Abstract

Despite the importance of source attention and evaluation for learning from texts, little is known about the particular conditions that encourage sourcing during reading. In this article, basic assumptions of the Discrepancy-Induced Source Comprehension (D-ISC) Model are presented, which describes the moment-by-moment cognitive processes that readers undergo when reading-to-understand controversial messages. We then review supporting evidence from single and multiple text comprehension research. In the discussion, we draw conclusions based on the theoretical and empirical research, highlight limitations of what is known to date, and how further investigations of D-ISC might address these concerns.

Keywords: Cognitive Strategies, Knowledge Representation, Reading Comprehension, Text Processing

The Discrepancy-Induced Source Comprehension (D-ISC) Model:

Basic Assumptions and Preliminary Evidence

Lifelong learning depends upon acquiring information from text, whether encountered as part of formal academic assignments or used for personal enjoyment and fulfillment. Readers surely benefit from the diverse resources available to them in the 21st century information age, however, it is also clear that unbridled access may be a cause for concern. In fact, many acknowledge that readers must now be equipped with competencies to locate, evaluate, and integrate high quality information to establish valid understandings (Alexander & The Disciplined Reading and Learning Research Laboratory, 2012; Braasch, Bråten, Strømsø, Anmarkrud, & Ferguson, 2013; Braasch et al., 2009; Bråten, Britt, Strømsø, & Rouet, 2011; Britt, Rouet, & Braasch, 2013; Goldman, Braasch, Wiley, Graesser, & Brodowinska, 2012; Goldman & Scardamalia, 2013; Leu, Kinzer, Coiro, Castek, & Henry, 2013; Rouet, 2006; Sandoval, Greene, & Bråten, 2016).

Several researchers have particularly argued that the relaxed parameters of publishing in the information age have shifted responsibility for "gatekeeping" (Bråten, Braasch, Strømsø, & Ferguson, 2015; Britt & Aglinskas, 2002; Coiro & Dobler, 2007; Lucassen, Muilwijk, Noordzij, & Schraagen, 2013; Wiley, et al., 2009). Whereas a reader could previously rely on information providers such as editors and publishing companies to "weed out" unreliable information, the current information boom has shifted this responsibility to readers. Ideally, readers will use sourcing strategies to focus their processing efforts on reliable information and disregard unreliable information. Throughout this article we use "sourcing" as an overarching term, which refers to students' propensities to attend to, evaluate, represent, and use available and accessible information about the sources of texts (Bråten, Stadtler, & Salmerón, in press). Source features

can include information about the author credentials, the type and date of publication, and the publication genre, to name but a few. These features can help readers decide on whether or not to trust the content presented within texts. The empirical research, however, demonstrates that readers vary greatly in their sourcing adequacies during reading, which in turn contributes to their comprehension success. Although mostly correlational in nature, the findings consistently demonstrate that the more readers evaluate texts for trustworthiness based on the available source features, the better they ultimately comprehend the information (Anmarkrud, Bråten, & Strømsø, 2014; Bråten, Strømsø, & Britt, 2009; Britt & Aglinskas, 2002; Goldman et al., 2012; Wiley et al., 2009; Wineburg, 1991).

Despite the importance of sourcing for learning from texts, little is known about the particular conditions that encourage sourcing during reading. That is, even though discourse psychologists have developed several theories of text comprehension over the past 40 years (see McNamara & Magliano, 2009, for an overview), there still exists a paucity of theory development concerning reasons that individuals come to use source features during reading. A greater understanding of the mental processes that underlie sourcing could inform on reasons that readers appear to be ill-equipped to successfully comprehend within 21st century literacy contexts (Alexander, et al., 2012; Braasch, et al., 2013; Brand-Gruwel & Stadtler, 2011; Bråten, et al., 2011; Goldman, et al., 2012; OECD, 2013).

This special issue presents recent theories that characterize the ways readers process, represent, and remember information from multiple information sources. Our contribution specifically focuses on the degree to which coherence is monitored during reading, with a specific lens on noticing contradictions as a mechanism for sourcing. We review the basic assumptions of the Discrepancy-Induced Source Comprehension (D-ISC) model (Braasch,

Rouet, Vibert, & Britt, 2012), and the evidence supporting its processing and representational assumptions. D-ISC provides insight into the cognitive mechanisms of source processing and memory for sources when readers engage with multiple controversial messages. Although the theory is admittedly nascent, we conclude the article with suggestions for how further investigations of D-ISC might address limitations of the empirical findings to date.

Overview of the Paper

The remainder of this paper is divided into three main sections. In the first, current theories of discourse comprehension are reviewed. Models of single text comprehension are first presented due to their rich description of the moment-by-moment cognitive processes readers engage in as they attempt to build coherent representations of text, in general (Kendeou & O'Brien, 2014; Kintsch, 1998; McNamara & Magliano, 2009; Myers & O'Brien, 1998). Models of multiple text comprehension – such as the Documents Model (DM) and the MD-TRACE model of Britt, Rouet, and colleagues – are then presented due to their focus on readers' source representations when reading multiple texts (Britt et al., 2013; Britt, Perfetti, Sandak, & Rouet, 1999; Britt & Rouet, 2012; Perfetti, Rouet, & Britt, 1999; Rouet, 2006; Rouet & Britt, 2011). Based on our review, none of these models appear to specify the particular conditions that stimulate a deeper processing of and consideration for information sources, in single or in multiple text scenarios. As such, we introduce a general model of source comprehension that can be assumed to function in both single and multiple text scenarios when information sources disagree on a topic. This model, the Discrepancy-Induced Source Comprehension (D-ISC) model (Braasch, et al., 2012), provides a detailed description of processes that occur when reading-to-understand controversial messages presented by multiple information sources. In the second main section, we review empirical evidence for the processing and representational assumptions

of D-ISC from single and multiple text comprehension research. Although the paradigms and
materials used across these empirical studies are broad in scope, all involve situations in which a
reader has to deal with information in text that contradicts information presented in previously-
read text (either within the same text or across multiple texts), or with prior beliefs or knowledge
activated from long-term memory (Barzilai & Eshet-Alkalai, 2015; Braasch, et al., 2012;
Braasch, McCabe, & Daniel, 2016; Bråten, Salmerón, & Strømsø, 2016; Kammerer & Gerjets,
2012; Kammerer, Kalbfell, & Gerjets, 2016; Maier & Richter, 2013; Rouet, Le Bigot, de
Pereyra, & Britt, 2016). The goal of this section is to evaluate the degree to which the various
effects derived from experiments support the processing assumptions of D-ISC, which describes
moment-by-moment changes during reading. Moreover, we evaluate the degree to which the
evidence supports that readers include more source features within their mental representations
of controversial compared to consistent messages once texts are no longer present (reflecting
their long-term memory for the events described). In the third and final section, we draw
conclusions based on this body of theoretical and empirical work, highlight limitations of what is
known to date, and how further investigations of D-ISC might address these concerns by way of
empirically tractable research questions.

Theoretical Assumptions

Models of Single Text Processing and Representation

Although models of single text comprehension have not specifically addressed sourcing,
they do offer insight into the ways that readers incrementally construct a mental representation of
a situation described in a text, and continually update it based on each new piece of information
that subsequent sentences provide (Gernsbacher, 1997; Goldman, Varma, & Coté, 1996; Kintsch,
1998; Myers & O'Brien, 1998; van den Broek, Young, Tzeng, & Linderholm, 1999). As

individuals read for comprehension, incoming propositions (sentences) connect with information

that is part of their developing mental representation (information carried over in working

memory) by way of co-reference and coherence-building processes (Kintsch, 1998; McNamara

& Magliano, 2009; van den Broek, Risden, & Husebye-Hartmann, 1995). More specifically, a

class of models asserts that prior knowledge – conceived of and modeled as an interconnected

network of concepts – is automatically and passively activated, with each independent text

proposition residing in working memory serving as a retrieval cue (Kendeou & O'Brien, 2014;

Kintsch, 1988; Myers & O'Brien, 1998; O'Brien & Cook, 2016; O'Brien & Myers, 1999).

Traces from long-term memory re-enter working memory based on the extent to which they

share feature overlap with the memory cue; essentially, the greater the match with the text input,

the more likely concepts from long-term memory will return to working memory (Cook &

Guéraud, 2005; Cook & O'Brien, 2014, Myers & O'Brien, 1998; Myers, O'Brien, Albrecht, &

Mason, 1994; O'Brien, Rizzella, Albrecht, & Halleran, 1998). This "resonance" is described as

an unrestricted "dumb" process, which is to say that sufficient spread of activation across the

prior knowledge network will return any information regardless of its accuracy or relevance to

the current context (Myers & O'Brien, 1998; O'Brien, et al., 1998; O'Brien, Cook, & Guéraud,

2010). Accordingly, the interaction between the textbase, that is the meaning of the propositions

residing in working memory, and the prior knowledge network initially results in a relatively

incoherent set of propositions – relevant, inconsistent, redundant, and irrelevant propositions are

all activated regardless of context (Kintsch, 1998; Myers & O'Brien, 1998).

  A representation of what the text is about gradually develops through successive

processing cycles as the individual continues to read. Concepts that are connected to many other

concepts stabilize and are increasingly likely to become a part of the reader's final mental

representation. By contrast, inappropriate, irrelevant, and redundant propositions are inhibited or decay until they are eliminated from the representation (Kintsch, 1988; 1998; McNamara & Magliano, 2009). As a representative example, Kintsch's (1998) Construction-Integration (CI) model states that the aforementioned set of processes results in an associative network of propositions (with contributions from the text and prior knowledge) in the form of an edited, elaborated, integrated, and coherent mental representation of a text, labeled a situation model, which is believed to be stable, resulting in a stronger long-term memory representation.

Although passive, automatic memory-based retrieval processes are surely involved in comprehension, other models of single text comprehension additionally theorize that so too are active, strategic processes (Graesser Singer, & Trabasso, 1994; Long, Seely, & Oppy, 1996; Magliano, Trabasso, & Graesser, 1999; Singer, Graesser, & Trabasso, 1994). This class of models states that individuals will selectively attend to information that serves their particular reading goals (Graesser, 2007). As such, reading goals direct whether individuals will or will not "search for meaning," that is strategically seek out explanations for events provided by a text. The end goal of these more effortful cognitive activities is to construct a representation that achieves both local and global coherence. Accordingly, when readers experience coherence breaks during reading, they will increase their cognitive efforts to strategically resolve them by way of inferences and reinterpretations of the events described in a text (Graesser, 2007).

From a "constructionist" perspective (Graesser, et al., 1994), when reading goals require a comprehension standard consistent with "deep" meaning making, readers will spend additional time and effort searching for and evaluating relevant background knowledge. Such knowledge is central for inference-making processes to adequately construct a coherent situation model (Graesser, et al., 1994; Long & Lea, 2005; McNamara & Magliano, 2009). If it is sufficient for

readers to process text in a shallow way (e.g., skimming to locate a key word), however, they may not put forth extra time and effort to generate inferences. This can result in an incoherent text representation and, ultimately, weaker long-term memory for the information (McNamara & Magliano, 2009). Taken together, the two overarching classes of models of single text comprehension models illustrate that optimal comprehension may warrant readers' use of both "bottom-up" (i.e. passive, automatic) and "top-down" (i.e. effortful, resource-consuming, strategic) processes.

Models of Multiple Text Processing and Representation

Of course, in everyday reading contexts, it is rarely the case that the semantic content found within a single text is enough to gain a complete understanding of a topic. Individuals must often read to locate, corroborate, evaluate, organize, and importantly combine ideas expressed across several texts (Afflerbach & Cho, 2009; Anmarkrud, et al., 2014; Goldman, et al., 2010; Goldman, et al., 2012; Hagen, Braasch, & Bråten, 2014; Rouet, 2006; Wineburg, 1991). Furthermore, texts are inherently artifacts constructed to communicate information, a facet that is crucial to consider in an information age. Texts are written by particular authors, for particular publication venues, at particular moments in time, and in support of particular agendas (Britt, et al., 2013; Rouet, et al., 2016; Wineburg, 1994). Accordingly, each text's source features provide readers with opportunities to strategically evaluate the trustworthiness of the information provided therein. Based on these regularities, many educational researchers stress that – to successfully comprehend in information-rich environments – individuals must be able to sufficiently build a representation that integrates relevant information, while also using available source features to interpret the semantic content provided within texts (Anmarkrud, et al., 2014; Beker, Jolles, Lorch, & van den Broek, 2016; Braasch, et al., 2012; Braasch, et al., 2013; Bråten,

et al., 2011; Bråten, et al., in press; Britt, et al., 1999; Goldman, 2004; Goldman, et al., 2012;

Rouet, 2006; Sparks & Rapp, 2011; Wiley, et al., 2009; Wiley & Voss, 1999). If individuals are

unable or unwilling to engage in these reading strategies, which can be considered to reflect

effortful cognitive activities, several comprehension problems could arise. For example, if

readers do not strategically integrate relevant concepts into a coherent representation, their

understandings within the domain may involve a fragmented mixture of unconnected facts and

concepts (Goldman, 2004). Moreover, if readers do not strategically use source features to

critically evaluate the content provided by texts, information overload and misinformation are

potential detriments to comprehension and learning (Braasch, et al., 2013; Rapp & Braasch,

2014).

  Over the past two decades, Britt, Rouet, Perfetti, and colleagues' have proposed two

theoretical models to describe different aspects of reading to construct understandings of

multiple texts – that of the Documents Model (DM) and the Multiple-Document Task-based

Relevance Assessment and Content Extraction (MD-TRACE) model (Britt, et al., 1999; Britt &

Rouet, 2012; Perfetti, et al., 1999; Rouet, 2006; Rouet & Britt, 2011).

  The Documents Model. In a seminal book chapter, Britt et al. (1999) characterized four

ways that readers could represent information gleaned from multiple texts. First, readers could

potentially construct completely separate representations of each text with no connections across

what was read. Alternatively, readers could construct what Britt et al. (1999) referred to as a

"mush model," in which semantic information found across various texts is integrated into a

mental model with no attention to or representation of source information, that is the origin of

each piece of information is lost. In a third kind of representation – one Britt et al. (1999)

referred to as a "tag all model" – a reader tags every event from every text to its respective

information source. The authors highlighted that this is, of course, an extremely taxing approach

to representing multiple texts, particularly given the high cognitive load that constant source

attention and representation might produce (Sweller, 1994). The fourth model put forth by Britt

et al. (1999) and Perfetti et al. (1999), and later expanded upon in Britt and Rouet (2012), is the

Documents Model (DM). The DM describes how good readers mentally represent multiple

messages in terms of the information sources conveying them. In particular, the DM specifies

that good readers will create two levels of multiple text representation with connections between

them: an *integrated mental model* and an *intertext model* (Britt & Rouet, 2012). An integrated

mental model about the situation or phenomena includes connections made across the semantic

content found within multiple texts. This level represents key ideas that are unique to each text,

ideas upon which multiple texts are in agreement, and instances where texts present ideas that

contradict one another. Unlike the undifferentiated mush model described above, however, a DM

also involves an intertext model representing source features of texts (e.g., authors, publication

venues, dates written, genres, intended audiences, and so forth) as "document nodes." "Intertext

links" serve as associations readers mentally construct to identify the relationships between

documents' nodes and their respective content information (e.g., "Author A says..."; "Author B

says..."), as well as the important relationships between multiple document nodes. Examples of

the latter type are "Author A agrees with Author B," "What Author A says complements Author

B," and "Author A contradicts Author B." Most importantly for the current work, the DM

suggests that readers form source-content links irrespective of the relationship between the

documents. Said another way, the DM specifies that readers will represent multiple messages in

terms of their respective information sources equally if the sources agree or disagree. We return

to this important point when differentiating our model's contribution from that of the DM. All

told, the DM primarily describes the end result of a good reader building a coherent mental

representation of a situation written about in multiple, distinct texts.

The MD-TRACE model. The MD-TRACE model describes a general sequence of

processes that readers could engage in when interacting with multiple texts for the purposes of

completing an overarching reading task (Rouet & Britt, 2011). In a first step, the task goals are

interpreted based on the provided instructions (e.g., Write an essay on the topic of climate

change). A set of actions are then planned to satisfy the task goals. Per Rouet and Britt (2011),

the end result of this first step is a "task model," a mental representation of the task that a reader

can use to guide subsequent inquiry into the topic. In a second step, information needs are

assessed given the current state of the task product (the essay) (Rouet & Britt, 2011). Step 3

reflects a set of substeps including a) selecting a text (e.g., clicking on a title about climate

change provided by a search engine), b) reading and comprehending the information in the text,

and c) integrating ideas he or she is currently reading with those from prior-read text. Thus, Step

3B and 3C are most important for our current concerns, as they signify creating and modifying a

DM. In Step 4, the task product is created or updated (the student writes the essay on climate

change). Finally, the reader assesses whether the task product sufficiently addresses his or her

needs for the assignment. At any point, the reader can cycle back through earlier steps if the

product is perceived as insufficiently addressing the overarching task goal. For example, based

on the current state of the climate change essay, a reader might decide there are additional

informational needs (Returning to Step 2). Consequently, he or she might return to the search

engine to find additional texts that will provide a better explanation of greenhouse gases

(Returning to Step 3a). Thus, decisions to return to earlier steps are contingent on the perceived

adequacy of the final product. For the current purposes, a review of the MD-TRACE model helps to situate that constructing a DM is but one aspect of task-oriented reading.

Limitations of current theories of text comprehension

The preceding review indicates that remarkable progress has been made in understanding single and multiple text comprehension. However, current models of text processing provide very little by way of reasons that readers do or do not expend additional mental effort towards understanding source information. As stated above, models of single text comprehension provide rich descriptions of the ways that readers incrementally construct a mental representation of a situation. However, none to date have focused on the ways that sourcing processes unfold during reading. Models of multiple text comprehension – such as the DM – focus on the outcomes of reading, in terms of the ways that readers ideally use information sources to organize their mental representations of texts. As such, current models of multiple text comprehension also do not provide sufficient details about the ways that sourcing processes unfold during reading. Save for a few recent examples (e.g., Sparks & Rapp, 2011), we still know very little about the particular conditions that encourage or discourage readers' use of source information during comprehension. In the next section, we therefore present a text processing model that theorizes one key condition that stimulates a deeper processing and representation of multiple information sources: two or more sources disagreeing on a topic.

Characterizing Source Processing and Representation: Introducing the D-ISC Model

The Discrepancy-Induced Source Comprehension (D-ISC) model (Braasch, et al., 2012) provides a detailed description of processes that occur when reading-to-understand controversial messages presented by multiple information sources. A discrepancy can occur within a single text (e.g., a newspaper article contrasts two political pundits' opposing views on global warming

policy regulations), or across multiple distinct texts (e.g., two political pundits' personal websites present their respective views on global warming policy regulations). When multiple information sources present discrepant accounts of a situation with no clear indication of who is right or wrong, as in the policy regulation example above, the reader may find it difficult or impossible to construct a coherent, integrated mental model of the situation. In alignment with seminal strategy-driven models of text comprehension (Graesser, et al., 1994), D-ISC states that readers in such instances will strategically shift their attentional resources towards constructing a mental representation of the messages that also includes source features (e.g., the authors of the messages, their respective expertise, and so forth) as organizational components (Braasch, et al., 2012).

Any relationship across the semantic content expressed by multiple accounts, however, can be considered as falling along a continuum from complete agreement to unresolvable conflict. When texts are in agreement about a topic, or when discrepancies are subtle or difficult to detect, readers will likely proceed to construct a coherent mental model of the situation described in a text or across multiple texts (Braasch, et al., 2016; Kurby, Britt, & Magliano, 2005). Since the D-ISC model presupposes that discrepancy is an impetus for sourcing, agreement amongst ideas may obviate the need to attend to sources, and disrupt the construction of source-content links. In such situations, readers may consider coordinating relationships between content and information sources an unnecessary cognitive load (Sweller, 1994), and avoid expending the additional mental effort. What follows is a greater specification of the processes we theorize that readers enact to establish global coherence when reading. Such a characterization is foundational for offering exact predictions and explanations of effects in

empirical research that we believe reflect D-ISC's processing and representational assumptions (see the *Empirical Evidence* section below).

Because D-ISC is a text processing model that describes sourcing within single as well as multiple text reading contexts, it assumes many of the same component processes described by prominent models of single text processing, such as the CI and Resonance models (Kintsch, 1998; Myers & O'Brien, 1998; O'Brien & Myers, 1999). As described previously, when an individual reads a sentence, it acts as a signal for related information from previously-processed information from the same text, a different text, or prior knowledge to be returned to working memory based on passive, automatic, and memory-based spreading of activation (Kendeou & O'Brien, 2014; Kintsch, 1998; Myers & O'Brien, 1998; O'Brien & Myers, 1999). An individual might have previously read the following sentence in a text: "greenhouse gases act like a blanket around Earth, trapping energy in the atmosphere, which causes it to warm" (Climate change: basic information, 2016). Imagine the same individual is currently reading the following sentence in a text: "global warming is a liberal hoax that the world is becoming dangerously warmer due to the emission of greenhouse gases" (Global warming, 2016). This example illustrates a reading scenario in which the current text input contradicts information that was previously read, possibly some time ago. In this simplified example, memory traces about greenhouse gases' contributions to global warming should become activated and resonate back into working memory. This is based on the high feature overlap between the current text input and the memory trace for the previously read text (Kendeou & O'Brien, 2014; Myers & O'Brien, 1998; O'Brien & Myers, 1999). The same processes should function if the "liberal hoax" statement was instead read first, and the "greenhouse gases" statement second. Thus, in alignment with processes specified by the Resonance Model (Myers & O'Brien, 1998), D-ISC

assumes a "dumb" mechanism returns information to working memory based on memory-based spreading of activation, irrespective of the accuracy of either proposition. Empirical studies of reading have consistently demonstrated that competent readers will read sentences introducing a discrepancy more slowly compared to comparable control sentences, that is to ones that are consistent with previously read information (Albrecht & O'Brien, 1993; Gernsbacher, Goldsmith, & Robertson, 1992; Guéraud, Harmon, & Peracchi, 2005; Hakala & O'Brien, 1995; O'Brien et al. 1998; Rapp, Gerrig, & Prentice, 2001; Rinck, Hähnel, & Becker, 2001). Although most of these studies have experimentally manipulated the presence of discrepancies within a single text, a recent extension by Beker at al. (2016) demonstrated the same effects when college students read multiple texts for comprehension. Together, the studies demonstrate that previously read information is readily reactivated from long-term memory, particularly when there is a high degree of feature overlap.

The first phase of passive, memory-based processes described above results in co-activation of the controversial content in working memory (Kendeou & O'Brien, 2014). As Kendeou and O'Brien (2014) addressed, this state may result in the reader experiencing cognitive conflict. Without information about who is making these claims, readers cannot easily re-establish coherence through inference-making about the semantic content alone. When information sources are not present in a text or texts conveying controversial statements, readers appear to apply problematic strategies to rectify their comprehension difficulties. For example, readers will create unwarranted causal relationships between discrepant sentences in a single text (Blanc, Kendeou, van den Broek, & Brouillet, 2008), or they will distort or hedge the content of one of the statements to "resolve" the discrepancy (Black, Turner, & Bower, 1979; Chinn & Brewer, 1998; Hakala & O'Brien, 1995; Rouet, et al., 2016). Perhaps most concerning, recent

research has demonstrated that, when readers come across misinformation in a text that clearly contradicts prior knowledge, they will later answer general knowledge questions based on the misinformation they recently read rather than their accurate prior knowledge (Eslick, Fazio, & Marsh, 2011; Fazio, Barbar, Rajaram, Ornstein, & Marsh, 2013; Hinze, Slaten, Horton, Jenkins, & Rapp, 2014; Marsh & Fazio, 2007; Rapp, Hinze, Kohlhepp, & Ryskin, 2014). Thus, when source information is not available within texts, readers appear to apply problematic strategies to resolve coherence breaks, without actually re-establishing global coherence of what was read (Stadtler & Bromme, 2014; Chinn & Brewer, 1998).

Now envision a reading situation in which the contradictory claims expressed above were explicitly provided by two distinct information sources: the US Environmental Protection Agency (EPA) and www.conservapedia.com, respectively. When multiple information sources are associated with the controversial statements, D-ISC states that a first passive processing phase of co-activating discrepant propositions in working memory will stimulate readers to engage in a second, more effortful processing phase. D-ISC asserts that readers will strategically attend to and evaluate the respective source information during encoding. In alignment with a constructionist perspective described earlier (Graesser, et al., 1994), readers may spend additional mental effort retrieving and evaluating relevant background knowledge about the topic and/or the sources themselves to think about possible reasons for the conflict. As stated above, inferences about the topic may not help the reader overcome experiences of cognitive conflict (global warming cannot veridically exist and be a hoax).

Readers could, however, strategically activate prior knowledge about sources to help them evaluate the trustworthiness of the claims that each has made, the evidence that is potentially provided, whether the claims' authors are knowledgeable on the topic, and so forth.

For example, a reader may activate prior knowledge to evaluate that the EPA is a governmental

agency expressly created to protect human health and the environment. As such, they might

consider the greenhouse gases claim conveyed by the EPA as potentially reflecting reliable

scientific methods. At the same time, even if readers have never visited the website

www.conservapedia.com, and thus have no knowledge of this particular source, they may

strategically activate general world knowledge about the relationships between conservatives and

liberals to evaluate the "liberal hoax" claim as possibly reflecting conservative motives for

making such claims about global warming. D-ISC states that a greater attention to and a "deeper"

evaluation of the connections between semantic content and respective information sources will

result in a text representation that uses sources as a principal organizing factor (Braasch, et al.,

2012; Braasch, et al., 2016). In the parlance of the DM, controversial messages will encourage

readers to actively construct document nodes and include them in their mental representations

(Britt & Rouet, 2012). With respect to the example, readers might link each source to the

semantic content of its message, while also making a rhetorical predicate (in this case, the EPA

contradicts www.conservapedia.com). Coordinating and evaluating relationships between

content and information sources may signify additional cognitive load (Sweller, 1994), in which

the reader increases mental effort towards understanding the roles that information sources might

play in the controversy.

A D-ISC reading strategy, therefore, affords opportunities to re-establish coherence by

considering the discrepancy as originating from different perspectives rather than a genuine,

unresolvable coherence break (Bråten, et al., 2011; Stadtler & Bromme, 2014; Strømsø, Bråten,

Britt, & Ferguson, 2013; Thomm, Hentschke, & Bromme, 2015). In this way, the D-ISC model

provides insight into the reasons individuals will dynamically engage in source processing

strategies during reading, based on what information is presumably activated. Moreover, D-ISC characterizes the memorial outcomes of these strategic shifts once the texts are no longer present: a representation of controversial information in terms of the respective sources.

Thus, D-ISC combines several aspects of single and multiple text comprehension models for the purposes of formulating a more detailed, comprehensive model of source processing and comprehension. In doing so, we offer initial steps towards addressing at least some of the limitations in the field. For example, D-ISC extends single text processing models to consider sourcing processes as they unfold during reading. Whereas the DM focuses on the end results of good comprehension – mental representations that use information sources as organizational components – D-ISC characterizes the processes individuals might engage in *during reading* to construct document models. Finally, and perhaps most importantly, the DM seems to suggest that readers represent multiple messages in terms of their respective information sources equally if the sources agree or disagree. However, the D-ISC model constrains that not all relationships will equally produce source-content links; in fact, discrepancies will produce more source-content links relative to instances where sources agree on a topic. This is the main premise that differentiates the D-ISC processing model from that of the DM, which we hope will prove useful for future empirical tests and refinements of each model.

D-ISC can also be related to Johnson and colleagues' prominent Source Monitoring Framework, abbreviated here as SMF (Johnson, Hashtroudi, & Lindsay, 1993). Unlike the previously discussed models of text comprehension, the SMF mainly describes processes individuals engage in when making attributions about the origins of their memories, knowledge, or beliefs. To use an example, an individual might engage in source monitoring processes to remember which author might have made a particular statement on the basis of what memory

traces gets activated during retrieval (Was it author A, or author B who made that claim?). Thus, whereas the SMF is primarily concerned with processes individuals engage in during retrieval, that is making decisions based on activated memory traces that return to working memory, D-ISC is primarily concerned with processes that individuals engage in during encoding, that is when a memory is being formed within working memory.

In relating the two theories, encoding processes described by D-ISC should support retrieval processes specified by SMF. On one hand, if source-content links were more deeply encoded as a function of having come across a contradiction, this should lead to greater success in attributing which source might have produced a statement at retrieval. On the other hand, if semantic information is congruent across texts, D-ISC would specify that source-content links will be encoded in a very shallow way. Accordingly, the memory trace that becomes activated at retrieval is likely only partial and insufficient to successfully attribute a piece of information to its respective information source. Although it is beyond the scope of the present article to cover all relationships between D-ISC and SMF, we acknowledge there are obvious connections to be made between these two theories when describing complex relationships between source encoding and retrieval. That is a matter for future theorization and empirical research to unpack.

If discrepancies within and between texts do promote changes in the moment-by-moment processes that readers undergo when reading-to-understand complex information, very specific predictions can be made and tested. During reading, D-ISC predicts that individuals should allocate more attention to sources after having come across a discrepancy relative to when they instead read consistent versions of texts. For example, in a single-text reading scenario, D-ISC would predict that a later-read discrepancy would cause readers to scan back to earlier portions of the same text to more deeply process the information sources, in hopes of better understanding

the controversy. In a multiple-text reading scenario, the controversy, of course, occurs across multiple distinct texts, most often with no reference to one another. In terms of the steps outlined in the MD-TRACE model presented earlier (Rouet & Britt, 2011), a discrepancy could introduce experiences of cognitive conflict, which might stimulate readers to return to a search engine to re-investigate prior-read texts. All told, a deeper processing and representation of source-content links may afford readers opportunities to resolve their experiences of cognitive conflict (Kendeou & O'Brien, 2014).

Because these hypotheses reflect "online" processing, studies presented as support in the current work incorporate eye movements and verbal protocols produced during reading as primary data sources. Moreover, D-ISC would predict an increased presence of source features in readers' mental representations of controversial messages after reading has concluded (e.g., more source information in an essay written on the topic from memory). To verify D-ISC's processing and representational assumptions, we next review evidence produced by empirical studies that have manipulated the presence of contradictions. We investigate support for D-ISC using three reading scenarios: a) discrepancies within a single text, b) discrepancies across multiple texts, and c) discrepancies between a single text and prior beliefs and knowledge. To make causal claims about contradictions as a mechanism of sourcing, all supporting studies have controlled for every text component (e.g., text length, reading ease) save for the presence of contradictions. An examination of these studies provides a window into the reproducibility of the cause-and-effect relationship espoused by D-ISC across single and multiple text reading scenarios, as well as across different samples, task instructions, procedures, languages/cultures, and various kinds of materials.

Empirical Evidence

In Braasch et al. (2012), French college undergraduates silently read two-sentence news stories to be able to provide a verbal summary statement after each. They were also tasked to remember the entire set of stories well enough to answer questions about them at the end of the experiment. To address D-ISC's processing assumptions, Braasch et al. (2012) measured eye movements produced during reading. Focal measures were the number of fixations and gaze times allocated to source segments after a reader accessed the second sentence that was either discrepant or consistent with a sentence they just read (See Example 1). Thus, as Example 1 illustrates, we measured the amount of time "According to the art critic" and "the lighting technician claims that" were re-viewed after readers came across the underlined portion of text, with a particular lens for whether the reading patterns differed across the manipulation. As the example also demonstrates, one word of the content in the first sentence of each text was changed to make discrepant or consistent versions of the news stories, while keeping everything else – including the information sources – exactly the same across the conditions.

Example 1

Discrepant text version:

│ According to the art critic, │ the public cheered the new show of the Paris opera. │ On the contrary, │ the lighting technician claims that │ half the public went back home before the intermission.

Consistent text version:

│ According to the art critic, │ the public booed the new show of the Paris opera. │ In addition, │ the lighting technician claims that │ half the public went back home before the intermission.

In addition to the processing measures, this study analyzed the presence of information sources in the summaries readers produced while looking at the information, and memory performance when they were later cued to recall information sources associated with various claims (e.g., Who said "half the public went back home before the intermission?"). As predicted by D-ISC, readers fixated significantly more often and gazed longer at source segments of the text when reading discrepant relative to consistent news stories. Furthermore, readers cited more information sources in the summaries they generated, and recalled them more often after reading discrepant compared to consistent versions of news stories. An additional experiment provided a direct replication of the summary and memory effects using a second sample of French undergraduates, while also generalizing the effects across several different reading goals. Thus, Braasch et al. (2012) was the first to introduce and provide support for D-ISC's processing and representational assumptions.

Rouet et al. (2016) recently provided additional support for D-ISC's assumptions using similar materials and procedures. American and French college undergraduates read discrepant or consistent versions of news stories for the purposes of summarizing them. In alignment with D-ISC, students mentioned more specific sources in their summaries of discrepant compared to consistent stories, an effect that conceptually replicated using animate (e.g., the lighting technician) or inanimate (e.g., the theater bulletin) information sources. A cued recall task was also used, which confirmed memory advantages for information sources associated with discrepant versus consistent news stories. Thus, Braasch et al. (2012) and Rouet et al. (2016) focused on reading experiences where there were clear contradictions between two juxtaposed sentences in a single text.

Kammerer, Gerjets, and colleagues have provided additional support for D-ISC's assumptions using a multiple-text reading paradigm. In their research, contradictory sentences were manipulated across multiple distinct texts. For example, in Kammerer and Gerjets (2012), German high school students read multiple pages in a sheltered web environment about a health-related topic. In the discrepant condition, readers were presented with four web pages stating that a supplement (L-Carnitine) effectively improves athletic performance, and one claiming that it was ineffective. In the consistent condition, all five web pages concluded that L-Carnitine was effective. Participants later wrote a recommendation about L-Carnitine's effectiveness. As in the aforementioned studies using brief news stories, high school students also referred to more information sources (i.e., the types or names of web pages) in their recommendations if they had read a conflicting as opposed to a consistent set of websites.

In Kammerer et al. (2016), German university students read two web pages to be able to write a recommendation on whether the national football team should allow their athletes to take a fictitious nutritional supplement. Readers were randomly assigned to one of three text conditions. In the discrepant condition, a commercially-biased web page (i.e., written by the National Association of Sports Nutrition) presented positive information about the supplement; an unbiased page (i.e., written by the Society of Sports and Nutrition) presented negative information about the effectiveness of the supplement. In two consistent conditions, web pages either provided consistently positive or consistently negative information. Source features were held constant across the manipulation and included logos and "about us" information, which elaborated on the nature of the information source (e.g., their motivations and goals for writing the texts). Participants provided think aloud data as they read the information, that is, they were asked to speak out loud about any thoughts that came to mind during reading. The eye

movements students produced during reading were also recorded. Students then generated recommendations from memory, and finally evaluated the trustworthiness and convincingness of the information within each text.

The obtained results were also consistent with D-ISC's processing and representational assumptions. Students fixated on the "about us" information for a longer amount of time after reading a discrepancy across the two texts. They also made more evaluative judgments when thinking aloud about the "about us" information compared to students who read consistent information. Readers appeared to strategically activate prior knowledge about the sources during reading to help them evaluate the trustworthiness of the claims, the evidence that was provided, and whether the sources were knowledgeable on the topic. Students who previously read contradictory texts also included more "about us" information in the recommendations they generated after reading compared to the students who read consistent information. Finally, readers of contradictory information considered the commercially-biased page to be less convincing and less trustworthy than those reading consistent information, which was assessed, again, after reading. As such, Kammerer and Gerjets (2012) and Kammerer et al. (2016) can be interpreted as supporting D-ISC's assumptions using an authentic reading context: attempting to acquire health information from multiple diverse Internet sources for the purposes of making behavioral decisions.

Recent research by Barzilai and Eshet-Alkalai (2015) examined the role of readers' epistemic perspectives – how they think about how people know – when comprehending authors' viewpoints within multiple text reading contexts. Prior to reading, Israeli university students completed a questionnaire assessing the degree to which they endorsed statements reflecting three different epistemic perspectives (Barzilai & Eshet-Alkalai, 2015; Kuhn, 2001). In

an absolutist perspective, knowledge is viewed as consisting of objective and certain facts, justified by checking against the external reality that they depict. In a multiplist perspective, knowledge is viewed as subjective and uncertain, justified by personal preferences and opinions. In an evaluativist perspective, knowledge is viewed as consisting of claims that require support in a framework of alternatives, evidence, and argument (Kuhn, 2001). Barzilai and Eshet-Alkalai (2015) computed composite scores for the three epistemic perspectives based on students' responses.

After completing the questionnaire, students read multiple blog posts on a socio-scientific topic: Should Israel continue to use seawater desalination techniques to increase fresh water availability? In the discrepant condition, students read two blog posts presenting arguments against desalination, and two presenting arguments in favor of desalination. In the consistent condition, all four blog posts supported Israel's desalination efforts. Several dependent measures were collected after reading, including students' abilities to identify, describe, and evaluate the various authors' viewpoints. A latent variable defined as "author viewpoint comprehension" was computed based on students' responses to the three kinds of questions.

Results indicated that discrepancies increased author viewpoint comprehension, but only for readers with particular epistemic perspectives, that is, for those who exhibited higher levels of multiplism and evaluativism (Barzilai & Eshet-Alkalai, 2015). Thus, Barzilai and Eshet-Alkalai's (2015) research suggests that a sufficient degree of awareness that knowledge is subjective and constructed by people arguing and providing evidence for different perspectives may be necessary to stimulate readers to more deeply process source features within multiple, diverse texts.

In the studies reviewed thus far, researchers experimentally manipulated whether contradictions were present or absent within a single text (Braasch, et al., 2012; Rouet, et al., 2016), or across multiple texts (Kammerer, et al., 2016). Recent extensions empirically validate D-ISC's assumptions when a single text contradicts to varying degrees readers' pre-existing beliefs. This suggests that the reader may consider him- or herself an information source, endorsing a belief that may or may not align with an assertion presented by an external information source (i.e., the text's author). Although studies addressing this issue are sparse, some recent evidence supports the idea. In Barzilai, Tzadok, & Eshet-Alkalai (2015), the majority of participants (approximately 64% percent of the sample) referred to themselves as a source of knowledge as they thought aloud while reading multiple, controversial texts. It is unclear, however, whether D-ISC processes function similarly when texts are discrepant within themselves, with other texts, or with the reader's beliefs. The following studies provide some initial evidence to this point.

In a recent example, Bråten, et al. (2016) examined whether readers displayed an increased presence of source features in their memory representations for a text that strongly contradicted pre-existing beliefs on a science topic, compared to one that was more consistent with pre-existing beliefs. Prior to reading, Norwegian undergraduates provided information about their degree of agreement with statements reflecting that radiation produced by cell phones can cause health risks such as cancer. Participants were then randomly assigned to read one of two text versions. One version concluded that "investigations provide scientific evidence that there is a relationship between the use of cell phones and cancer;" the other version concluded that "investigations provide scientific evidence that there is no relationship between the use of cell phones and cancer." Like all of the other studies presented in this review, source features

were held constant across the manipulation. After a delay, readers were asked about the source of the conclusion they had been reading and also given a cued source memory task. Responses were coded for the presence of source features (e.g., author credentials, type and date of publication). Interestingly, readers' memory for source features depended on the degree to which the main conclusion of the text they read was discrepant with their prior beliefs about the topic. In alignment with D-ISC, readers appeared to more deeply process and represent source features when texts clearly contradicted their beliefs on the topic.

In related work, Maier and Richter (2013) investigated German undergraduates' memory for the content of multiple texts, some of which were consistent and some of which were inconsistent with pre-existing beliefs. Participants first rated their agreement with a series of statements designed to measure their pre-existing beliefs (e.g., rating agreement that mankind caused global warming, or that natural phenomena caused global warming). A composite measure was calculated as a measure of readers' pre-existing beliefs on the topic. All students then read the same four texts. Two claimed that mankind is responsible for global warming, and two claimed that natural causes are responsible. After reading they responded to a number of measures reflecting different facets of understandings derived from the reading experience. We focus here on Maier and Richter's (2013) measure of source memory: readers' abilities to assign paraphrased sentences back to their respective information sources (i.e. matching each sentence to one of the four respective titles). The findings showed that readers displayed a stronger memory for the information sources associated with texts that contradicted their pre-reading beliefs than they did for texts that were consistent with their initial beliefs. Thus, similar to Bråten, et al. (2016) and interpretable through the D-ISC model, readers appeared to more deeply

process connections between the semantic content conveyed by multiple texts and their

information sources, especially when texts contradicted pre-existing beliefs on the topic.

We finally review recent work focusing on contexts where there is complete agreement

amongst a set of texts. Since D-ISC presupposes a first phase of reading where discrepancies

promote sourcing, agreement between texts may discourage readers from expending additional

mental effort towards attending to and using information sources to organize their mental

representations (Braasch, et al., 2016). Readers may spend less of their cognitive resources

attending to information sources that completely agree as a way to minimize any additional

cognitive load that sourcing activities may incur (Sweller, 1994). A shallow encoding of the links

between sources and their respective statements should result in a poorer-quality memory trace,

making it more difficult for readers to recall and discriminate amongst the various information

sources at retrieval (Johnson, et al., 1993).

In Braasch et al. (2016), American undergraduates read a series of texts on a

controversial topic: whether social media is beneficial or detrimental for society. There was a

within-subjects manipulation where half of the texts read reflected sets of congruent arguments

(e.g., three separate texts all claiming that social media is detrimental for society because it

promotes cyberbullying); the other half were manipulated to provide unique arguments. Sources

were held constant across the manipulation of the semantic content. After reading, students

generated a comprehensive essay on the topic from memory. They finally completed an

additional source memory assessment, which asked them to recognize the correct information

source associated with each claim.

The essay results indicated that students remembered more arguments (both in terms of

claims and evidence) previously presented in congruent compared to distinct texts. The source

memory results, however, demonstrated the opposite pattern: Students were less accurate when identifying the information sources from congruent compared to distinct texts. They also made more "source confusion errors," inaccurately recalling a source associated with one of the other similarly-themed arguments. Thus, when information is compatible – that is devoid of discrepancies – readers appeared to process texts in ways that prioritized semantic content integration at the expense of attending to and consequently remembering source feature information, which may reflect a representation similar to Britt et al.'s (1999) "mush model."

Summary of the empirical findings

The empirical evidence supports that readers spend more time processing information sources and displaying a better memory for them when a discrepancy is present. The effects replicated using very simple single texts ensuring that discrepant ideas were co-activated in working memory (Braasch, et al., 2012; Rouet, et al., 2016), but also with more complex materials where discrepancies were present across multiple texts (Kammerer, et al., 2016). In the latter case, we assume that text propositions residing in working memory acted as retrieval cues for related concepts to become automatically and passively activated from long-term memory (Kendeou & O'Brien, 2014; Kintsch, 1998; Myers & O'Brien, 1998; O'Brien & Myers, 1999; O'Brien & Cook, 2016). Readers may perceive of the co-activated discrepancy as a break in coherence of the situation being described and, consequently, experience cognitive conflict (D'Mello, Lehman, Pekrun, & Graesser, 2014; Kendeou & O'Brien, 2014; Otero, 2002; van den Broek & Kendeou, 2008). To reduce or eliminate this conflict, readers appeared to strategically turn to sources as a means by which they interpreted the information and organized the mental representations they constructed during reading. Measures of information processing (e.g., eye movements produced during reading, think aloud comments) and memory representations (e.g.,

recognition and recall tasks) consistently supported that discrepancies cause readers to more frequently attend to, evaluate, and strategically use sources as a way to organize their memory for what was read. When there was no discord between information sources, readers did not appear to experience cognitive conflict. Accordingly, they were far less likely to use source features to organize their understandings.

Thus, the D-ISC model shows promise in providing reasons individuals will dynamically switch towards an active, strategic processing of source information "midstream" during reading, based on what information is presumably activated. In replicating the cause-and-effect relationships across various samples, task instructions, procedures, languages/cultures, and various kinds of materials (from simple claims to more complex arguments), we can say with a degree of confidence that D-ISC is a promising empirically-based model upon which researchers can continue to refine and build.

Implications and Future Directions

Up until this point, the purpose of the current article has been twofold. First, the assumptions of the rather-recently proposed D-ISC model were further articulated. A more detailed description affords additional opportunities to develop and test predictions about contexts that promote source attention, evaluation, and ultimately inclusion in memory and use. A related second purpose was to examine the extent to which previously-collected empirical data support the model, specifically with reference to experiments manipulating the presence of contradictory information. Across the studies, individuals appeared to more actively and strategically process source information after having come across a portion of text that contradicts itself, a separate text, or the reader's pre-existing beliefs. The D-ISC model assumes that contradictory propositions become co-activated in working memory, which in turn produces

an experience of cognitive conflict. This underlying conflict is presumed to promote reader

attention to any available source information (e.g., the authors of the claims, the publication

venues, dates with which an article was published) to resolve the discrepancy by way of source

representation. Thus, the current work advances our understandings of the particular conditions

that encourage sourcing during reading. We offer one such mechanism: inconsistencies between

what the individual is currently reading, and other concepts that currently reside in or are

returned to working memory (be they from prior-read texts or from prior beliefs and knowledge).

In summarizing and reflecting on this work, however, it was clear that there are several

unaddressed limitations. In this final section, we provide specific avenues for future research that

could further strengthen and enrich the D-ISC model. These include investigations of type and

degree of discrepancy recognition, layers of sourcing and source knowledge, and dependent

measures that target source evaluation and spontaneous sourcing in written responses.

First, research testing D-ISC model assumptions is limited by the type and degree of

discrepancies that have been included in experimental materials to date. D-ISC is cast as a

general model of comprehension that functions when contradictions are present, irrespective of

the type of contradiction. There is a growing evidence base that within-text contradictions

(Braasch et al., 2012; Rouet, et al., 2016), and to a lesser extent between-text contradictions

(Kammerer, et al., 2016), result in increased processing efforts devoted to source features.

However, it is still unclear whether D-ISC processes function similarly when texts contradict the

reader's pre-existing beliefs. Although a few studies provide initial evidence to this point (Bråten

et al., 2016; Maier & Richter, 2013), none have used online measures of reading (e.g,

eyetracking, think aloud). Further investigations could include measures of readers' prior topic

beliefs, while also manipulating textual materials to vary the presence of different types of

contradictions (prior-belief, within-text, across text). Based on the theoretical assumptions of D-ISC, we hypothesize that readers would similarly increase their attention to and representation of source information for all three types of discrepancies relative to control conditions.

We also know very little about the role the *degree* of discrepancy might play in D-ISC-related processes. All experimental manipulations of texts to date have incorporated clear, unresolvable contradictions (e.g., global warming cannot simultaneously exist and be a hoax). However, discrepancies in authentic contexts can be far subtler, and potentially more difficult for readers to detect. For example, texts' authors may use different vocabulary terms to describe the same situation or phenomenon. When this occurs, readers must have a sufficient level of prior knowledge to be able to elaborate on the meaning of the propositions to recognize that, indeed, contradictions exist (Anmarkrud, et al., 2014; Beker, et al., 2016; Goldman, et al., 2012; Stadtler, Scharrer, Brummernhenrich, & Bromme, 2013). As a concrete example, if one text states that "we should do our best to reduce CO2 emissions," while another states "we should not worry about greenhouse gases," the reader must use prior topic knowledge to recognize that the terms greenhouse gases and CO2 emissions are, in fact, synonymous. If the reader does not have a sufficient prior knowledge base, she or he may not grasp that the concept of greenhouse gases has a high degree of conceptual overlap with the concept of CO2 emissions. Accordingly, reading a sentence about greenhouse gases may not cue previously-read contradictory information about needs for reducing CO2 emissions. The controversial content would not become co-activated in working memory (Kendeou & O'Brien, 2014), making it unlikely that the reader experiences cognitive conflict (D'Mello, et al., 2014; Otero, 2002; van den Broek & Kendeou, 2008). Thus, extent of overlap in the actual vocabulary used to describe the situation likely influences whether concepts will become co-activated or not. Contradictions incorporating

the same terminology might produce greater co-activation and experiences of cognitive conflict than contradictions in which different vocabulary terms are used. Moreover, the level of a reader's prior knowledge may moderate the vocabulary effects hypothesized above. Those with lower prior knowledge may require more vocabulary overlap than those with higher knowledge to recognize discrepancies, which should in turn facilitate source processing and representation. Further research could examine prior knowledge contributions to noticing of discrepancies to better specify the parameters of D-ISC. Such analyses may also prove useful in promoting source attention and evaluation in younger students, who often fail to detect contradictions present within texts they are reading (Garner & Kraus, 1981-1982; Garner & Taylor, 1982; Markman, 1979; Markman & Gorin, 1981; Paris & Myers, 1981; van der Schoot, et al., 2012; Zabrucky & Moore, 1989; Zabrucky & Ratner, 1989).

- Future research might also elucidate similarities and differences in processing of sources embedded within the texts (two experts consulted in the writing of a newspaper article) versus superordinate sources that are outside of the texts (the staff writer who wrote the newspaper article). To date, most research has separately investigated conflicts between sources embedded within brief texts (e.g., Braasch et al., 2012) or between the sources of the texts themselves (e.g., Kammerer et al., 2016). Although source processing and representation patterns appear to function similarly, the effects may differ depending on whether the sources are embedded versus superordinate. Potential differences may reflect that embedded are oftentimes more proximate to the situation or phenomenon described as compared to the superordinate source. For example, de Pereyra, Britt, Braasch, & Rouet (2014) manipulated source position using only embedded sources. In this work, sources associated with news stories that were close to the events (e.g., an eyewitness) were better remembered than remote sources (e.g., a news anchor commenting on

the topic from a distance). When using only superordinate sources, that is those that were completely external to the text, Sparks and Rapp (2011) recently demonstrated that readers do not appear to adequately use knowledge of source credibility during comprehension. In fact, readers appeared to only take source credibility into account when the reading task specifically required that they decide upon the validity of stories' outcomes. Thus, future experiments could address whether conflicts within texts similarly increase attention and evaluation for embedded as compared to superordinate sources by manipulating this variable.

We also note that authentic conflicts also occur amongst the different layers of sources (e.g., the superordinate source might ultimately conclude the article by refuting one of the embedded sources). These types of conflicts require much more research attention. It is still an open question whether layer of sourcing moderates the D-ISC processing and representation findings demonstrated in prior work. Moreover, just as vocabulary knowledge might moderate the degree to which readers will even notice a contradiction (as addressed above), knowledge of the source features might moderate the likelihood that readers will strategically use source information to re-establish coherence. Envision a scenario where the reader has absolutely no knowledge of the superordinate or the embedded authors. Readers may find source attention and evaluation unproductive, and instead revert to problematic strategies. For example, readers might ignore source information (Sparks & Rapp, 2011), explain away comprehension difficulties by distorting or hedging content to "resolve" the discrepancy (Black, et al., 1979; Hakala & O'Brien, 1995), or ignore one of the perspectives altogether (Chinn & Brewer, 1998; Stadtler & Bromme, 2014). Future research could elaborate on the types of inter-source discrepancies that particularly encourage or discourage source attention, evaluation, and representation. Furthermore, pre-reading assessments of source knowledge would improve our understandings

of the roles that prior knowledge about sources play in comprehension. For further discussion of

individual difference factors that may influence how readers are able to cope with conflicts in

multiple source use, see Bråten and Braasch (in press) for a review.

Finally, the D-ISC model has been characterized as a starting point to develop and test

predictions about contexts that promote source attention, evaluation, and ultimately inclusion in

memory and use. The empirical research has begun to substantiate D-ISC's assumptions about

source attention during reading and memory for sources after reading. However, findings are

limited with respect to associations with students' source evaluation during reading, or

spontaneous use of sources in writing and argumentation. Clearly much more work is needed in

this area. Recent think aloud studies have provided descriptions of sourcing behaviors (Strømsø

& Bråten 2014; Barzilai, et al., 2015), and in correlating measures of source evaluation with

argumentation in written responses, for example (Anmarkrud, et al., 2014; Barzilai et al., 2015).

However, no studies have experimentally manipulated texts to include (or not include) the

features described above (e.g., different types of discrepancies, different layers of sourcing).

More work along these lines is needed to further clarify causal mechanisms of source evaluation.

Additional think aloud and interview studies could substantiate whether discrepancies cause

readers to more readily evaluate sources, above and beyond what is already known about source

attention. Moreover, a greater diversity of reading tasks could address the use of information

sources in more open-ended outcome measures, such as writing an argument on a topic.

Conclusion

As we continue to investigate models of text comprehension, further theoretical

clarification needs to proceed in parallel with basic empirical research testing specific predictions

derived from these models. Additionally, we need to consider the practical implications of the evolving models for understanding text processing and comprehension and carefully evaluate the outcomes of their implementation in educational settings. Hopefully, this detailed discussion of the D-ISC model, the experimental evidence supporting this model, and the future directions that could advance understandings of the assumptions will prove useful for researchers and educators aiming to understand and promote 21st century literacy skills.

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