

Title: Building mental models from multiple texts: How readers construct coherence from inconsistent sources

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21 Abstract

22 Text comprehension theories propose that readers try to achieve a coherent representation of the
23 situation depicted in a text. When reading multiple texts on the same topic, however, achieving a
24 coherent representation of a situation poses additional challenges. Different sources may offer
25 inconsistent descriptions or interpretations of the situation, or even contradict one another. Thus,
26 additional assumptions are needed to explain how readers build a coherent representation of a situation
27 when reading multiple individual texts on the same subject. This paper reviews research contributions
28 from the psychology of text comprehension on how readers integrate inconsistent information from
29 multiple sources. We concentrate on two key processes: the construction of an interconnected
30 representation of sources and text contents, and the evaluation of the acquired information. We begin
31 by briefly discussing the standard approach of single-text comprehension theories to representational
32 coherence. Then, we examine the Documents Model Framework and other, associated proposals that
33 claim that readers can achieve coherence of divergent text contents by constructing a representation of
34 the texts which integrates information about the sources of the contents. We also consider the role of
35 source evaluation as a reader strategy for constructing a single, coherent solution. Finally, we discuss
36 theoretical and practical implications and we make suggestions for further readings.

37

38 *Keywords:* Multiple text, Coherence, Information Source, Mental Models, Inconsistencies

39

40 1. Introduction

41 Reading is a pervasive, but also complex and highly versatile activity. Readers read diverse types
42 of texts, from simple stories to online news to abstract scientific explanations. They read for all sorts of
43 purposes and with all levels of engagement, from a casual glance to systematic and deep processing of
44 the text information. A common assumption of text comprehension theories is that regardless of genre,
45 context and goals, readers try to attain a coherent mental representation of the situation presented in the
46 text (McNamara & Magliano, 2009). Coherence, as it applies to text comprehension, broadly refers to

the integration, or connectedness of one's cognitive representation of the text content (McNamara & Magliano, 2009; van den Broek & Gustafson, 1999). Connections, in turn, refer to the continuity and logical organization of ideas along situational dimensions such as time, space, or causation (Zwaan & Radvansky, 1998). Readers may achieve a coherent representation by using preexisting schemata (e.g., a story schema), or by organizing individual ideas *en route* into an ad hoc frame of reference. An author's use of linguistic markings for referential continuity and situational dimensions can facilitate readers' construction of a coherent text representation. However, coherence also requires the information to be mostly consistent with the readers' knowledge and beliefs about the world (Black et al., 1986) and inferable from that knowledge, as connections between individual propositions are not always explicit (e.g. "Jack bumped into the desk. Coffee splashed onto the laptop."). Thus, coherence is both an inherent feature of well-written texts and the outcome of readers' active comprehension based on their relevant background knowledge.

Defining comprehension as the construction of a coherent representation has served as a useful organizing framework for a great deal of research on discourse processes (Gernsbacher, 1990; Goldman & Varma, 1995; Graesser et al., 1994; Kintsch, 1998; McKoon & Ratcliff, 1992; Myers & O'Brien, 1998; O'Brien & Cook, 2016; van Dijk & Kintsch, 1983; van den Broek et al., 1996; see McNamara & Magliano, 2009, for a review). However, over the past few decades new and emerging reading contexts have brought a number of different and intriguing challenges for theories of reading comprehension. One such challenge has been the democratization of publishing brought about by the internet and World Wide Web.

Reading in the digital era comes with a paradox. The Internet has supported the dissemination of an incommensurable wealth of information about any potential topic of interest. Access to written texts was never easier or faster. In fact, citizens in post-industrial societies spend a large and possibly increasing amount of time interacting with written information (Britt et al., 2018). Yet - or perhaps because of this, forming a coherent representation of situations seems to pose greater challenges to readers of online texts. In fact, in 2020 the World Health Organization coined the term 'infodemic' to describe the unconstrained spread of information that followed the Covid-19 pandemic (WHO, 2020).

74 Whereas the over-abundance of information is a problem by itself, there is also the added difficulty of
75 finding trustworthy sources and reliable advice. Now more than ever it falls on readers to navigate
76 through multiple sources, to gauge, to prune, to compare and contrast information in order to build an
77 integrated representation that makes sense out of what they read.

78 Such a dramatic evolution in the production and dissemination of texts warrants a critical
79 examination of the theories that account for the processes at work when reading multiple texts. We refer
80 to multiple text comprehension as making sense of a situation presented in two or more texts, where
81 each text originates from a different source (e.g., author, journal, media outlet; Perfetti et al., 1999;
82 Rouet et al., 2019). The basic cognitive processes underlying multiple text comprehension are arguably
83 similar to those involved in single text comprehension. For example, when trying to connect the
84 information found in one text with other information found in a previously read text, readers need to
85 activate previously acquired information and to integrate it with their current reading focus (e.g., Beker
86 et al., 2016). Likewise, comprehending multiple texts requires processes such as shifting attention in-
87 and-out of texts to resolve a reference, skimming a text by disregarding already known information to
88 locate new information, and reasoning about the validity of what's being comprehended, among other
89 possible tasks.

90 However, multiple texts dealing with the same situation do not always neatly combine into a
91 coherent picture of the situation. This creates new challenges for readers and a need to explain how
92 readers can make sense of the texts as a set. First, differences in time, space, and modality of presentation
93 can reduce the chances that the reader will connect them (Britt et al., 1999). Second, unlike a single text,
94 multiple texts present differences in structure, genre and language style that can hinder the identification
95 of common points (e.g., Rouet & Britt, 2014). Third, the connection across several texts is hard to signal
96 with figures, graphs, and videos, or linguistic cohesion markers, such as connectors, anaphors, and other
97 resources, typically employed to prop up intra-textual coherence (Salmerón et al., 2018; Stadtler et al.,
98 2018). Finally, different texts may refer to the same content from dissimilar perspectives, yielding
99 differences, discrepancies, or even flagrant contradictions across accounts (e.g., Bråten & Braasch,
100 2018; Perfetti et al., 1999). For instance, a reader faced with two texts claiming respectively that climate

change is *caused* by human activity and *unrelated to* human activity cannot include these idea units into a common situation model. How then do readers build a unique and stable representation that includes two (or more) incompatible versions of the same account, the same time-space sequence, the same causal structure, etc.? A core undertaking of research into the comprehension of multiple texts has been to uncover the additional processes that are required for readers to construct coherent representations of multiple text contents, including discrepant or conflicting ones.

The following sections review research contributions over the last 30 years from the psychology of text comprehension on the problem of forming a coherent representation out of inconsistent or conflicting accounts. Among the multiple processes involved in dealing with complex information (Rouet, 2006), we focus on two key processes: the construction of an integrated representation of contents and sources and the evaluation of the acquired information. Although present in single text comprehension, these processes differ markedly when comprehending multiple texts.

This article is written with an interested but non-specialist audience in mind. Therefore, we have intentionally adopted a simplified, introductory approach that focuses on empirical contributions associated with theoretical models. For a more technical review, we suggest consulting the *Further Reading* section, at the end of the paper.

2. Text comprehension and the problem of inconsistencies

What happens in our minds as we read and comprehend the meaning of a text? Over the past four decades, cognitive psychologists have forged a view of text comprehension as the reader's gradual construction of a cognitive representation that captures the meaning of the text. The representation may be modeled as a network of concepts and semantic propositions, although it may also include other constituents such as mental images or the reader's emotional responses (Kintsch, 1998).

Texts are expected to be internally coherent, and a core goal for the reader is to achieve a representation that corresponds to the organization of ideas, facts or events as depicted in the text (Goldman et al., 2007). The Construction-Integration model (Kintsch, 1988, 1998) proposed that comprehension begins with a construction phase, (with both coherent and incoherent meanings potentially included in the representation) before transitioning to an integration phase, in which the

128 representational network settles into a coherent state. This is achieved by prioritizing the information
129 that best fits the discourse context and the readers' prior knowledge, to the detriment of less central or
130 less consistent information. For instance, upon reading the word “spade” in a text, the reader may
131 initially represent both the symbol on a playing card and the gardening tool. If the text is a story about
132 a group of friends playing poker, however, the skilled reader's representation will quickly converge
133 toward the former meaning, discarding the second, less relevant one (Gernsbacher, 1990). Thus,
134 semantic nodes with a weak relation to the rest of the network, and those that may contradict or
135 destabilize other parts of the network are excluded from the final representation.

136 A core finding supporting the coherence-based approach to comprehension comes from the study
137 of readers' reaction to statements that contradict information previously stated in the same text. For
138 example, participants slow down when reading a sentence about a character ordering a cheeseburger if
139 the character was previously introduced as being a strict vegetarian (Albrecht & O'Brien, 1993). This
140 provides evidence for a phenomenon called comprehension monitoring (Baker, 1979), and attributed in
141 part to the "resonance" of previously read information in readers' memory (Myers & O'Brien, 1998).

142 Other studies have examined the influence of new, inconsistent information on readers updating
143 of their initial understanding of the situation (for a review, see van Oostendorp, 2014). For example,
144 readers were asked to read a report stating that a fire in a warehouse was caused by the negligent storage
145 of flammable materials. Then, they read a subsequent report that retracts this information by stating that
146 there were no such materials when the fire started (Wilkes & Leatherbarrow, 1988). When required to
147 respond to inferential questions, such as what caused the fire in the warehouse, readers still refer to the
148 flammable materials, even though they recall that this information had been discarded as the reports
149 unfolded. These findings are consistent with readers' reactivating previously read information, but they
150 suggest that readers will tend to “stick” to their initial understanding of the situation and discard new
151 information that does not fit their existing representation (e.g., van Oostendorp & Bonebakker, 1999),
152 particularly when the correction would require a deep reorganization of the representation (van
153 Oostendorp, 1996).

To sum up, the manipulation of within-text inconsistencies has provided significant knowledge of how memory works as comprehension unfolds, but not necessarily of how readers make sense of inconsistent information. The inconsistencies themselves were not part of the theory, but rather a technical way to highlight the importance of coherence in normal reading. In today's world, though, inconsistencies and even outright contradictions are more often part and parcel of the reader's daily experience. The way people used to acquire written information 30 years ago is very different from how they acquire it today, in part because we can now easily access multiple, divergent texts (think again about the "infodemic" associated to the 2020 Coronavirus pandemic). Following a traditional, cognitive approach to text comprehension (e.g., Gernsbacher, 1990; Kintsch, 1998), constructing a coherent representation would require the rejection of some of the perspectives because they would prevent one from achieving a coherent representation. Indeed, ignoring or bypassing the inconsistencies are possible strategies when reading multiple texts (e.g., Richter & Maier, 2017; Stadtler & Bromme, 2014). However, there is also extensive evidence that readers can form a coherent mental representation out of a set of multiple discrepant texts without excluding the contradicting information (e.g., Rouet et al., 2016).

3. Comprehending multiple texts: representing contents and sources of information

Research interest in the cognitive processes involved in multiple text comprehension emerged in the early 1990's, prompted both by some early works, such as Wineburg's (1991) seminal study on the comprehension of historical documents, and the growing interest in the then-emerging digital reading paradigm (Rouet et al., 1996). History was a fertile area for multiple text research because learning within this domain typically requires the consultation of several documents. Wineburg (1991) found that history experts, unlike high school students, used various heuristics when studying a set of documents about an episode in the American Revolution: they paid attention to the source of each document (sourcing), they compared and contrasted the information across documents (corroboration) and they reflected on the information based on their knowledge of the period, the context and the actual situation (contextualisation). In a series of experiments, Rouet et al. (1996, 1997) asked college students to read several documents on the history of the Panama Canal. The documents presented different

perspectives and evidence, although they also maintained a basic core of common information. After collecting several measures (e.g., summary production, comprehension questions, reasoning probes, etc.), they concluded that readers of multiple texts represent more than the situation described in the text(s). Their representation also includes information about who says what and about how multiple accounts connect to each other. This approach came to be known as the Documents model framework (Britt et al., 1999; Perfetti, 1999).

3.1. Overview of the documents model framework

The Documents model framework (thereafter DMF; Britt et al., 1999; Britt & Rouet, 2012; Perfetti et al., 1999) argued that, in addition to comprehending the situation, readers must comprehend how the documents represent (and sometimes distort) the situation. A documents model is a cognitive representation that integrates the different versions of the situation referred to in the texts along with information on the sources that produced those texts. A documents model consists of two components: the integrated mental model and the intertext model (Figure 1).

[INSERT FIGURE 1 HERE]

The integrated mental model (to the right of Fig. 1) is a representation of the different versions of the common subject matter depicted in the texts¹. Most often, people read multiple documents just to increase their knowledge of a situation. Additional documents may provide new details on aspects of the situation or phenomenon, or they may elaborate on circumstances, antecedents, causes, or consequences of the phenomenon. In those cases, documents complement each other and the information is presumably merged into a single mental model. However, multiple documents sometimes provide divergent and even conflicting information (Britt et al., 2013). As an example, let us reframe the fire story presented in the previous section (Wilkes & Leatherbarrow, 1988). Let's suppose now that the fire did not take place in a warehouse, but that it hit one of the largest extensions of primitive forest

¹ Originally called "Situations Model" (Perfetti et al., 1999, p. 102), the name was changed to "Integrated Mental Model" in the last decade (Britt & Rouet, 2012, p. 285) to extend the approach to texts depicting abstract phenomena.

on the planet. A person browsing the news to find out more about the fire is likely to find discrepant explanations. A newspaper article could attribute the cause of the fire to an extraordinary increase of human exploitation of the natural resources, while a government statement could instead attribute it to a normal, natural process (for a similar case, see United Nations News, 2019). If, after reading the texts, someone explained that “the causes of the fire are not clear” s/he would be assumed to have connected the situation models derived from each text. It could be argued, though, that this connection emerges from simply accumulating information as novel texts are read. The problem with this last option is that it is impossible to represent a state of affairs where the cause of the fire is extraordinary and ordinary at the same time. Instead, the DMF proposes that two situation models have been generated and related together into an integrated mental model (Perfetti et al., 1999).

The second component of the documents model is the intertext model (in the center of Fig. 1). This is a representation of the *sources* of information. The DMF conceives of sources as a set of parameters that identify the origin of a text’s content, including information about the author (name, characteristics and motives), the context of content production (editor, volume, date and cultural context of the publication, etc.), the type of document (blog, textbook, scientific article, etc.) and possibly the communicative intentions of the message (inform, persuade, disinform, etc.). The intertext model is structured into document nodes and intertext links (represented respectively by circles and lines in Fig. 1). The nodes represent discrete knowledge about the source, whereas the links connect the source nodes to text content (or Source-Content links; e.g., "A asserts X", "B asserts Y") and the source nodes between them (or Source-Source links; e.g., "A agrees with B", "A supports B", "A contradicts B", etc.). The Source-Content links form indexes that separate the specific contributions of each text, whereas the Source-Source links relate the texts with respect to who produced the information they contain. Returning to the jungle fire example, the reader who connects each version of the cause (i.e., human abnormal exploitation vs. normal events) to its source (i.e., the newspaper article and the government statement, respectively) and relates both sources through a rhetorical link (e.g., the newspaper article contradicts the government statement), would have built an intertext model.

One can think of the degree of integration in a documents model representation as occupying a position along a continuum which ranges from completely separate representations of each text to a mushed fusion of all information (Britt et al, 1999). The construction of a documents model requires integration but also enough representational separation to accommodate any discrepancies. This is achieved by creating indexes that organize knowledge based on its origin or source. Furthermore, the intertext model is constructed from information that does not necessarily belong to the contents of the texts themselves. This implies an understanding of documents as artifacts created by people for social purposes and not only as situation models (Britt et al., 2013; Wineburg, 1991).

3.2. How documents models establish coherence when contents do not cohere

Inconsistencies across texts prevent readers from just merging the texts' contents into a single mental model, because this would result in an incoherent representation per the traditional definition of coherence. The DMF offers a solution to the coherence problem by proposing that a reader will construct more than one mental model, and that he or she will connect the mental models by making an instrumental use of the information sources. Thus, the framework proposes that coherence is achieved when multiple pieces of discourse can be integrated into a single model of who says what. This amounts to broadening the range of dimensions whereby discourse elements can be integrated, to include so-called rhetorical relationships, such as "supports", "corroborates", "opposes", "contradicts" and so forth (Perfetti et al., 1999).

Empirical data accumulated over the past decades have largely supported this view. In an influential study, Braasch et al. (2012) asked their participants to read news stories in one of two possible versions. The "discrepant" version included two contradictory statements about the same event, each attributed to a different source (e.g., a character stating that the audience loved the show vs. another asserting that the audience hated the show). The "consistent" version was identical, except that the statements were compatible. Compared to the consistent version, participants reading the discrepant version looked more often at the sources during reading. They also included more references to the sources when writing summaries of the stories and better remembered who said what in a memory task. To explain these results, the researchers postulated a discrepancy-induced source comprehension

hypothesis (or D-ISC), framed within the more general DMF proposal. According to D-ISC, discrepancies induce the reader to create source-content links as a strategy to maximize coherence (note, however, that readers could also resort to other strategies to deal with the discrepancy, as we will discuss later).

The D-ISC hypothesis has received additional support in several studies conducted in the last decade (see Braasch & Scharrer, 2020 for a recent review). These follow-up studies have extended the original effect to different age ranges and educational levels (De Pereyra et al., 2014a; Salmerón et al., 2016); different components of the intertext model (e.g., Saux et al., 2017), sources embedded in the same text or across multiple texts (De Pereyra et al., 2014b), different sourcing aspects such as attention, memory, evaluation, and use of the sources (e.g., Kammerer et al., 2016; Strømsø et al., 2013; Barzilai & Eshet-Alkalai, 2015; Rouet et al., 2016; Stadtler et al., 2014), and situations in which the discrepancy involves the reader's prior knowledge (De Pereyra et al., 2014b) and prior beliefs (Bråten et al., 2016). These extensions have also involved testing the effect in different languages, including English, German, Hebrew, Norwegian, and Spanish (see Braasch & Bråten, 2017). The original D-ISC studies were conducted in French). Of particular note, some research has investigated the relationship between multiple conflicting perspectives outside the original D-ISC scope (e.g., Anmarkrud et al., 2014; Strømsø et al., 2010; von der Mühlen et al., 2016; Wiley et al., 2009). Typically, research within the D-ISC tradition has dealt with factual, flagrant contradictions between two sources and has used the term discrepancy to refer to the situational incoherence. Related research has tended to examine larger sets of sources which present partially inconsistent information, extending not only to facts but also to perspectives and attitudes, and has preferred the term "conflict" to refer to the lack of coherence among the pieces of information. Still, the distinction between discrepancies and conflicts should not be taken categorically. Overall, the empirical data concurs with the idea that readers can use document-level representational elements to create coherence when they perceive a lack of it.

4. The role of evaluation when representing multiple texts

Creating an interconnected representation of multiple sources and contents implies more than merely mentally coding or symbolizing this information—sources also require evaluation. Many

features related to source evaluation have been extensively studied by psychologists in context of assessing the persuasiveness of a message (e.g., Wallace, Wegener, & Petty, 2020), our focus here, however, is limited to factors affecting the representation of texts and sources rather than the impact of these representations on changing pre-existing attitudes. Let's consider the role of evaluation that can occur from a text processing perspective by revisiting the jungle fire example. Imagine now that the same administration that claims the fire is not related to human overexploitation provides a new statement declaring that protected lands are an obstacle to economic growth and commercial exploitation. Would the reader still consider this source trustworthy? Would this alter the organization of the documents model?

4.1. First vs. second-hand evaluation

Multiple text evaluation refers to making judgments or assessing the different documents in a related set based on the *reliability* of the information (e.g., Stadtler et al., 2018), defined as the reader's perception of whether the information is accurate, up-to-date and trustworthy. Bromme, Kienhues, and Porsch (2010) proposed two ways of evaluating the reliability of multiple perspectives: based on the reader's own understanding of the subject matter (also called first-hand evaluation), or based on the information about the sources (also called second-hand evaluation). The evaluation parameters vary between the two cases. In the first, they are likely to be content-related (e.g., the consistency perceived in the arguments; Scharrer et al., 2017), while in the second they are likely to be source-related. In this later case, trustworthiness is usually described as formed by two basic dimensions: the source's intentions (e.g., the integrity in adhering to communicational standards and the benevolence toward others) and the source's ability (e.g., their competence and pertinence with respect to the topic).

Importantly, the construction and evaluation of a documents model should not be considered separately. In fact, the relationship between reliability assessment processes, such as the evaluation of the trustworthiness of a source, and other comprehension processes, such as the construction of a coherent representation of discourse, may be more related than traditionally assumed (e.g., Richter & Maier, 2017; O'Brien & Cook, 2016). This is because multiple text evaluation should be seen as an extension of a broader and more basic set of processes, known as text validation. In its basic form, text

validation implies the tendency to establish consistency within the mental representation and to remedy possible contradictions between different text parts as well as between the text and world knowledge (Singer, 2019). Multiple text evaluation relies on additional skills (e.g., Rouet & Potocki, 2018), but it should be conceived as part of a continuum with more basic comprehension processes, rather than as a completely different activity.

4.2. Source evaluation as a resolution strategy: The Content-Source Integration model

The impact of text discrepancies on evaluation has been linked to an effortful attempt by the reader to restore coherence, as well as to develop a personal stance toward the conflicting issue. The Content-Source Integration Model (or CSI model, Stadtler & Bromme, 2014) provides a taxonomy of readers' strategic responses to conflicts in texts and links some of these reactions to sourcing strategies. By "sourcing" we mean a reader's attempts to focus on, retrieve, mention, and/or evaluate sources when performing tasks based on either current or previous reading (Britt et al., 2013; Britt & Rouet, 2012). According to CSI, readers must first detect a coherence problem and classify it as a conflict between text ideas. Next, they attempt to regulate the conflict by organizing the discrepant information. Conflict regulation can be achieved through diverse strategies, such as ignoring the conflict (for instance by picking a side and ignoring the other), reconciling it (by inferentially generating an explanation for the conflicting information), or acknowledging it as due to different points of view (by constructing a documents model). The original findings supporting the D-ISC effect (e.g., Braasch et al., 2012) can be considered an example of the latter type of regulatory reaction. Finally, readers might attempt to resolve the conflict by evaluating the validity of the competing assertions and developing a personal stance. Here, readers can either rely on their own understanding of the subject to determine what to believe, or they can turn to sources they trust to determine whom to believe. Whereas regulation serves mainly to integrate sources with contents, the attempts to resolve the conflict by scrutinizing the trustworthiness of the sources serves to validate the information.

Indeed, several studies have reported a difference in how readers inspect and use multiple sources after they evaluate them. Interestingly, however, because the development of a personal stance towards

a topic leans both on strategic as well as automatic processes, the result of evaluating sources will not always take the same direction. When a reader's purpose is to actively elaborate a balanced representation of the topic, source evaluation favors increased attention and use of trustworthy contents (e.g., Wiley et al., 2009; Gottschling et al., 2019; Kammerer et al., 2016; Rouet et al., 2020; Salmerón et al., 2016; Saux et al., 2018; Stadtler et al., 2014; von der Mühlen et al., 2016). However, if the evaluation occurs in an automatic and routine fashion, it may lead to a one-sided, biased model that will exclude information from reliable documents if they do not match the reader's prior knowledge and beliefs (see Richter & Maier, 2017, for a review).

5. *Constructing coherence from multiple texts: beyond discrepancies*

Unlike single texts, coherence gaps are to be expected when reading multiple texts about a topic, which in a way defines the modern world. The *Documents Model Framework* explains how readers can deal with multiple, incoherent texts by signaling the importance of integrating *source information* into the representation of the texts. This is illustrated by the D-ISC hypothesis in its original formulation and in follow-up research. Building a documents model, however, is not a perfect solution, because most of the time readers also want to know what they should believe in the end. Proposals like the CSI model emphasize the role of *evaluation*. Readers evaluate the contents and the sources to come up with a single, coherent representation. Thus, a documents model is one way to achieve coherence at the discourse level when confronted with multiple factual inconsistencies, but for many purposes resolving the discrepancy is also desirable.

Studying how a documents model can help readers deal with the coherence problem, and how this in turn is constrained by the situation the reader is immersed in, is relevant both for theoretical and practical reasons. At a theoretical level, document models emphasize the situated, purposeful nature of reading in two ways: First, by assuming that the semantic content of the text is integrated with features of the text as an artifact (e.g., who wrote it; Perfetti et al., 1999; Britt et al., 1999). Second, by recognizing that the nature of the representation is contingent upon the reader context and goals. Constructing and evaluating a documents model is one strategy among other, perhaps more parsimonious strategies that enable a form of coherence when reading multiple texts. These include

constructing a one-sided representation consistent with prior beliefs (Maier & Richter, 2017), drawing unwarranted inferences to reconcile the detected inconsistency (Stadtler & Bromme, 2014), or hedging the content of the text to minimize or self-explain the lack of coherence (Rouet et al., 2016). Why, then, would a reader lean towards such a more demanding strategy? Research has identified several document-related triggers that foster documents model construction, such as the presence of explicit references to sources in the text (Strømsø et al, 2013), the degree of conceptual overlap between texts (Kurby et al., 2005), the perceived difficulty of science documents (e.g., Scharrer et al., 2014), or the position in which source information is presented (e.g., before or after the text contents, Merkt & Huff, 2020), among others.

Importantly, the effortful process of interconnecting sources with contents is more likely to take place when the task context makes it highly relevant. When readers receive instructions that explicitly recommend verifying the intentions and competencies of the sources, they improve intertext integration and evaluation both during and after reading (see Wiley et al., 2018 for a recent review). Likewise, certain reading goals or situations may require such a representation, as when reading legal briefs that describe the positions of opposing sides of a dispute. Thus, the construction of a documents model is based on knowing that sourcing can be relevant to comprehension, as much as on understanding *when* and *how* to apply this knowledge. Recently, Britt and her colleagues (Britt et al., 2018; Rouet et al., 2018) introduced the RESOLV model which construes reading as a problem-solving activity, in which strategic decisions are made on the basis of the context and purpose of the reader. According to RESOLV, the construction of a documents model will be more likely when it becomes instrumental to the task and context.

The basic scheme proposed by the DMF has been deepened and complemented by a growing body of research that entails a large range of mental activity, from basic memory processes to high-level decision making, task monitoring and psychosocial processes. Much of the work has followed a cognitive approach to reading comprehension. Given this base, it is perhaps time to begin to better understand the role of motivation or emotion during reading multiple documents. Related proposals have emerged in recent years to emphasize these different aspects, such as the role of prior knowledge

and beliefs (Richter & Maier, 2017) or the influence of affect and motivation (List & Alexander, 2017). Research examining factors effecting readers' benefit-cost analysis, proposed by the RESOLV model (Britt et al., 2018), may help to elucidate the important role of motivation. Empirical research has also advanced in describing individual differences and elaborating prescriptions for interventions that foster the use of sources when learning or comprehending from texts (Braasch et al., 2018).

Although basic assumptions have been articulated, there is still much to learn about the relationship between performing functional tasks, such as evaluating the reliability of sources, and the organization of the intertext model in memory. A question of interest is whether readers use specific features of a source when reasoning about the validity of the document. Does the name, occupation, motivation of an author play an equivalent role? If some features are more frequently used, does this imply a hierarchy or some organization within the intertext model? Also, more research is needed to better understand the conditions that lead readers to build and use a documents model.

Much of the work reviewed here involves issues with creating coherence when the documents include inconsistencies or contradictions. However, there are many situations in which readers must construct an integrated model when there is no inconsistency. For example, when reading about the causes of climate change, the reader may have to use the content from a text about the carbon cycle that never mentions temperature but is relevant to the phenomenon of global temperature change (e.g., Griffin et al., 2012). In this line, several educational studies have shown that readers struggle to learn from multiple documents even when they do not contain discrepancies (e.g., Cerdán & Vidal-Abarca, 2008; Goldman et al., 2019; Griffin et al., 2012; Wiley & Voss, 1999). More research is needed to discover whether prompting readers to encode who says what would facilitate the production of inferences that enable the connection of information across texts. So far, research on multiple document comprehension has focused on contradictory contents because they challenge the very notion of coherence-based integration. However, coherence gaps may also originate in the readers' difficulty in recognizing that several texts address the same issue, or in reconciling how different perspectives relate to each other. Indeed, the DMF originally highlighted two conditions (in addition to the presence of contradictions) that might prompt readers to construct a documents model: The first condition is when

one document provides direct evidence for a claim made in another document (argumentative support). The second condition is when information within two separate documents both support a state of affairs initially deemed uncertain (corroboration; Perfetti et al., 1999; Rouet, 2006). In both of these cases, it is likely that source-to-source and source-to-content links would be included in the reader's final representation of the situation. A comprehensive approach to the problem of coherence in multiple text reading should account for a broad range of intertextual relationships.

6. The relevance of multiple text comprehension in an information-rich world As research into multiple text comprehension has rapidly expanded in the past 20 years, so has the way in which people access, read and use written information. Rapid technological advances, such as mobile computing, social media, and the profusion of online videos challenge researchers to keep pace with them in the discussion of how people comprehend and learn from multiple documents (Kammerer et al., 2018). For example, the growing Internet access through cell phones brings about a change in operational skills (i.e., skills on how to use digital media tools, Van Deursen & Van Dijk, 2016). The extent to which these differences affect documents model construction, as theorized in this paper, is still an open question. Also, an emerging trend in online reading is to pick information from both written and audiovisual sources. This is fostered by mobile technology which gravitates increasingly towards multimedia communication (photos, videos and audio in messaging and social networks). Multimedia presentations (i.e., combining words and pictures, video or audio; Mayer, 2001) do not imply *per se* the notion of multiple sources as we have discussed it here. However, audiovisual documents may prompt different evaluation strategies. For instance, Salmerón et al. (2020) reported that, as compared to written format (i.e., a webpage), video format favored source trust and attitude change in primary school students when they learned about a controversial topic (i.e., pros and cons of bottled water use), perhaps because they perceived the video sources as more human and more capable than in the written format, thus prompting a positive evaluation. There have been recent efforts to develop a joint explanation of multiple resource learning (i.e., learning from both multiple representations and multiple perspectives; van Meter et al., 2020), However, to date, research into multimedia and multi-source comprehension is still scarce and deserves further efforts.

447 Children's increased exposure to multiple and sometimes dubious sources of information also
448 warrants an increased effort to teach multiple text comprehension skills. Multiple text comprehension
449 is supported by cognitively demanding processes and complex personal epistemic constructs, which are
450 usually considered a dimension of adult literacy. However, five-year old children already show some
451 notion "that knowledge is unequally distributed and that their own qualification as a source of
452 knowledge varies depending on the situation" (Stadtler et al., 2018, p. 49, referring to research by
453 Danovitch & Keil, 2004). In addition, teachers make ample use of documents of all sorts when teaching
454 subject matters such as history or science. Therefore, it appears critical to prepare young students to
455 tackle the challenges of multiple text comprehension. Up to now, however, intervention studies aiming
456 to promote primary school students' attention and use of sources as part of reading are still scarce. In
457 2018, Brand-Gruwel and van Strien published a systematic review and identified only four articles in
458 English, dated after 2000, aimed at fostering primary/elementary students' sourcing skills (i.e., de Vries
459 et al., 2008; Kroustallaki et al., 2015; Kuiper et al., 2008; Macedo-Rouet et al., 2013). Whereas the four
460 studies presented variations, they all included training and assessing of the children' skills to search,
461 evaluate, and select credible sources. All studies showed some improvement after the intervention,
462 although the effect tended to be qualified by various variables. Research on the domain of history
463 teaching in elementary school have yielded similar conclusions (e.g., VanSledright, 2002). Overall,
464 these studies suggest that some basic features of multiple text comprehension can fruitfully be taught to
465 developing readers, although multiple document literacy is also an important goal for secondary and
466 higher education. A conception of reading as a problem-solving activity (i.e., an activity that requires
467 gathering spread and diverse information and making decisions based on specific reading purposes) has
468 become essential to the definition of literacy and even of responsible citizenship in the twenty-first
469 century (Britt et al., 2018). Therefore, an empirical understanding of how multiple text comprehension
470 skills develop and how education can support them has become increasingly relevant, both for current
471 research and practice.

472 From a practical angle, the problem of coherence in multiple text reading is inextricably linked
473 to the massification of the internet and the general public's increased access to a vast and heterogeneous

number of texts. An important implication from the work presented in this paper is that being aware of the versatility of reading and of the fact that texts are produced and spread with various communicative intents, and knowing how to use this knowledge purposefully, has become a distinctive skill of proficient readers. Educating someone to integrate and evaluate multiple texts through sourcing in the light of a specific task and context may seem a massive undertaking. Indeed, despite the conditions that promote document model formation, such as detecting intertextual contradictions, readers struggle to construct an integrated intertext model. For example, List et al. (2019) reported that only a quarter of a sample of undergraduates produced a documents model after a multiple text reading task, with the rest producing mostly separate representations of the texts or mush models that do not differentiate where the information came from. This deficit has stimulated an increasing number of intervention approaches that try to direct readers' attention to the construction of coherent intertext models. So far, the data support the claim that short, theory-driven and targeted interventions can actually foster sourcing and multiple-text integration successfully (Barzilai et al, 2018; Brante & Strømsø., 2017; McGrew et al., 2019, Pérez et al., 2018). The effectiveness of these short-term focused interventions may lie in the fact that most readers are aware that there is no text without a source, that multiple texts can diverge, or that their standards for processing information vary as a function of context and stakes. They emphasize, however, that in today's world, the teaching of reading comprehension extends to connecting heterogeneous pieces of discourses, connecting contents to sources and adjusting coherence standards to one's goals and purposes.

7. Further readings

Several models of multiple text comprehension subsequent to the DMF framework were compiled in a special issue of *Educational Psychologist*, edited by List and Alexander (2017). For an extensive review of the factors affecting source representation and use we recommend consulting the Handbook of Multiple Source Use, edited by Braasch, Bråten, and McCrudden (2018) and the Handbook of Learning from Multiple Representations and Perspectives, edited by Van Meter, List, Lombardi, &

499 Kendeou (2020). For a more comprehensive presentation of the RESOLV model highlighting the
 500 importance of context and decision making in reading, please refer to Britt, Rouet, & Durik (2018).

501

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507 9. References

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779 **Figure captions**

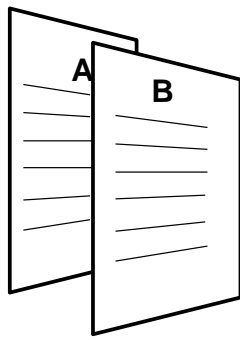
780

781 *Figure 1.* Components of a documents model (adapted from Britt & Rouet, 2012).

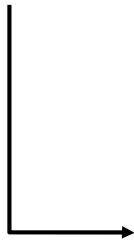
782 S-S: source-to-source; S-C: source-to-content

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784



*TEXTS (contents +
information about the sources)*



Reader's mental representation

