3

Comprehending Multiple Documents

OVERVIEW AND CONTENTS

When reading for real-life purposes, readers often have to get information from multiple texts. They must both integrate information taken from various texts, and remember where each piece of information comes from. This chapter investigates the cognitive processes that underlie our ability to build up memory representations of multiple documents. Even though multiple document comprehension is typically carried out by experts in professional activities (e.g., historians, architects, or computer scientists), it may also be used as a means to foster students' comprehension of complex topics. Thus, novice reading of complex documents requires specific cognitive processes, but it gives way to expert-like mental representations and forms of reasoning.

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INTRODUCTION

From primary school until higher education, students find themselves confronted with an increasing variety of information sources. Learning from multiple sources begins with the traditional classroom teaching situation, where the teacher speaks, presents overheads, passes handouts with additional information, documents, and exercises. When studying at the school library, students also have to make their way through a large diversity of printed materials, including books, journals, magazines, newspapers, and so on. For many assignments such as poster making, essay writing, or personal research, students need to collect and make use of more than just a single text. Other forms of education such as distance learning, informal education, or online training also rely heavily on students' ability to learn from multiple documents. Furthermore, students' environment provides them with various ways to complement, enrich, and sometimes contradict information received at school. In the past few years, the advent of the Internet has resulted in a huge increase in the number and diversity of sources potentially available for learning.

Looking at educational materials from a closer point of view, the multiplicity of sources used in learning is even more obvious. In textbooks, for example, information is often presented in the form of a main text, along with figures, tables, diagrams, photographs, and other materials. Take, for example, the double page shown on the upper part of Fig. 3.1 (in reduced format). This document is drawn from an 11th-grade French history textbook. Even though the texts and pictures are blurred, a simple glance at the double page shows that it includes several information sources of different kinds. The main categories are shown on the lower part of Fig. 3.1: headings, content list and introduction, legends, supporting documents, and so forth. Such a salient visual structure provides a comprehensive illustration of the role of text organizers in complex documents (see chapter 2).

Let us assume that an 11th-grade student is using this page to work on a class assignment. The student will identify the contents of this section of the book thanks to the *title* and *content list* found at the top left corner of the page. Nearby, the general *introduction* presents an overview of the chapter's main points. In the lower left page, a *thematic chronology* may help categorize key events in the period considered (i.e., cultural life in the aftermath of World War I).

The right-hand page presents a series of documents and illustrations that introduce more specific aspects of the historical period covered in this section of the textbook. A *photograph* (upper right corner) shows the damages caused by bombings on a European city. A *painting* (lower right corner) shows an artistic representation of soldiers with mon-

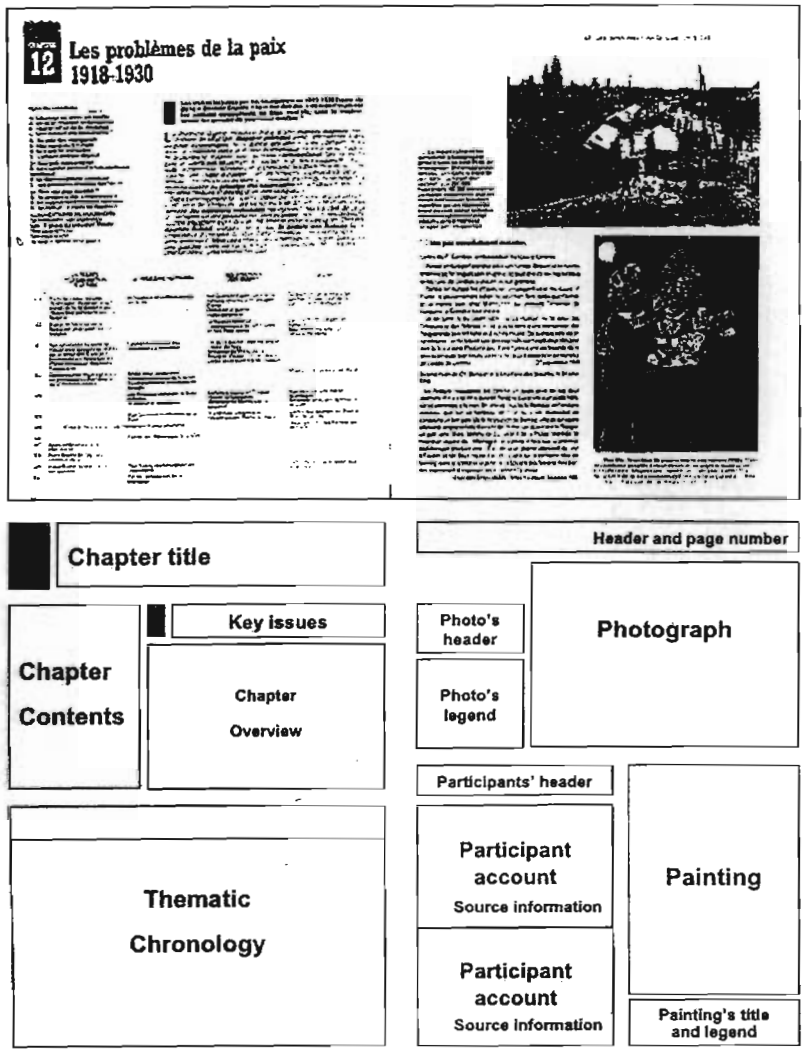

FIG. 3.1. Excerpt from a French 11th-grade history textbook (Marseille, 1988). Reprinted by permission of Nathan.

strous wounds playing cards, suggesting the deep psychological consequences of the violence and injuries they have suffered. Finally, two *accounts* by political figures at the time—one French, one British—discuss the consequences of war and the ambiguity of the Versailles Treaty. The following pages in the book, just like the first one, include both a "voiceless" lesson (in fact, that of the textbook author) and a large variety of documents. Such a diversity of sources is rather common in high

school and higher education textbooks. It is also found in magazines and encyclopedia.

What are students supposed to do when they study multiple documents? And what kind of mental representation of such materials do they form? Learning from multiple documents requires one to decide on a study plan (given, e.g., time constraints and a study assignment), then to read and comprehend each document. The student must also understand the specific features of each source (e.g., whether it is important, credible, reliable, useful, and so forth). Finally, the student must integrate information from the various sources into a coherent whole, while assigning each contribution to the relevant source.

What kind of knowledge structures and cognitive processes are involved in these activities? A simple answer could be that they are essentially the same as the text comprehension processes discussed in chapter 1 (see also Kintsch, 1998; Otero, León, & Graesser, 2002). However, as I already suggested in section 1.4, there are several objections to this simplistic view. First, a set of documents such as presented on Fig. 3.1.does not meet the minimal coherence criteria required to construct a single propositional representation, let alone a situation model in the sense of contemporary cognitive theories of comprehension (see chapter 1). Second, there may be some differences or even discrepancies in the various "stories" told by these documents, preventing the construction of a single coherent representation (regardless of the underlying cognitive theory). Finally, there is no direct correspondence between any of the sources and the "situation" the student is trying to study. Each document may be used as a tool to build a representation of the situation, but none of them is a complete and reliable representation of the situation. Therefore, comprehension partly amounts to evaluating and selecting those aspects of the documents that may fit into a coherent whole, and assigning each of them a special status or role as descriptors of the situation.

For this reason, it seems likely that specific meaning-making processes are involved when reading multiple documents. There are also reasons to believe that the mental representation built from a set of multiple sources includes more than a representation of the situation described in the sources. Such a representation must also keep track of "who says what," that is, where and how the information presented in each document comes from. An integrated representation should also include the relationships between different documents, in order to account for explicit or implicit cross-references.

3.1. HOW EXPERTS INTEGRATE MULTIPLE INFORMATION SOURCES

Only recently has the issue of multiple document comprehension been acknowledged per se by psychologists and instructional scientists. Wineburg (1991, 1994) conducted one of the earliest empirical studies of multiple document comprehension in the area of history. In Wineburg's (1991) study, eight high school seniors (history novices) and eight graduate stu-

dents and faculty from history departments (history experts) participated. They were asked to study a set of paintings and documents representing the battle of Lexington (one of the opening chapters of the United States' Independence War, at the end of the 18th century). The textual materials included witnesses' accounts (e.g., an excerpt from a soldier's diary), related primary sources (e.g., a court decision), and a variety of second-hand accounts (e.g., excerpts from historical essays, novels, and textbooks). The participants were examined individually and they were asked to think aloud while studying the documents. Wineburg examined the study strategies of experts and novices (i.e., how they read the documents, in what order), and their evaluation of each document (i.e., whether they found the documents useful and trustworthy, and why).

The expert participants demonstrated three study strategies not shared by novices. First, they focused on source information presented at the bottom of each document, even prior to reading the document. The experts used source information to evaluate and interpret the document content. For instance, one history expert dismissed information found in a historical novel because of the mixture of fiction and fact found in this type of text. The diary of a soldier directly involved in the event raised much more interest because it was firsthand testimony, even though this account was likely to be strongly biased. In contrast, high school seniors hardly ever consulted source information prior to reading. They generally paid little attention to source details, except for the textbook excerpt. Wineburg's study also found that experts and novices differed in the way they evaluated source information. The historians tended to find primary sources more useful and trustworthy, whereas high school students trusted the textbook as the most useful and reliable source.

Second, experts corroborated information across documents, especially for critical details such as time, place, or the participants' attitudes. The corroboration heuristic involved physical manipulation of the documents, in order, for example, to put them side by side so as to facilitate parallel reading. Expert students were sensitive to discrepancies, and they established relations between different versions of the events. For instance, one expert was able to notice a contradiction between the timing of the battle (dawn) and one report mentioning weapons "glittering in the sunshine." In contrast, high school seniors considered each source in isolation, and seldom noticed discrepancies across sources. They tended to "take it or leave it" without attempting to weight the contribution of the most complex or ambiguous sources. For instance, they accepted the textbook version even though some aspects were in contradiction to other documents (the contradiction was noticed by most historians, who dismissed the textbook).

Third, the experts contextualized document information using their prior knowledge of the situation. They used contextual information to put the specific events described in the documents into a broad context of time, space, and conditions. For this, the historians brought to bear whatever knowledge they may have had about the period, the actors

and political figures, and related facts and events. New information was readily integrated in a dense network of prior knowledge and contributed to its development. The contextualization heuristic is an illustration of the role of content area knowledge in comprehending new information (see, e.g., Spilich et al., 1979; Afflerbach, 1990). In a study similar to Wineburg's, Carretero and Limon (1995) also found that experienced historians were able to draw more elaborate conclusions from a set of texts and tables about a particular topic in Spanish history, compared to a group of undergraduate history majors.

Wineburg's (1991) study pointed out that "being an expert" in a discipline such as history does not only mean that one has a great deal of knowledge about facts, events, dates, or characters. Expertise also means having specialized knowledge about information sources and how to use them. Source knowledge is brought to bear at the time of reading, as illustrated by the sourcing and corroboration heuristics. It is also used at the time of evaluating and using content information found in the documents.

Is expertise about discourse styles, sources, and rhetorics bound to the discipline of history? Even though few studies have been conducted in other areas, there are reasons to believe that it is not. A case study by Rouet, Deleuze-Dordron, and Bisseret (1995) provided evidence that both general and project-specific knowledge is brought to bear as expert software designers search, select, and write comments about software modules. Dillon (1991) found that human factors specialists possess detailed knowledge about the structure of scientific articles, which allows them to guess the likely location of any paragraph excerpted from an article, even though they have not read the article before (see chapter 2, section 2.2.3.).

These studies suggest that expertise in any discipline includes both *content area knowledge* and *document knowledge*, that is, knowledge about how knowledge is represented in documents, characteristics of various types of documents, and so forth. Document knowledge pertains to the broader category of metatextual knowledge discussed in chapter 2. It may take various forms, including generalized schemata that represent typical documents normally found in a given area of knowledge and/or activity. Document knowledge, whether general or domain-specific, is most likely used to encode, store, and retrieve information from multiple sources, as part of learning or other specialized activities. The nature of document knowledge and how it affects expert comprehension strategies is the subject of a new and fast-growing research area that has important implications both for discourse comprehension theories and for the teaching of literacy skills.

3.2. A THEORY OF MULTIPLE DOCUMENT REPRESENTATION

In this section, I present some theoretical notions concerning the mental representation of multiple documents. A mental representation of multiple documents is formed as the person reads several independent documents

that refer to the same situation or topic, during a continuous time interval. Such an activity may require elaborate strategies, such as skimming or corroborating information across texts (Wineburg, 1991). It may also involve rereading, taking notes, or consulting adjunct sources such as a dictionary. Defined in those terms, comprehending multiple documents differs from comprehending single texts in at least three ways.

First, each text or document has a proper identity, which is represented by explicit or implicit *source information*. Source information includes the authors' identity, his or her credentials, and other details helpful in assessing the author's authority (e.g., previous publications in the domain). Source information also includes the conditions surrounding the publication of the document: whether it is private or official, the date of publication, whether it was reviewed, and so forth. Source information is relevant for comprehending single texts, but it plays a more prominent role in comprehending multiple documents. When studying multiple documents, source information simply cannot be ignored. This is because source information allows the reader to differentiate documents, and to evaluate the respective contribution of each document to a global representation of the situation.

Second, multiple document comprehension emphasizes the *distinction between texts and situations*. In Table 1.2, for instance, reading the second passage about the protest allows one to appreciate the relativity of the first report as regards, for example, the number of people wounded. Thus, reading multiple documents may promote the updating of previous knowledge or beliefs (Johnson & Seifert, 1999; van Oostendorp, 1996). This is important because updating previous knowledge is a central aspect of text-based learning.

Finally, *documents may complement each other* in various ways. A document may provide support in favor of the arguments presented in another document. It may fill in the gaps left over by the other document, thus confirming or disconfirming the inferences generated by the reader in order to fill in those gaps. When reading two scientific papers, two newspaper editorials, or two reports about a company's activities, the reader has to decide whether and how the texts are compatible or contradictory, whether one prolongates, responds to, or turns down the other one. The most common case is probably one in which each document contributes to representing one part or aspect of the situation, as in Fig. 3.1. In such a case, the reader has to identify global relationships between documents in order to integrate them into a coherent whole. Representing multiple documents thus includes, in addition to the semantic relationships described in the text-processing literature, higher level discourse relationships that connect and organize the sources into a coherent whole.

3.2.1. Describing the Organization of Document Sets: An Example

In a series of studies conducted together with Britt, Perfetti, and other colleagues at the Universities of Pittsburgh and Poitiers, we have proposed a number of theoretical principles in an attempt to account for the mental construction of global intertextual relationships (Britt, Rouet, Georgi, & Perfetti, 1994; Perfetti, Britt, & Georgi, 1995; Perfetti, Rouet, & Britt, 1999). In these studies, we used documents sets dealing with controversial historical events such as the 1903 acquisition of a canal in Panama by the United States. This is a controversial chapter of American history, due in part to the ambiguous role played by the U.S. armed forces during the revolt that started in Panama City in November 1903. The rebels wanted Panama (then a Colombian province) to secede from Colombia. The U.S. armed forces present in the harbor of Colón prevented the Colombian regular troops to travel to Panama City in order to suppress the revolt. This allowed the rebels to declare the independence of the Republic of Panama. Soon after, the United States and the Republic of Panama signed a treaty that granted the United States full control over a piece of Panamanian territory, a provision that allowed the United States to build and control the Panama Canal until its restitution to Panama in the 1990s.

The U.S. intervention in Panama has generated an abundant, colorful, and highly conflicting literature. Among other controversies, two opposed interpretations have been proposed as regards the rights of the U.S. army to intervene in Panama. According to one interpretation, the intervention was justified on the grounds of the Bidlack-Mallarino Treaty signed in 1857 between the United States and Colombia. The treaty granted the United States the right to intervene to maintain order in Panama (the United States had just completed the construction of a railway in Panama, to facilitate westward emigration). The second interpretation claims that the intervention was illegal based on a different chapter of the same treaty that guaranteed the sovereignty of Colombia over Panama. Both interpretations also make use of participants' accounts and various other sources.

In order to understand the story of the Panama Canal, one has to build up a mental representation of the situation: characters, places, goals, actions, influences, and the rich set of temporal and causal relationships among them (Magliano et al., 1999; see also chapter 1). One must also understand the similarities and differences among the various versions of the story available. In other words, one must bear in mind "who said what" and whether the different points of view are compatible or not. What would this type of representation be made of? Let us consider the set of documents presented in Fig. 3.2.

Figure 3.2 offers a simplified representation of a set of documents about the Panama revolt and their relationships. Each document is shown as a card with some basic information about its source and contents. For instance, the document by "Professor Norman" argues that "the U.S. military intervention in Panama was not justified on legal grounds." The document set includes two main types of documents: primary sources (e.g., military correspondence) and second-hand accounts (e.g., historical

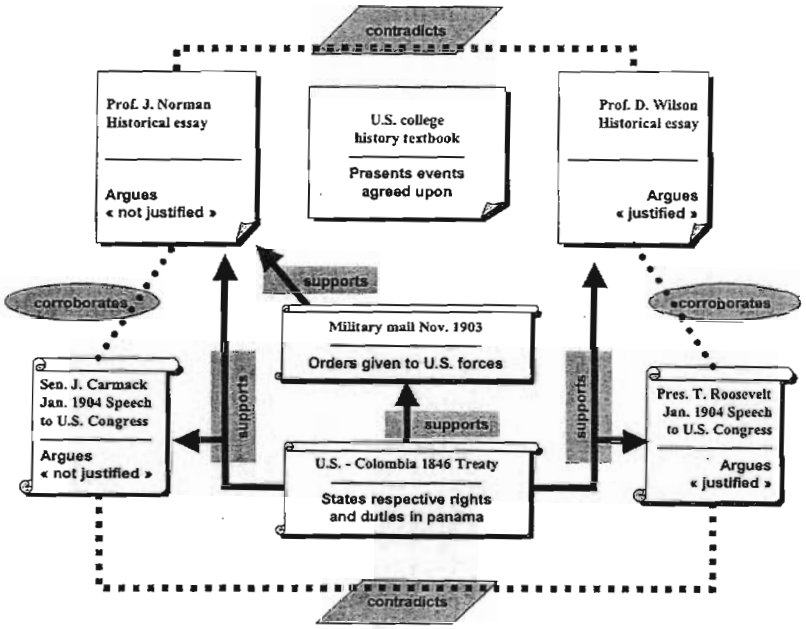

FIG. 3.2. Example of a document set dealing with one of the Panama controversies. The arrows indicate explicit (full lines) or implicit relationships (broken lines) between documents (adapted from Britt, Perfetti, & Rouet, 1996).

essays). Primary sources are written by characters directly involved in the events, for example, diplomats, politicians, military, and other participants. Secondary sources are written by characters commenting on the events, sometimes much later. All the documents contribute to a global representation of the situation in Panama in the Fall of 1903. Some documents, however, provide a rather neutral view, whereas other documents argue in favor of specific interpretations of the events (e.g., the U.S. intervention in Panama was/was not legally justified). The neutral/biased dimension is independent from the primary/secondhand dimension.

Relationships between documents are shown as arrows in Fig. 3.2. "Support" relations are represented by solid lines. They indicate that a document is used by another document to support the latter's view or claim. Primary sources are typically used to support secondhand accounts. An example is the arrow between the 1846 United States–Colombia treaty and President Roosevelt's 1904 speech. President Roosevelt explicitly cited this treaty in his speech. A second example of a "support" link is the arrow from the 1846 United States–Colombia treaty and Professor Norman's historical essay. In his essay, Norman cited the treaty to support his claim that U.S. intervention in Panama was not justified. Other, implicit relationships are shown in Fig. 3.2 by

broken-line arrows. These include *corroboration* and *contradiction* relationships. An example is the contradiction between Prof. Norman and Prof. Wilson's claims. Finally, some documents may be related by more than one type of relationship. For instance, Roosevelt's speech and Wilson's essay are related by a "support" arrow, because the latter explicitly cites the former. The two documents also corroborate each other, in that both come to the conclusion that the intervention was justified.

An important issue is to find out how readers will manage to construct a coherent representation based on such multiple and partly contradictory accounts of the situation in Panama. Clearly, a theory assuming that comprehension is achieved by simply integrating the information found in a document to knowledge previously acquired from other documents would not work because the documents do not make up a single coherent story (see chapter 1). For instance, some documents contain conflicting semantic propositions, for example, "the military intervention was legal " versus "the military intervention was not legal." Conflicting propositions can hardly participate in a single coherent representation of a situation. Assuming that the reader will update the representation by replacing prior knowledge with new information would not work either because there is no way to decide a priori if the information found in the latter source is any more valid than information found in the previous one(s). Thus, specific integration mechanisms must be involved when comprehending multiple documents.

3.2.2. The Components of Multiple Document Representations

When reading a set of multiple documents, competent readers encode both source and content information from each document. Thus, a description of the mental representation of any single document must include a "source" component and a "content" component. Both components take the form of conceptual networks that integrate prior knowledge and knowledge newly acquired from the document. Source and content components are connected through source–content links, for example, "*according to* source S, event E occurred." Multiple sources are connected through higher level connections that integrate the sources into a coherent "source model." Figure 3.3 summarizes the main components of such a representation.

Two documents (A and B) are represented to the left of Fig. 3.3. Each document gives birth to two representation components or "nodes": a *source node* (rs) and a *content node* (rc). The source node includes any information available about the source, as well as any information that may be added based on the reader's prior knowledge of the source. The content node is a representation of the situation as it can be drawn from the document, that is, a situation model (see chapter 1). The nodes are connected through source–content links (S-C), for example, *attribution*. Furthermore, sources A and B are also connected through source-to-source links (S–S). For instance, source A may cite source B (reference), or the reader

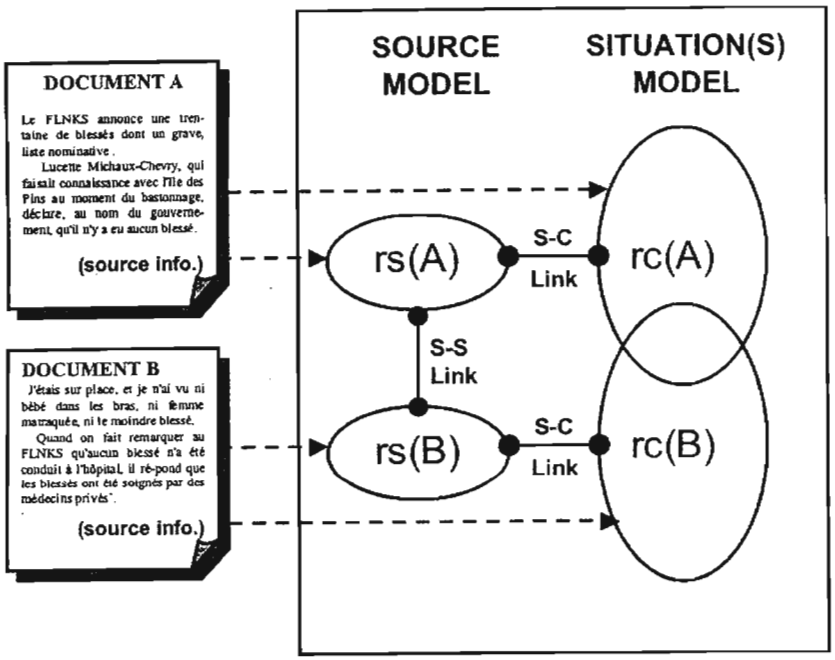

FIG. 3.3. Elements of a mental model constructed from multiple documents. rs(A) = representation of source A; rc(a) = representation of content found in document A.

may find that they corroborate each other. Conversely, the two sources may oppose or contradict each other to some extent.

The Semantics of Source Representations. What kind of information is included in a source node? This question is complex and largely open. Common sense would predict that the author's identity (name, credentials) is likely to be encoded, provided that it is mentioned in the document. Other important information such as the type of document, date of publication, language, and length are also likely to be identified as characteristics of a source. Chances are that the amount and type of information identified and stored from a document will vary as a function of the reader's expertise and the situational constraints. Perfetti et al. (1999) proposed that an expert source representation includes information about the author, setting, and form of the document. Author identification variables include the name of the author (whether an individual or an organization), his or her credentials (e.g., status, experience, reputation), and means as regards access to the information reported (e.g., witness, participant, student-of, individual, or teamwork). Information about the author also includes his or her motivations in conveying the content (e.g., career, profit, posterity), intended audience (students, colleagues, customers), and communication purposes (e.g., to inform, persuade, sell).

Information about a source is not bound to knowing the author. Source information also includes the setting or context of production (i.e., place in which the document is created, date and historic period, economic, political, or cultural context). In addition, document form variables characterize the type (e.g., treaty, letter, textbook, magazine, essay, and so forth) and the language style (e.g., legal, diplomatic, conversational) of the document. Source information might even include some content information, for example, the topic or main point in the source. This information is merely a summary or rough description of what the document is about. It pertains both to a description of the document and to the situation model that can be drawn from it.

It should be noted that source characteristics may be explicit in a document, or they may have to be inferred by the reader. For example, the rhetorical goals are not always explicitly stated, or explicit statements about them may not be complete or accurate. The actual goals have to be inferred by the reader based on prior knowledge. Wineburg (1994) refers to these goals as a *document's subtext*. Whether a slot in the source node will be filled in or not depends on a number of factors, among which are the availability of the information at the time of reading, document specificity, task requirement, and the reader's expertise. For instance, a novice history student with little prior experience of document-based learning may only be able to identify and memorize salient attributes (e.g., author name, text type), or familiar values of these attributes (e.g., document type is a textbook). A more knowledgeable reader will be able to add more subtle attributes, for example, the author's reputation, experience in the topic, the document's publication date or intended audience. Moreover, it is likely that various "source models" are available to expert readers, in the form of preexisting schemata or memory packages. An experienced historian may possess a schema for a "press release," "private correspondence," "official document," "research report," or "novel."

Finally, the expert representation of a source node may vary from one knowledge/discourse domain to another. The source characteristics studied by Perfetti et al. (1999) pertain to reading history documents. In other areas (e.g., science, literature, business, engineering), however, other source features may have a more prominent role. In computer science, for instance, the version of a document describing a project or software component is often a critical parameter (see Rouet et al., 1995). In literature, the status of agents (e.g., says, like, wants, knows) with respect to the actions or speech acts stated in the story can also be encoded (Graesser et al., 1999). The framework does not make any systematic prediction as regards the centrality or importance of these parameters. The hypothesis is merely that sources are represented as a structured set of parameters that are used by the reader when reading and evaluating content information.

The Role of Source Information in Document Comprehension. When reading multiple documents about a situation, the reader may come across different accounts of the same event. The accounts may agree on many aspects of the situation, but they may also differ on other aspects. This is because the authors want to emphasize different aspects of the situation or because they disagree about the facts, their respective importance, and/or the causal relationships among them.

Consider again the two newspaper accounts presented in Table 1.2 (chapter 1). The two excerpts describe the same controversial protest, but with quite different viewpoints. Furthermore, each of them uses a distinct set of sources. The first report mentions three sources (i.e., the protesters, city physician, and government spokesperson), two of which support the view that there were at least some people injured during the protest. The third source (spokesperson) is dismissed because she did not witness the events, and because she speaks on behalf of the government, who is interested in minimizing the degree of police brutality. On the other hand, the author of the second report introduces himself as a firsthand witness and claims that no one was injured during the protest. Furthermore, the second excerpt tends to dismiss the protesters' party because they only offer unverifiable evidence (i.e., that all the wounded were helped "by private physicians," the latter expression between quotation marks in the original).

In these two excerpts, the sources play an important role in understanding the events. In fact, there are almost as many sources as there are facts being reported. A full interpretation of those texts can only be achieved if one understands why the different sources would give different versions of the story. The FLNKS, a party in favor of independence, is interested in emphasizing that the ruling government has a brutal attitude against the local people. The government's spokesperson is interested in emphasizing the opposite. And L'Humanité, a newspaper opposing the government at the time, is interested in criticizing the government policies. On the other hand, Le Figaro and their reporter, who support the governing political party at the time, are interested in showing that the protest did not turn violent.

Knowing the identity and motives of the sources helps a lot to understand the content of these two accounts. The benefit is even greater if one considers that information about the sources allows one to reconcile the two versions. If no such information were available, the reader would be left with two discrepant accounts of the same event: There is no way to believe at the same time that people were wounded and that nobody was wounded. With the help of sources and source information, the reader can encapsulate each version into an independent mental space: that of the reporter telling each story. When later telling about these events in an essay or in a conversation with friends, the reader will be able to use source-to-content predicates such as "*according to* L'Humanité, there were several people wounded" or "Le Figaro *claims that* no one was wounded."

Text variables affect the way source information is stored in memory. Graesser et al. (1999) examined readers' ability to remember the source of statements after reading literary stories. They assumed that there would be differences in the salience of agents (including the narrator and story characters) as a function of whether they are introduced explicitly or not. They proposed that stories written in the first person would increase the salience of the narrator (in this case also a character) in memory. The first-person narrator would also be more salient than other, nonnarrator characters. In the first experiment, 120 undergraduate students read one of 10 short stories (9–18 pages long), five of which were in the third person (i.e., "invisible narrator") and five in the first person (i.e., amalgamated narrator and character). Each story contained two prominent characters. Immediately after reading, the participants were presented with 36 statements taken from or derived from the stories. Nine statements were spoken by the narrator, nine were spoken by each character, and nine were foils obtained by modifying the meaning of a text statement. The participants were asked to identify the source of each statement. Four answers were proposed: narrator, character A, character B, or neither. For stories in the first person, mean proportion of correct answers were higher for the narrator (71%) than for other prominent characters (61%). For stories in the third person, answers were less accurate for narrator statements (53%) than for prominent characters (64%).

Graesser et al. (1999) also analyzed the linguistic features that signal who the speaker is, in case of nonnarrator character's utterances. Five cases were identified: (a) the speaker is explicitly mentioned, for example, "Vicky said, 'Jim is now a baker'"; (b) the speaker is mentioned through a direct reference ("Vicky") or through a pronoun ("she"); (c) speaker is mentioned in the same versus in a different sentence; (d) the speech act is a direct quote versus an indirect form (e.g., "Vicky said that Jim is now a baker"); (e) speaker is identified before or after the speech act (e.g., "'Jim is now a baker,' said Vicky"). None of these linguistic surface features was found to have an impact on source recognition.

In the second experiment, Graesser et al. (1999) studied the effect of retention delay on source memory. The underlying hypothesis was that source retrieval from memory could rely on the use of literal memory for discourse. They also tested whether sources for story statements could be guessed based on reading an abstract of the story. One hundred twenty-eight participants read one of four first-person stories in one of four conditions: full story–immediate test, full story–delayed test, abstract–immediate test, and abstract–delayed test. Reading the abstract did not allow the participants to make accurate source attributions. This ruled out the possibility that source memory could be based on sophisticated guessing or reconstructive inferencing. Source memory was overall less accurate after a 1-week interval. The decay rate, however, was more steep for nonnarrator characters (72% and 50% at immediate and delayed tests, respectively) than for the first-person narrator (85%

vs. 72%, respectively). According to the authors, this result demonstrates that first-person narrators are a salient source of information that is slow to decay in memory.

Thus, when reading literary stories, readers construct agents at various levels. One level is the story line, with characters as agents; another level is the discourse, or pragmatic level, with the narrator, narratee, author, and reader as agents. Graesser et al. suggest that the ability to identify and keep track of these agents may vary as a function of the reader's training or level of instruction. For instance, students in literature would be more apt to pay attention to the narrator or author as an agent; or readers who have more knowledge of the world depicted in the story may be more able to examine critically the facts and claims stated in the story.

The findings by Graesser et al. (1999) suggest that a complete model of document comprehension should include source parameters as an integral part of readers' memory representation. Such a model of document comprehension helps reinterpret the results from past research on the updating of text-based mental models. In their experiments (already discussed in chapter 1), both Johnson and Seifert (1994), and van Oostendorp and Bonebakker (1999) used lists of messages, not texts, as materials representing evolving situations. Had the messages been presented as connected texts, the information would have simply been inconsistent. In addition, the researchers suggested implicitly that several sources were telling the same story by arranging the messages chronologically and by using fuzzy source references such as "the police report." Even though there is no direct evidence for this, it is tempting to suggest that with no further information about who says what, the reader is left with some confusion as regards which account they should trust or remember. Hence the high rate of answers based on the initial information generally observed. It would be interesting to check whether updating mental models is made easier when one uses a clearer marking of source differences across "messages."

Establishing Connections Across Sources. How are multiple sources connected to each other? The schematic representation in Fig. 3.3 assumes that the reader builds up links that convey any relationship between sources. These links may be very general (e.g. "talk about the same thing"), or more specific. Table 3.1 presents a few examples of "predicates" that convey source-to-source relations in the context of the Panama Canal story previously outlined.

Each example is taken from a text passage. In the first example, the passage is a presidential address in which the president (source A) cites a treaty (source B) to justify a military intervention. In this example, the source-to-source connection originates from one of the documents. It serves the purpose of supporting the claim made in this document. In the next example, the passage is an essay written by a student after reading a set of documents. The student cites two sources (president, historian Norman) and mentions that these sources agree as to the legality of the intervention. In this case, the connection did not originate explicitly from one of

TABLE 3.1
Examples of Source-to-Source Connections in the Context of Historical Problem Solving

Example	*Sources connected*	*Origin of connection*	*Type of connection*
(excerpt from Presidential address) "According to the treaty, the intervention was absolutely legal."	A. President B. Treaty	Source A	Reference (rhetorical support)
(excerpt from student essay) "The President at the time and historian Norman agree on the legality of the intervention."	A. President B. Historian Norman	reader (student)	Corroboration, agreement
(excerpt from student essay) "The senator challenges the president's claim that the intervention was justified."	A. Senator B. President	reader (student)	Opposition, conflict

the documents. It was built up (inferred) by the student after reading the documents. Finally, the third example shows a similar case, but with a different type of connection. The student acknowledges a discrepancy between the information acquired from two sources (i.e., senator, president).

There is currently no full grammar to describe the many connections that can be established between two documents or more. Scientific reports, press releases, and literary essays (to cite only a few genres) contain a very large variety of intertextual connections. Some of them are unidirectional (e.g., source A cites source B, but source B does not cite source A); others are symmetrical (e.g., source A and source B both corroborate each other). Furthermore, some source-to-source connections may have a complex structure. For instance, the "rhetorical support" connection may take different forms: community of opinions, reference to authority, or new facts provided by an external source that feed one's reasoning. Rhetorical support can also vary in intensity (e.g., partly vs. fully agree) and scope (e.g., citing an external source globally or only parts of it).

The type of links that typically connect sources may also vary across knowledge domains. In the case of historical controversies, the dimension of "solidarity versus opposition" often dominates. Common types of links include "agree/disagree," "support/oppose," "provide evidence for/against," and so forth. These links are not unique to historical discourse, though. They also appear in elaborate scientific discourse and virtually any form of argumentative discourse. There are probably many more types of intersource relationships that play a role in more specific areas of knowledge or intellectual activity. For instance, verbal protocols from computer scientists using a library of software components bear the trace of elaborate discourse models, in which parameters such as the date, author, and production context are used to compare

the relevance of various objects (Rouet et al., 1995). More generally, intertextual connections can refer to any incremental relationship ("based on ..."), temporal or genetic ("after the work by ..."), intellectual or aesthetic ("in the spirit of ...," "in the style of"), or even unspecified relationships ("relevant for ...").

In scientific discourse, bibliographic citations are the most common expression of intertextual relationships. The expert reader will often want to check the bibliographic references found in a paper in order to assist his or her interpretation of the situation described in the paper. Document types play a major role in this process. Depending on the domain, peer-reviewed journals, edited books, conference proceedings, monographs, or unpublished reports are associated with various levels of credibility. Bibliographic references allow the reader to represent both the situation model and the source model proposed by the author of a paper. When bibliographic references are missing, the reader must infer the influences or sources used by the author (see parameter "access" already mentioned) based on his or her own knowledge of the domain. Scholarly works often include a large number and variety of references. Other types of works (e.g., inexpert students' essays) often lack references, cite inappropriate references, or make inappropriate use of references. Examples of inappropriate citing strategies are citing a very large number of references to support a mundane assertion, or making a highly specific claim without providing any bibliographic support. Another inappropriate strategy consists in not citing any source at all, which amounts to overemphasizing the author's own contribution to the idea presented in his or her text (plagiarism). In any case, the pervasive use of bibliographic references in scholarly texts further demonstrates that forming multiple document representation is an intrinsic part of elaborate discourse.

3.3 CONDITIONS ON LEARNING FROM MULTIPLE DOCUMENTS

So far I have discussed the construction of multiple document representations in fairly general terms. An implicit assumption was that the reader has enough knowledge and skills to perform the required operations. This is not to say, however, that complete and coherent document models are constructed any time a reader comes across various accounts of the same story. Constructing document models is an expert activity that can be achieved only under certain conditions. In this section, I summarize the available evidence about the nature of these conditions and the effects of studying multiple sources on student's ability to reason about complex events.

3.3.1. Novice Versus Expert Comprehension of Multiple Documents

Two general assumptions underlying the multiple document comprehension theory just presented are that (a) mature readers can, to some extent, read and understand events presented in the form of multiple sources, and (b) that expertise in a content area greatly facilitates the comprehension of and reasoning from multiple documents.

There is mixed evidence about younger readers' ability to integrate materials that present different points of view. Stein and Miller (1993) found evidence that children as young as 7 can participate in an argumentative dialogue, provided that the topic refers to personal values. Golder and Coirier (1994), on the other hand, showed that some 12- to 14-year-olds have trouble using counterarguments, which are typical of controversy accounts.

There have been few studies examining directly teenage students' ability to understand multiple documents. Golder and Rouet (2000) conducted an experiment in order to find out whether 6th- and 8th-grade students understand texts presenting conflicting accounts of a controversial event. They hypothesized that a text organized by arguments (i.e., comparing directly the two versions of the same event) would be easier to understand for 8th-graders because the argument structure would be apparent. They used a text describing a fictitious protest, based on several newspaper accounts like those presented in Table 1.2. The text described five episodes of the story: The reason for the protest, the number of protesters, their attitude, the attitude of the police, and the number of people wounded. For each episode, two different sides or interpretations were provided: the "government's side" versus the "protest organizers' side." Moreover, Golder and Rouet wrote two versions of the text. In the *source version*, the two interpretations were given separately, as two subsequent paragraphs (e.g., the protesters' version followed by the government's version). In the *argument version*, the two interpretations were given for each episode, for example, "According to the government, there were only a few superficial wounds. However, the organizers claimed that many people were seriously injured."

The participants were 63 6th-grade students and 52 8th-grade students from a semi-urban middle school. They participated collectively as part of a regular language class. In the first session, the students read silently one of the four versions of the text. Then, they answered two comparative questions (e.g., "According to the text, what can be said about the number of wounded?") and one integrative question (e.g., "According to the participants, what happened during the protest?"). One week later, the students answered the same questions again. The order of sources within a text and the content of the questions were counterbalanced.

The results indicated that the text was rather difficult to understand, especially for 6th-graders. Students' answers to the comparative questions ranged from one argument (e.g., "that is too much (wounded people). The police are too violent.") to a complete counterargumentative structure (e.g., "the government says there were only a few people slightly wounded, but the protesters say there were many wounded, many of which badly.") with all the intermediate levels represented (see Table 3.2).

TABLE 3.2

Examples of Answers to Comparative Questions by 6th and 8th Graders in the Golder and Rouet (2000) Study. The Participants' Answers Are Adapted From French

Answer categories and examples	*6th Grade (%)*	*8th Grade (%)*
Complete structure	16.7	56.7
"Government says there were only a dozen of slightly wounded, however the protesters claim that there were many wounded among which many seriously [sic]."		
One argument only	33.3	8.7
"It is too much. The police are too aggressive."		
Partial structure	17.5	23.1
One source, one argument		
"The number would be of only a few people slightly wounded, a young woman said it."		
Only sources		
"We do not know because the protester say a figure and the police say another."		
One source, two arguments		
"The government is lying because there were many wounded."		
No answer	32.5	11.5

Only 17% of the 6th-graders were able to provide complete argument structure in response to comparative questions. The percentage rose to 57% at the 8th grade. One in four 8th-graders provided incomplete source–content structures, with either one source and one argument, only two sources, or two sources and one argument. Most 6th-graders either did not answer (33%) or only mentioned a single argument (33%). Scores on the integrative question also rose sharply from 6th to 8th grade, with an average of four out of five topics recalled by 8th-graders at the immediate test (versus an average of two out of five at the 6th grade). Furthermore, a qualitative analysis showed that many answers to integrative questions included intrusions from the other side, as if the students did not keep track of the source-to-content connections. Thus, keeping precise track of what the two sides said about each episode proved a daunting task for 11- to 12-year-old students. It might be, however, that the students did not feel particularly motivated in studying this type of event, which involved characters and motivations that

do not belong to their everyday environment (see e.g., Stein & Miller, 1993). Whether or not they would better recall two-side stories dealing with more familiar topics remains to be found.

How about older students? Can they learn about a complex issue by studying from multiple documents? And to what extent do they appreciate differences across sources in terms of usefulness and trustworthiness, with respect to the issue at stake? Rouet, Britt, Mason, and Perfetti (1996) conducted a study in order to examine these questions in the context of history learning. More specifically, they wanted to determine whether letting students read primary documents (e.g., treaties, correspondence) would influence their representation of complex historical stories. Rouet et al. used four controversies related to the history of the Panama Canal (e.g., "Was the U.S. military intervention in the 1903 Panamanian revolution justified?"). For each controversy, they prepared a chronological list of the main facts, and a "study set" made of seven documents:

- *Two historian essays*. These accounts were written by historians or politicians commenting on, but not participating in the events. Historian essays argued opposing interpretations of the controversy, citing other documents as support (see Fig. 3.2).
- *Two participant accounts*. These were accounts written by characters directly involved in the events, and arguing opposite positions on the controversy.
- *Two primary documents*. Primary documents were defined using three criteria: First, primary documents were written before or during the events (e.g., the 1846 treaty between the United States and Colombia). Second, they did not contain arguments nor did they take a position regarding the controversy. Third, primary documents were explicitly cited in the historians' essays and in some of the participant accounts to support their arguments.
- *One textbook-like excerpt*. The textbook-like excerpt was written by the experimenters, but it was introduced as an excerpt from a college-level textbook. The textbook-like excerpt gave a factual description of the major events. It did not contain any argument pertaining to the controversy.

In order to assess the influence of primary documents on students' reasoning, Rouet et al. also selected two additional historians' essays to replace the primary documents in the control condition. The additional essays were selected according to the guidelines previously described for the historian essays. One essay argued for one side of the controversy and the other argued for the opposing side.

The subjects were 24 college students with varying experience in history. However, none of the students was a history major. In the first session, students were tested for their history and geography knowledge

and then given a background text. Subject assignment to the primary group or to the secondary group was balanced for gender, history knowledge, and reading ability. In the second session, the students were asked to study each controversy for about 20 minutes. Half the participants received a study set containing the primary documents ("primary group"), and the other half received a study set containing the additional secondary documents ("secondary group"). At the end of the study period, the students were asked to write a one-page essay expressing their opinion about the controversy and to evaluate the documents' usefulness and trustworthiness.

The ranking and justification results showed that students were aware of the properties of different document types. In the secondary condition, students trusted the textbook most. However, when given relevant primary documents, the students trusted those documents as much as the textbook. Furthermore, the students' justifications of their trustworthiness rankings varied across groups and document types. Content characteristics were critical for evaluating textbooks and historian essays, whereas source characteristics (document type, author) were critical for primary documents and participant accounts.

Rouet et al. also counted the number of explicit references to the sources in students' essays. The data showed that source information was selectively used to recall the story (Fig. 3.4).

Figure 3.4. shows the frequency of mention of each type of source. For most types of documents, there was less than one reference per essay on average. For the primary documents, however, the citation rate was

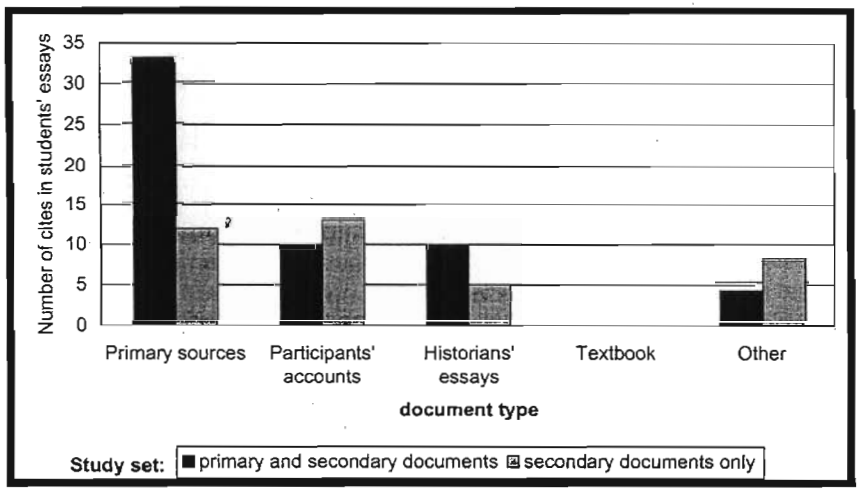

FIG. 3.4. Number of references to documents by type of document, collapsed across problems (adapted from Rouet, Britt, Mason, & Perfetti, 1996).

much higher, especially in the group that actually got a chance to study those documents. As a result, two thirds of the essays written by primary-group students included at least one reference, compared to only 39% in the secondary group.

Rouet et al. (1996) concluded that inexperienced students' were able, to some extent, to reason about various types of historical documents. More specifically, they concluded that readers of multiple documents use information at two levels, the discourse level and the content level. At the *discourse level*, students recognize the document as belonging to a certain discourse category (e.g., textbooks). They also notice some features of the source. At the *content level*, students identify the facts and events stated in the document, as well as the claim or position stated, if any. These features are used to determine the document's usefulness (e.g., whether the document contains information relevant to the issue) and the document's trustworthiness (i.e., whether it contains a biased position, a partial selection of evidence, or even a misrepresentation of the story).

Does discipline expertise increase students' ability to learn from multiple sources? Academic training allows students to build up expertise in specialized content area knowledge. An interesting question is whether training in a discipline also develops students' awareness of document properties, and their document comprehension strategies. This question is a rather difficult one because document comprehension skill is not easily separated from domain knowledge. Rouet, Favart, Britt, and Perfetti (1997) attempted to circumvent this problem by comparing students of comparable academic level—two groups of graduate students—who differed primarily in their area of specialization. They recruited 11 psychology graduates and 8 history graduates from a French university. The students were asked to study two of the Panama controversies, presented as sets of primary and secondary documents in a way similar to that of Rouet et al. (1996). After studying the documents, the participants were asked to evaluate the usefulness and trustworthiness of each document on a seven-point scale, and to write a short statement justifying their evaluation.

Both the history and psychology students found primary documents most useful. Contrary to the psychology students, the history students also found participants' accounts useful. Conversely, the psychology students, but not the history students, rated the textbook as useful. History and psychology students tended to use different criteria to justify their evaluations. The psychology students mostly justified their rankings using the document content as a criterion, for example, "(the document) presents the agreement with Colombia and the reasons for intervention" (60% on average). In contrast, the history specialists used a roughly equal proportion of content, source, and task justifications. Source justifications were based on at least one parameter of the document source (e.g., "The author is a senator opposed to Roosevelt."). Task justifications mentioned or alluded to the problem statement (e.g., "This is a key document of the controversy."). Furthermore, the justifications

used by the specialists varied across documents. They used both content and task for the textbook and historians' essays, and mainly source for the participants' accounts.

As regards the essays written by the two groups of students, several interesting differences appeared. Seventy-three percent of the essays written by psychology students included straightforward claims (e.g., "I believe that the intervention was/was not justified"), compared to 31% in the historians' essays. History students tended to make restricted claims or no claim at all. Furthermore, the specialists tended to make more extensive use of contextual information and firsthand accounts. In a reanalysis of some of these essays collected as part of this study, Rouet, Favart, Gaonac'h, and Lacroix (1996) categorized the students' statements in four broad categories:

- *First hand information:* Statements based on official documents (e.g., citing or paraphrasing a Treaty provision).
- *Secondhand information:* Statements based on participants' accounts or historians' essays. Most often the students would endorse the interpretations proposed in the documents.
- *Subject's opinion:* Any statement expressing the subject's personal view on the issue (e.g., "I think that the Hay-Buneau-Varilla Treaty was a bad deal for Panama.").
- *Other sources.* Statements that referred to external sources of information such as general historical context ("Obviously the US wouldn't have intervened militarily without an interest at stake.").

A frequency analysis of the pool of idea units found in the essays showed that novice and specialist students made different uses of information sources. About 75% of the statements made by the psychology graduates were drawn from secondhand accounts or from their own opinion. In contrast, history graduates used official documents or contextual information in 55.4% of their statements. In other terms, they tended to build up their own arguments based on primary evidence and contextual knowledge, rather than adopting or challenging other writers' opinions. To further illustrate this contrast, consider the two texts presented in Table 3.3.

The texts in Table 3.3 are excerpts from essays written by two graduate students: a psychology student (excerpt 1) and a history student (excerpt 2). In order to emphasize the differences between these texts, I have underlined references to documents (single line) and to the main story characters (double line). Essay 1 contains many references to the participants (the United States, Columbia, and Panama) and related concepts (Isthmus of Panama, Colombian territory). It starts with a comment on the treaty, and then provides an interpretation of U.S. motives and actions. The facts are evaluated against the writer's own opinion (e.g., "The Colombian army did not threaten free transit.").

TABLE 3.3

Excerpts From Two Opinion Essays About the November 1903 U.S. Military Intervention in Panama. (Adapted from French)

Excerpt 1. (French psychology graduate student)

It seems that most of the controversy rests on an ambiguity in the Bidlack (1846) Treaty. Article 35 grants the *U.S.* the mission to protect free access to the *Isthmus of Panama* as well as the sovereignty of *Columbia* on the *Isthmus*. The *U.S.* took advantage of the ambiguity to prevent the *Colombian army* from intervening. One must bear in mind that at the time, *Panama* was a *Colombian province*. Thus, this was *Colombia's* internal affairs. It was, however, the *U.S.*'s interests to favor the revolution (...). The *Colombian army* did not threaten free transit on the *Isthmus*, since it was headed toward *Panama City* (...).

Excerpt 2. (French history graduate student)

The *U.S.* intervention in *Panama* gave birth to two radically opposed theses: One defending the intervention, the other one not supporting it. (...) However the arguments proposed in each thesis do not "weight" the same. The U.S. President as well as historian Wilson seem to consider [past events] as a unique criterion. (...) Whereas the thesis which does not defend the *U.S.* intervention is supported by arguments selected in the very text that rules the relations between *Colombia* and the *U.S.*: the 1846 Treaty. It is on the basis of a text of international law that they argue; and they consider that there was a violation of the Treaty.

Note. Underlining signals references to documents; italics signals references to story characters.

The second excerpt starts with a presentation of the global structure of the controversy, that is, two interpretations of the events opposed to each other and supported by various kinds of evidence. No attempt is made to provide a single, author-based story or interpretation. Instead, there are many references to the sources (e.g., "the thesis," "President Roosevelt," "Wilson"), and a clear effort to present the contribution of each one. This essay fits the description of a documents representation presented in Fig. 3.3.

These data suggest that extensive training in history allows students to develop more complete source representations. This is apparent in their use of multiple criteria when evaluating the documents' usefulness. History specialists' greater document expertise is also shown in their ability to reuse primary sources directly, whereas novice students, despite being at the same level of academic training, tend to rely on ready-made interpretations. More generally, the comparison of novice and expert students suggests that studying multiple documents can result in various types of representations, which vary in the extent to which connections between content and sources of information are established.

The data summarized here suggest that discipline experts are also more likely to identify source information, to develop connections be-

tween situations and text sources, and to construct a more interconnected document representation. A study by Strømsø and Bråten (2002) found similar results in a different domain. They examined the type of elaboration and connections made by law students as they read lengthy texts for the purpose of preparing for class or the final exam. Seven students participated in three meetings at a 1-month interval. At each meeting, the students were asked to bring a text that they had planned to study, along with any supporting literature. During the first meeting, they were trained to think aloud while reading, and they were recorded as they read while thinking aloud in a 20–30-minute period. They were allowed to take notes, to consult notes taken previously, and to consult additional materials. In the second and third sessions, the students repeated the same procedure with new materials (sometimes taken from the same source, e.g., their textbook). Strømsø and Bråten established a typology of the associations or "links" made by students while reading (Table 3.4.).

Primary endogenous links involve sources located in the sentence, passage, or section of a book currently being studied. Secondary endogenous links involve sources located in other sections or in documents directly supporting the text being read. Exogenous links involve sources located in other texts or documents, as well as sources pertaining to the reader's prior experience.

TABLE 3.4
Typology of Links to Sources Made by Law Students as They Are Reading

Type of link	*Definition, examples*
Primary endogenous	Source located in current sentence, passage, or section
Secondary endogenous	Source located in other section of current text
	Source located in main supporting literature (i.e., code of laws) mentioned in the text
	Source located in other supporting literature (e.g., case descriptions) mentioned in the text
Exogenous	Source located in other, unmentioned supporting literature (e.g., lecture notes, other books of interest)
	Source related to other student's activities, lectures, or prior experience

Note. Based on Strømsø & Bråten (2002).

Content analysis of verbal protocols showed that most of the links expressed by students were of the "primary endogenous" type (62%). The percentage of exogenous links, however, increased from one session to another, to reach 32% on average during session 3. Concretely, the students made more references to their own notes and previous readings. They sometimes completed or modified their notes during these episodes. The shift in the type of sources mentioned by students was attributed to their getting prepared to take the final exam, which required them to review and integrate knowledge acquired during the term. Interestingly, the authors observed a relationship between students' success at the final exam and the frequency of their exogenous comments during the last reading session. Despite the small number of students involved in the study, the data support the view that, in naturalistic reading contexts, students normally establish connections between what they are studying and various other sources of information from the same text, different texts, or their own experience. These data corroborate the findings by Rouet et al. (1997) that students specializing in history tended to connect the materials currently read to other related materials or background information.

In conclusion, discipline experts are more likely to develop a detailed document model from a collection of texts in their area of expertise. This is, of course, largely due to their greater knowledge of the content area (Afflerbach, 1990; Perfetti, Britt, & Georgi, 1995). But the research summarized here suggests that discipline experts' better performance in document-based tasks also comes from their knowledge of the properties of different document types. Each new reading episode involving a document that pertains to a recognizable category activates generic knowledge of the document properties and conditions of use. This knowledge is used to evaluate and select relevant information from the document for further processing.

3.3.2. Benefits of Learning from Multiple Documents

Does studying multiple sources affect students' knowledge in the long run? Evidence from previous research supports the view that exposing students to multiple documents changes their perception and reasoning about a situation. Perfetti et al. (1995) studied a small group of college students over an 8-week period as they sequentially read lengthy excerpts from scholarly and popular books describing the U.S. negotiations to build the Panama Canal. Each week, the students read an average of 30 pages about the Panama Canal and then produced written summaries and answered knowledge and reasoning questions about the materials. Perfetti et al.'s analysis of students' responses revealed two interesting findings. First, students initially learned the basic narrative. They identified the main characters and major events, but little else. After reading subsequent texts covering the same subject, they learned other, less central, events and details. Second, as students acquired more events and de-

tails, they engaged in more complex reasoning. They began to give more supporting reasons for their claims, more qualifiers, and they used longer causal chains. It is possible that the increased quality in students' reasoning was due to students' acquisition of new domain-specific knowledge as well as to their exposure to multiple documents.

Does learning from multiple documents encourage students to think in the way experts do? Wiley and Voss (1997) proposed a distinction between document learning and document understanding. Document learning would require the identification and memorization of information, whereas document understanding would require the students to produce their own reasoning based on the available information. Wiley and Voss hypothesized that presenting information in the form of multiple, clearly separated and identified sources would foster students' understanding, compared to a more traditional single-text presentation. They asked 60 undergraduate students to study the 19th-century Irish potato famine either from a list of sources (e.g., legal documents, map, demographic data) or from the same information presented in a textbook-like single-text format. Moreover, they gave the students three types of study directions: One third of the students were asked to write a historical account, one third wrote an argument, and the last third wrote a narrative. Memory for text was assessed through a recall task, and understanding was assessed by analyzing the content of students' essays.

The students in the "source–argument" condition wrote more critical essays than students in the other conditions. Moreover, the students in the source condition included more transformed information (compared to borrowed and added information; see Scardamalia & Bereiter, 1987) than students in the textbook condition. The argument condition increased their use of causal connectives. Finally, recall was higher in the "source–argument" and "textbook–narrative" than in the other conditions. Wiley and Voss concluded that both the use of multiple sources and the argument production task promote deeper understanding of the events.

In another study, Wiley and Voss (1999) also tested the prediction that an argument production task would promote students' deep comprehension of a historical event. In the first experiment, 64 students read a series of documents about the potato famine. The data were presented either in the form of a single (long) text, or in the form of multiple sources presented through the Web. Four tasks were compared: write a narrative, an argument, a summary, or an explanation about the famine. Students were given 30 minutes to study the information and write up their essays. Then they had to perform a paraphrase recognition task, an inference judgment task, and an analogy task. Again, the argument writing task and the online source presentation format increased the rate of transformed information. Moreover, participants in the "argument–sources" condition made more accurate inference and analogy judgments. Thus, the increase of transformed information seemed the result of a deeper comprehension.

Are younger readers sensitive to voice and authorship when they study textual materials? A study by Paxton (1997) suggests that they are. Paxton asked six secondary school students to read two texts about ancient Egypt while thinking aloud. Then the participants answered questionnaires and participated in a retrospective interview. One of the texts was taken from a textbook chapter, whereas the other was more "visible": the author used first-person narrative, expressed commitment, used modal expressions, and so forth. Paxton observed that readers of the visible version were more engaged in their activity, and that reading seemed to promote a deeper level of reasoning. Beck, McKeown, Sandora, Kucan, and Worthy's (1996) Questioning the Author method also improved 4th-graders' comprehension of expository texts. The method encouraged children to visually represent the author and to question his or her purposes, motives, and methods. In other words, the author was made more "visible" to the reader, which may have stimulated interest and engagement in the comprehension activity.

It seems that, at the level of high school, students get a sense of "epistemic authority" and use it when evaluating document information (Otero & Campanario, 1990). García-Arista et al. (1996) examined the effects of study settings on high school students' comprehension monitoring. Study setting was defined as a combination of the class context in which reading took place (language or science class), and as the source attribution of the texts to be comprehended (newspaper or science textbook, respectively). In experiment 1, 76 10th-grade students (16 years old) were assigned to one of two settings: language class/newspaper article, or science class/science textbook. The students were asked to read a series of six short passages about unfamiliar science topics (e.g., superconductivity). Four of the six passages contained an obvious contradiction between two sentences (e.g., "Superconductivity has only been obtained by cooling (sentence 2) / increasing the temperature of (last sentence) certain materials"). The students were asked to read with an explicit purpose of evaluating comprehensibility and underlining conflictive sentences, if any. More contradictions were detected in the science than in the language study setting. The students were able to explain the contradiction in about half of the cases when detection was successful. In the second experiment, the same pattern was found with a larger sample and a reduced set of texts. García-Arista et al. concluded that high school students make use of the study context to set up standards and comprehension strategies for themselves. Contrary to what was expected, students were more likely to detect inconsistencies in the science class/science textbook setting. This was not expected because the science textbook is supposed to be more "authoritative" than newspapers. The authors suggested that students tend to increase their standards of coherence and comprehensibility when reading texts with a high perceived epistemic authority. Because of the confound between the source and setting manipulation, however, it is hard to know which of the two dimensions was the most influential.

In sum, the evidence so far suggests that multiple documents and/or authentic settings with visible authors seems to foster deep comprehension in students. There are, however, some limits to the process, at least with inexperienced students. For instance, if the task specifically asks the students to integrate information across two texts, then too much heterogeneity might hinder their ability to do so. Nash, Schumacher, and Carlson (1993) demonstrated the influence of linguistic characteristics of source materials on subjects' written essays. Eighty-four undergraduate students were asked to study two texts describing Native American tribes in order to write an essay comparing the two tribes. The source texts had either the same or different overall structures (one was organized by topic, the second one chronologically). The participants were influenced by the structure of the first passage they read. Moreover, subjects' essays were better organized when text structure was identical across sources than when the organization was different, even though they may be of a lesser linguistic quality. This finding can be related to the results of a study by Kieras (1980), where the initial sentence of a passage influenced subjects' representation of the whole passage (see chapter 2). Stahl, Hynd, Britton, McNish, & Bosquet (1996) also found that reading two documents about the Tonkin Gulf incident did improve high school students' mental representation of the story. Studying additional materials, however, did not cause any further improvement. The analysis of students' notes and essays showed that studying multiple documents did not make students depart from basic, copy-paste strategies. The authors suggested that high school students need explicit study directions in order to take advantage of reading multiple documents.

Mannes (1994) discussed the benefits of reading an outline and a main text with different perspectives. She pointed out the need for a reasonable compromise between the complexity of the materials and students' processing capacities. She noted that "(...) increasing comprehension difficulty (within the range of the targeted learners' abilities) by presentation of multiple perspectives, may be effective in producing a richer domain model and, consequently, a deeper level of understanding than is obtained with traditional advance organizers." However, she also warned that "(...) care must be taken to ensure that the perspectives presented are not so disparate as to preclude the identification of any relationships by the readers, nor so similar that the perspectives entail the same sets of relations" (p. 586).

Bearing these limitations in mind, the results of Wiley and Voss' (1997, 1999) studies are consistent with the expert comprehension framework presented earlier in this chapter. When reading from multiple sources, learners have to distribute their attention between the two major components of the document space, the source model and the situations model. The multiple documents space allows a source model to be constructed; and the argumentative task encourages the development of an integrated documents model—one in which the source and the situations components are interconnected, at least during the writing task. In contrast, narrative writing appears to encourage the construction of a single situation model.

In conclusion, there are apparent benefits in the use of multiple documents as part of high school or college teaching. But using multiple documents alone does not ensure that inexperienced students will come to a thorough understanding of the situation. A critical parameter seems to be the task setting that surrounds the reading activity. The best results were obtained in conditions where students were explicitly instructed to read in order to come up with informed opinions, and/or to use the information in order to reason about the situation. A difference between novice and more experienced students might then be their capacity to self-organize the study activity, which is consistent with the studies reviewed in chapter 2 (section 2.3).

CONCLUSIONS

In a large number of school and professional activities, people are required to use several information sources simultaneously. Evidence comes from a simple look at the shelves, desks, and, sometimes, chairs in people's offices or study rooms. Very often do we see not just one, but several books, journals or magazines, technical documents, and notes scattered around, obviously for the purpose of being used in parallel. Reading multiple documents requires specific comprehension strategies: One may need to *identify the source* of each document (e.g., who wrote it, when, for what audience and purposes); to *compare information across sources*, in order to corroborate the veracity and the accuracy of information; and to *integrate information* into a coherent representation. All these processes pertain to a comprehensive definition of reading literacy such as that offered in the introduction to this book. They have, however, been somewhat overlooked in theories of reading competence and reading instruction, possibly because the importance of such processes only appears when studying complex, naturalistic text-processing activities.

In this chapter, I have suggested a number of hypotheses as regards the processes that are brought to bear in multiple document comprehension. Based on earlier works by Wineburg, Britt, Perfetti, and others, I have suggested that the mental representation of multiple documents (or "documents model") involves two distinct but interconnected components: a source model and a situations model. The *source model* contains a representation of each source and rhetorical connections among sources. The *situations model* contains a representation of the situation described in the documents. The situations model may also contain several alternate representations for complex or controversial events, hence the use of the plural form of the term "situations." I have argued that, in the latter case, a powerful means for readers to maintain coherence in their knowledge representation is to maintain active links between source representations and content representations. In other words, the

reader has to remember both what was said and who said it. This is a core characteristic of elaborate document models.

Constructing complete and coherent document models is not an easy task. Rather, it characterizes the behavior of expert readers studying documents that pertain to their field of expertise. Expert readers need to rely on surface and content cues characteristic of their familiar sources (see Dillon, 1991; see also chapter 2). Several experiments have shown, however, that even inexpert university students can use and evaluate multiple documents. They do need, however, to be provided explicit instructions about why and how to do so. When students are given appropriate materials and task contexts, they may benefit from studying multiple sources, compared to single "voiceless" texts.

Analyzing the mental processes brought to bear when comprehending multiple documents points out the role of readers' objectives and purposes. In naturalistic contexts, the point of reading documents is seldom to memorize information or even to achieve comprehension of the contents. Very often do people use documents for much more specific purposes, like searching information about a topic. Thus, functional literacy involves one's ability to make appropriate selections among vast repositories of information. I examine the relationships between comprehension, question answering, and information search in the next chapter.

As online technologies become more available, studying from a variety of sources is becoming a rather common way of acquiring knowledge in content areas. The studies on multiple document comprehension and learning also suggest that there may be some benefits of using the World Wide Web to design instructional tasks that require students to study and confront multiple sources of evidence. Instructional designers and policymakers should be aware of the opportunities, and also the constraints, that characterize learning from multiple online documents. I return to this issue in chapter 6.

4

Question Answering and Document Search

OVERVIEW AND CONTENTS

Reading often takes place in a purposeful context, in which people engage in interactions with documents in order to satisfy a specific need or objective, for example , to locate a piece of information, to answer a question, or to perform a concrete action. The materials available may or may not offer exactly the information that fits the reader's purpose. When they do contain such information, it is rarely accessible at first sight. Instead, in order to access the relevant information, readers have to engage in document search. Document search is the activity that consists in consulting, rather than reading extensively, a document or a set of documents. Document search relies on specific cognitive processes and strategies, quite distinct from those used when reading for comprehension or memory. Answering questions from texts requires one to make extensive use of text organizers in order to proceed quickly to the relevant passage. Furthermore, deep comprehension is not always needed in order to locate information. Finally, search and comprehension may interact as searching a document influences the reader's mental representation of the document's contents. Executive control processes play a critical role in planning and conducting efficient document search.

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