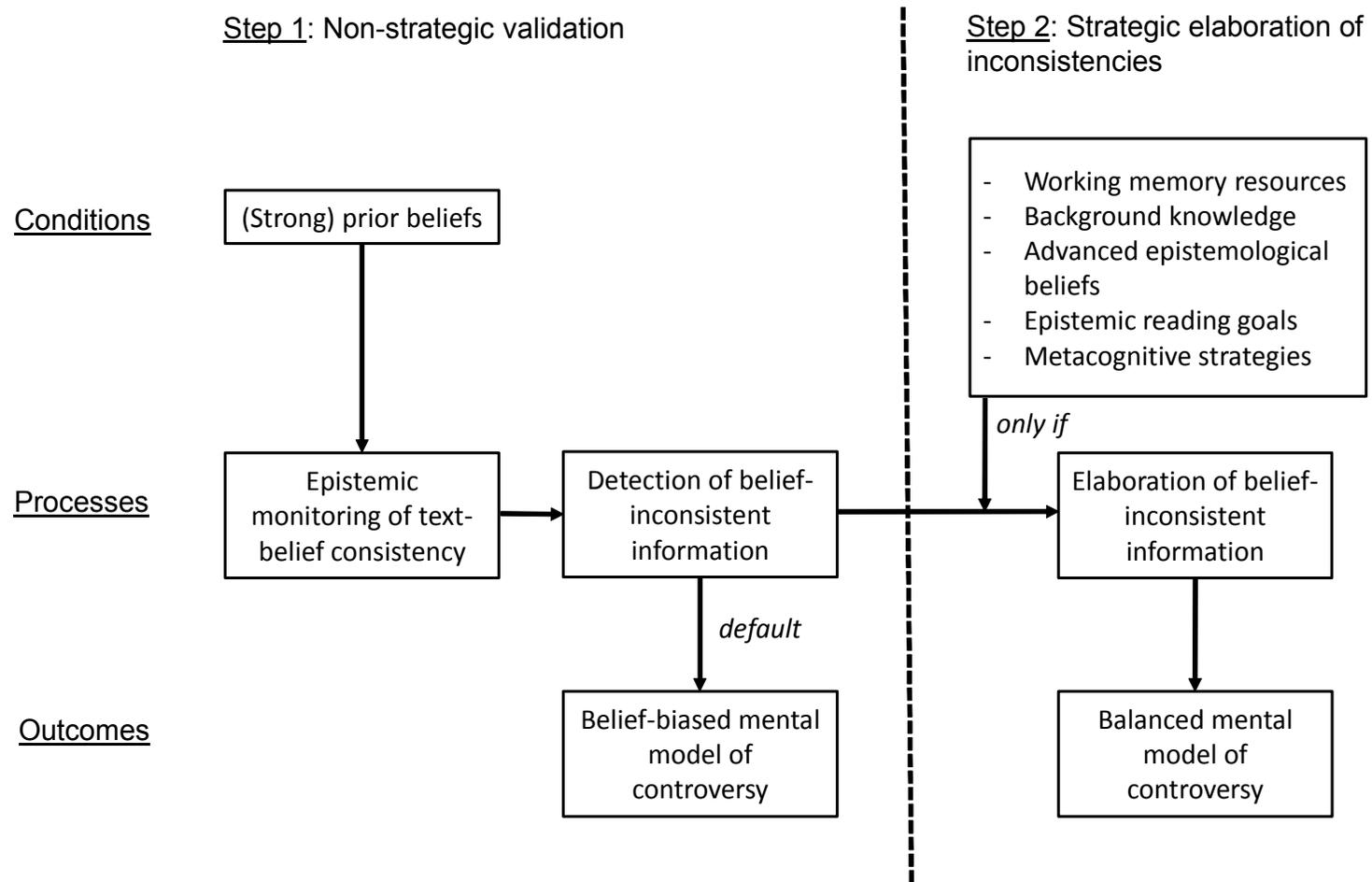


Figure 1. The two-step model of validation in multiple text comprehension (Richter & Maier, 2017).