Questions Drive Comprehension of Text and Internet Exploration

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Abstract

One way to view goal-driven comprehension is to consider the underlying questions that frame the goals. Indeed, it could be argued that any cognitive task can be analyzed by mapping out the questions that drive the activities at varying grain sizes. There are main questions at the most super-ordinate level and more specific questions at more embedded subordinate levels. Information is defined as being relevant if it answers any of the questions in the question structure that drives comprehension. Moreover, new questions may be posted as the material is being explored and comprehended. We call this the *question-driven model* of comprehension. This chapter begins by justifying this approach and presenting theoretical schemes for classifying questions. The chapter subsequently reports some studies on text comprehension and internet exploration that show how reading processes are influenced by the questions that drive comprehension. The final section of the chapter addresses the issue of how new questions are generated during comprehension.

Questions Drive Comprehension of Text and Internet Exploration

The notion that goals guide reading activities is an important insight that is receiving more attention in models of comprehension (Magliano, Millis, Ozuru, & McNamara, 2007; Graesser & McNamara, in press; McCrudden & Schraw, 2007). Goals are particularly important in today's frenetic information ecology. We live in a world of email, instant messaging, facebook, chat rooms, portals, Google, Wikipedia, teleconferences, solitary and multiparty games, sensuously rich video, YouTube, Twitter, iPhones, and other technologies that break up our experiences into smaller packages of time and content. Texts are not only shorter, but the reading process is typically distributed and integrated with other media, tasks, and actions. Texts are read for the purpose of accomplishing short-term goals, solving problems, communicating with others, writing reports, and playing games. It is becoming difficult to schedule long periods of sustained concentration, which ordinarily is a prerequisite for deeper levels of comprehension. However, as an alternative to long stretches of time to read, perhaps deep comprehension can be achieved in a distributed information ecology if it is guided by judiciously selected reader goals. These goals would be generated from a cognitive mechanism with skilled self-regulated learning.

The importance of goals has always been routinely acknowledged in reading models. For example, reader goals were regarded as one of the three distinctive assumptions of the constructionist theory of comprehension proposed by Graesser, Singer, and Trabasso (1994); the other two assumptions were the explanation assumption (i.e., readers attempting to explain the text content and why it is expressed) and the coherence assumption (i.e., readers trying to connect text ideas and construct a global message). Acknowledging the importance of goals is an important step but only the beginning. The more fundamental challenge is to develop a theory that explains how goals are generated and how they guide the reading process.

Our approach to developing such a theory is to recast the notion of *goal-driven* comprehension as *question-driven* comprehension. Simply put, behind every goal, there is a question. In essence, goal-driven comprehension can be viewed as the asking and answering of questions. Questions are at the heart of virtually any complex task that an adult performs (Graesser, Baggett & Williams, 1996; Graesser, Lu, Olde, Cooper-Pye, & Whitten, 2005; Graesser & Olde, 2003; Graesser, Ozuru, & Sullins, 2010). For example, when a person encounters a device that malfunctions, the relevant questions are “What’s wrong?” and “How can it be fixed?". When a person reads an office memo, the relevant questions are “Why is this important?” and “What should I do about it, if anything?". When an adult reads a job ad, the relevant questions are “Am I a good match for the job?," “How much would I make?”, and “What are the perks?”. Moreover, we assume that these questions may or may not be expressed in language. Conceptual questions also can be viewed as driving actions, eye movements, emotions, and other psychological activities (D’Mello & Graesser, in press; Graesser et al., 2005). The research agenda is therefore to investigate the cognitive mechanisms that trigger question asking and exploration patterns.

The remainder of this chapter has four sections. We first justify why we believe it is useful to formulate goal-driven comprehension as question-driven comprehension. The second section presents some taxonomies of questions that may be useful in models of question-driven comprehension. The third section presents some experiments that illustrate the impact of questions on the process of reading and the resulting cognitive representations. The final section of the chapter addresses the issue of how questions are generated during comprehension. This includes a model of question generation that specifies the questions that are theoretically generated as a function of the content in the text.

Why Questions?

What advantages are there in thinking in terms of questions instead of goals? Are we merely substituting one set of ill-defined psychological constructs with another set? Isn't it possible to map goals onto questions just as it is possible to map questions onto goals? If so, what's the point? The position that we wish to advance is that questions are better specified and understood than goals, so a question-driven view of reading is a promising approach to developing a theory of active reading comprehension. Reading researchers have occasionally identified the goals associated with reading, but there is a much richer history of research on the impact of adjunct questions in reading (Andre, 1979; Swenson & Kulhavy, 1974; Sagaria & di Vesta, 1978), the impact of question generation training on comprehension (Davey & McBride, 1986; King, 1989, 1994; Rosenshine, Meister, & Chapman, 1996), and componential analyses or taxonomies of questions (Beck, McKeown, Hamilton, & Kucan, 1997; Graesser et al., 2010; Graesser & Person, 1994; Guthrie, 1988; Lehnert, 1978; Mosenthal, 1996; Rus & Graesser, 2009; Van der Meij, 1993). Perhaps there are good reasons why the question ontology has dominated the goal ontology throughout the years in reading and education research.

The vagueness and under-specification of goals are apparent when one considers some of the studies that manipulate goals by instructions to the participants before they read the text. These goal manipulations are sometimes called orienting tasks or instructional set. For example, some common contrasts are between the goals of reading for comprehension, recall memory, recognition memory, enjoyment, summarization, and argumentation. In essence, readers in these various conditions are given instructions on their mindset in processing the text or on the nature of a subsequent test. The hope is that these instructions will systematically influence their reading processes and resulting cognitive representations. Sometimes such instructional manipulations are successful (McCrudden, Schraw, & Kambe, 2005; Reynolds, Trathen, Sawyer, & Shepard, 1993; Rothkopf & Billington, 1979; Schraw & Dennison, 1994; van den Broek, Lorch, Linderholm, & Gustafson, 2001), as is reported in many of the chapters in this volume. However, such instructions have often resulted in subtle, non-significant, unexpected, or un-replicated differences in studies conducted in our laboratory over the years (Graesser & Nakamura, 1982; Zwaan, Magliano, & Graesser, 1995; Wiley et al., 2010).

There are at least three reasons why the instructional manipulations of reading goals may sometimes yield unspectacular results. One reason is that the skills and strategies of reading are so weathered into the reader after decades of reading that a 5-minute instructional manipulation is destined to be insensitive. A second reason is that readers get very little feedback on their attempts to follow instructions in most experiments involving instructional manipulations. A third reason is that readers have unspectacular proficiencies of metacomprehension and metacognition (Hacker, Dunlosky, & Graesser, 2009) so they do not systematically respond to instructional variations. When instructed to "read for comprehension," how is this going to be construed by the reader? Comprehension calibration research informs us that there is only a .27 correlation between college students' judgments of how well they comprehend texts and how well they perform on comprehension tests (Glenberg & Epstein, 1985; Glenberg, Sanocki, Epstein, & Morris, 1987; Maki, 1998). How do readers view instructions to "read for a later recall test" versus "read for a later recognition memory test" when they have unspectacular meta-memory skills? What does it mean to the reader to "read for enjoyment" when they are given rather uninspiring reading material?

One interesting contrast in orienting tasks was conducted in a study by Graesser, Higginbotham, Robertson, and Smith (1978). They contrasted reading under self-induced versus task-induced reading comprehension conditions when college students read sheets from the *National Enquirer*, a sensationalist newspaper. Students were in a waiting room in anticipation of participating in a scheduled experiment. In the waiting room there was a sheet from the *National Enquirer* on a table. Over 90% of the students voluntarily picked up the sheet and read it while waiting for the experiment in this *self-induced* reading phase. The experimenter viewed the student through a one-way mirror and recorded the time in seconds that the student read the news sheet. Shortly after the student put the news sheet down, the experimenter entered the room and gave the student another news sheet from the National Enquirer. The students were instructed to read the sheet carefully because they would be tested on their comprehension of the stories in a subsequent test. They were told how much time they had to read the sheet in this *task-induced* reading phase; the time was yoked to their reading time in the self-induced reading phase. After the students were finished reading the sheets in the task-induced phase, the participants were tested in what they had read from the two sheets (which of course were counterbalanced across students in their assignment to the two phases). One test was a list of the titles of the stories. The students indicated the titles of the articles they had read. A second test was a multiple-choice test on the contents of each article. One question per article tapped actions and events (what happened) whereas another question tapped static information (who, what, when, where).

The results of the National Enquirer study showed dramatic differences between the self-induced and task-induced reading phases. Compared with the task-induced phase, in the self-induced phase they tended to select more articles to read on familiar topics. Topic familiarity was measured with a normative group of participants who read and rated topics in the news sheets on a scale of topic familiarity. Thus, the students wisely distributed their efforts to unfamiliar material in the task-induced condition in anticipation of the subsequent test. Another difference was found on the comprehension test. Students had more correct answers on test questions tapping actions and events in the self-induced condition than the task-induced condition whereas performance on the static questions was highest in the task-induced condition. Thus, the students tended to read for narrative plot in self-induced condition but for static facts in the task-induced conditions.

These differences between self-induced and task-induced reading conditions are quite intriguing. We also discovered what students read when they genuinely want to read. However, the disappointing aspect of this study is that the results were not predictable from any theory of reading, comprehension, or learning. This was a refreshing demonstration experiment, but not a landmark advance on our theoretical understanding of active goal-based reading comprehension.

By way of contrast, we believe that the question-driven approach is very promising for exploring top-down active reading comprehension. It is possible to precisely specify the orienting questions before students read the text, to observe whether they spend more time reading content that answers those questions, and to assess through tests whether they encode content relevant to those questions. There are clear-cut operational definitions of what content in the text and test is relevant to the orienting question versus not relevant. Investigations of this question-driven approach are reported later in this chapter. The next section discusses question taxonomies and analytical schemes for specifying questions.

Questions Taxonomies and Analytical Schemes

Questions have been categorized and scaled on multiple dimensions (Beck et al., 1997; Graesser et al., 2010; Graesser & Person, 1994; Guthrie, 1988; Lehnert, 1978; Mosenthal, 1996;

Rus & Graesser, 2009). It is important to take stock of these analytical schemes and then speculate how these categories and dimensions may influence reading comprehension.

Graesser et al. (2010) proposed a *landscape of questions* that identifies question categories, the levels of knowledge tapped by a question, and the cognitive processes involved in answering questions. If there are Q question categories, K categories of knowledge, and P cognitive processes, then there are Q x K x P *cells* in the total space of questions. This landscape is useful to researchers in reading comprehension to the extent that it offers predictions about the levels of comprehension and the segments in the text that a question serves.

Types of Questions. Question taxonomies have been proposed in the fields of psychology, education, artificial intelligence, and information retrieval. We will describe one of these taxonomies developed by our research team (Graesser & Person, 1994).

The *Graesser–Person taxonomy* (Graesser & Person, 1994) classifies questions according to the nature of the information being sought in a good answer to the question. Table 1 lists and defines these categories. The 16 question categories are scaled on depth, defined as the amount and complexity of content produced in a good answer to the question. The scale has three values: *shallow* questions (categories 1-4), *intermediate* questions (5-8), versus *deep* questions (9-16). This depth scale correlates significantly ($r = .60 \pm .05$) with both Mosenthal's (1996) scale of question depth and Bloom's taxonomy of cognitive difficulty (1956). The deeper questions require longer answers and tend to be cognitively more challenging.

*** INSERT TABLE 1 ABOUT HERE ***

The Graesser-Person taxonomy is a reasonable taxonomy of questions that can be scaled on depth, but it is imperfect in a number of ways. Sometimes it is difficult to classify actual questions because there is some ambiguity on which category a question fits or because a question does not closely match any category. Sometimes a question is a hybrid of multiple categories. For example, the following question is a hybrid between the verification, disjunctive, and causal consequence question categories: *When the passenger is rear-ended, does the head initially (a) go forward, (b) go backwards, or (c) stay the same?* Would this hybrid question be considered shallow or deep, given that it could be assigned to two shallow categories and one deep category? There are questions that would be classified as intermediate or deep, even though they recruit common knowledge and require minimal thought and reasoning: *How do you open a refrigerator?* and *Why did the chicken cross the road?* The Graesser-Person question classification and scale of question depth is only crude and approximate because it does not sufficiently consider the knowledge representations and cognitive processes that are recruited during the course of question answering. However, it is a reasonable solution for researchers who desire a simple taxonomy and a unidimensional scale of depth.

Mosenthal (1996) proposed a coding system to scale questions on abstractness, which roughly corresponds to depth. Mosenthal's levels of abstractness range from most concrete (which targets explicit information), to an intermediate level that identifies information such as procedures and goals that may or may not be explicit, to abstract levels that tap identification of causes and effects, reasons, and evidence. As in the taxonomy of the Graesser-Person scheme, Mosenthal's classification scheme is based on the information sought in the answer and does not systematically consider the world knowledge and cognitive processes needed to generate answers to questions.

Beck et al. (1997) developed their *Questioning the Author* reading program to encourage deeper comprehension through question categories that encouraged the reader to think of the author's goals behind their writing. Examples of such questions are: *What is the author trying to* *tell you?, Why is the author telling you that?, Does the author say it clearly?, How could the author have said things more clearly?,* and *What would you say instead?.* These questions encourage students to reflect on the process of communication through text, on the quality of the text in meeting communication goals, on text coherence, and on the possibility of a text having alternative forms of expression. Text is viewed as a fallible and flexible medium of communication that merits critical scrutiny instead of viewing text as a perfect artifact that is etched in stone. This shift in the reader's mental model of the reading process results in deeper comprehension.

Some questions serve social or pragmatic functions that are not obviously relevant to learning and text comprehension (Graesser, Person, & Huber, 1992). For example, there are rhetorical questions (*When does a person know true happiness?*), gripes (*When will it ever stop raining?*), greetings (*How are you?*), and attempts to redirect the flow of conversation in a group (a hostess asks a quite guest *So when did you move to Memphis, Chris?*). These question categories are not considered further in this chapter because the present focus is on question-driven comprehension of text.

Types of Knowledge. Researchers in cognitive science and artificial intelligence devoted considerable effort to dissecting the formal and psychological properties of different classes of knowledge (Lehmann, 1992; Lenat, 1995). These theories specified the formal properties of particular elements, relations, and classes of knowledge instead of relying on intuition and folklore. The question categories in Table 1 were found to operate systematically on particular types of knowledge in various computational models of question answering, such as QUALM (Lehnert, 1978) and QUEST (Graesser, Gordon, & Brainerd, 1992). The categories of knowledge enumerated below were proposed by Wisher and Graesser (2007).

Agents and entities: Organized sets of people, organizations, countries, and entities.

Class inclusion: One concept is a subtype or subclass of another concept.

Spatial layout: Spatial relations among regions and entities in regions.

Compositional structures: Components have subparts and subcomponents.

Procedures & plans: A sequence of steps/actions in a procedure accomplishes a goal.

Causal chains & networks: An event is caused by a sequence of events and enabling states.

Others: Property descriptions, quantitative specifications, rules, mental states of agents.

Each of these types of knowledge has a unique set of properties, relations, and constraints. For example an IS-A relation connects concept nodes in class inclusion knowledge, e.g., *a collie is a dog, a dog is a mammal, a mammal is an animal.* A CAUSE relation would connect event nodes in a causal network. Question categories in Table 1 are systematically aligned with the types of knowledge in the above knowledge categories. For example, definition questions have a close affinity to class inclusion structures whereas goal-orientation questions have a close affinity to procedures and plans. The QUEST model of question answering (Graesser et al., 1992) provided a systematic mapping between the types of knowledge and many of the question classes in Table 1.

Researchers in the field of discourse processing have claimed that text representations are separated into levels of explicit text-based information, the referential situation models (sometimes called mental models), rhetorical structure, and pragmatic communication (Graesser & McNamara, in press; Graesser, Millis, & Zwaan, 1997; Kintsch, 1998; Snow, 2002). The *explicit information* preserves the wording, syntax, and semantic content of the material that is directly presented. The *situation model* is the referential content of what the explicit material is about. In a technical text that explains a device, for example, the mental model would include: the components of the device, the spatial arrangement of components, the causal chain of events when the system successfully unfolds, the mechanisms that explain each causal step, the functions of components, and the plans of humans who manipulate the system for various purposes. The *rhetorical structure* is the more global composition and genre that organizes the discourse. For example, the structure of a story is very different from an expository text with a claim + evidence rhetorical structure. The *pragmatic communication* specifies the main messages or points that the author is trying to convey to the reader. These four levels of discourse can be ordered on depth. More inferences and deeper levels of processing are needed as one moves from the explicit information to the situation models and onward to the rhetorical and pragmatic communication levels.

Types of Cognitive Processes. Cognitive processes operate on knowledge during the course of question-answering. Some of these processes have been investigated in the fields of cognitive psychology and discourse processing (Goldman, Duschl, Ellenbogen, Williams, & Tzou, 2003; Graesser, Lang, & Roberts, 1991; Graesser & Hemphill, 1991; Guthrie, 1988; Juvina, 2006; Kyllonen & Roberts, 2003; Reder, 1987; Rouet, 2006; Singer, 2003). One of the early contributions in education was Bloom's taxonomy (1956), which included the process categories of recognition, recall, comprehension, application, analysis, synthesis, and evaluation. This order of categories to some extent reflected greater difficulty. Recognition and recall are the easiest, comprehension is intermediate, whereas application, analysis, synthesis, and evaluation are the most difficult. Recognition and recall are the primary processes associated with questions that access facts and events presented explicitly in the text. However, comprehension and synthesis are needed when a question requires generating inferences from the text and combining ideas from different parts of the text. Application is needed when the reader needs to solve a problem and uses the text information route to a solution.

Given that this book focuses on learning from text, it is important to consider the cognitive processes that are relevant to a question-driven model of comprehension. When a reader has a question in mind before they start reading a text, their attention and effort is allocated to searching for and locating relevant information in the text (Guthrie, 1988; Juvina, 2006; Rouet, 2006). If we might use a metaphor from visual perception, the text has a receptive field of relevant information. For broad questions at deeper levels, the receptive field is wide. For factual questions, the receptive fields may be as narrow as a single sentence or word in the text. In both cases, relevant processes include searching and locating relevant information. Text information within the receptive field should receive more attention, cognitive resources, and conceptual elaboration than text information outside of the receptive field. Questions with wider receptive fields should show general comprehension advantages over questions with narrow receptive fields. These conclusions are compatible with most of the research that has been reported on the impact of adjunct questions that readers receive before they read a text and eventually answer a question (Andre, 1979; Guthrie, 1988; Kintsch, 2005; McCrudden & Schraw, 2007).

The story is a bit more complex, however, when one considers questions that involve inferences, deeper levels of comprehension, and pragmatic communication. The receptive field metaphor still holds up, but it is also important to perform critical evaluation of information within the scope of the receptive field. Specifically, the reader needs to evaluate the quality of the information source (called source evaluation), to compare information from multiple texts or sections within the text (called information comparison), and to integrate relevant information into a coherent answer (called information integration). The *documents model* proposed by Rouet (2006) has discussed such extended processes in the context of traditional text and also hypertext and other electronic media.

This section has analyzed the landscape of questions that can potentially guide the reader in comprehending text. Questions vary with respect to the question category, type of knowledge, and cognitive processes. The next section focuses on the impact of questions on reading comprehension.

How Do Questions Impact Reading?

This section concentrates on top-down influences of questions on reading. More formally, given an orienting question Q, how is reading comprehension for text T influenced by question Q, the affiliated expected answer A, and information in text T that is relevant to A? Let us define the receptive field (*rf*) of T with respect to Q as rf(Q,T) and the remaining information in the text as ~rf(Q,T). The *focus assumption* predicts that attention, effort, and conceptual elaboration will drift to text information in the receptive field at the expense of neglecting information outside of the receptive field. Some of the predictions are specified below:

$$\mathrm{rf}(Q, T) > {\sim}\mathrm{rf}(Q,T) \quad (1)$$

$$[\mathrm{rf}(Q,T) \mid \text{adjunct question } Q] > [\mathrm{rf}(Q,T) \mid \text{no adjunct question } Q] \quad (2)$$

$$[{\sim}\mathrm{rf}(Q,T) \mid \text{no adjunct question } Q] > [{\sim}\mathrm{rf}(Q,T) \mid \text{adjunct question } Q] \quad (3)$$

Assumption 1 expresses that more attention and encoding will be devoted to information within the question's receptive field than information outside of the receptive field. Assumption 2 expresses that information within the question's receptive field will receive more attention and encoding when the adjunct question is administered than when it is not. Assumption 3 states that information outside of a question's receptive field will receive more attention and encoding when the adjunct question is not administered than when it is; thus, the adjunct question imposes a processing penalty on information outside of the receptive field. The predictions of the focus assumption have been confirmed in much of the research on adjunct questions. The *span assumption* predicts that deeper, more integrative questions (Q_d) have a wider receptive field and therefore yield better comprehension of the text than a shallow, fact-focused question (Q_s).

$$rf(Q_d,T) > rf(Q_s,T) \qquad (4)$$

It, of course, is an open question how general these four predictions will apply to a broad range of questions, texts, knowledge representations, and cognitive processes. Moreover, students with deeper comprehension should conform to these predictions to a greater extent than those who settle for shallow comprehension of the material.

We have conducted a number of eye tracking studies that have confirmed predictions of the focus assumption. In one study, we collected data while students studied web sites on plate tectonics for the purpose of answering the question "What caused the eruption of Mt. St. Helen's volcano?" (Wiley, Goldman, Graesser, Sanchez, Asch, & Hemmerich, 2010). We recorded the amount of time the eyes fixated on areas of interest (AOI's) on the display that matched relevant information to answer the question, i.e., the receptive field, as opposed to other information on the screens of the web sites. Good comprehenders of plate tectonics tended to attend to relevant areas of interest compared with poorer comprehenders, and there was a greater differential for relevant versus irrelevant information. Good comprehenders tended to read the web sites of credible sources more than the other sites with information of poorer quality. Although prediction 1 of the focus assumption was confirmed, there was no direct test of predictions 2 and 3 because there was no reading of the web sites under neutral orienting tasks.

In another eye tracking study (Graesser, Lu et al., 2005) college students read illustrated texts on mechanical and electronic devices written by David MacCaulay on the popular book *The Way Things Work* (1998). Example devices were on a cylinder lock, a toaster, and a dish washer. After reading an illustrated text on a device, such as a cylinder lock, they were given a breakdown scenario (e.g., The key turns but the bolt does not move) and were asked to generate questions for a couple of minutes. After they did this with a handful of devices, they were given a multiple-choice test on how well they comprehended the illustrated texts. Students who scored higher on the device comprehension tests also tended to allocate their gaze durations to AOI's on the display that were likely causes of the breakdown. In contrast, the poor comprehenders tended to indiscriminately allocate their attention all over the display of the illustrated texts. Prediction 1 of the focus assumption was therefore confirmed, but the status of predictions 2 and 3 are uncertain because there was no suitable control condition of normal reading.

To further investigate the impact of orienting questions, we conducted a study on Navy web sites and manipulated the questions given to college students before they inspected the sites. The web sites were attempts to recruit young adults into the Navy and to reveal diverse jobs that were available to sailors. Eye tracking data were collected while college students perused 12 of the web pages for the purpose of answering questions. College students were randomly assigned to one of three conditions with different orienting questions: (1) What are the educational and financial benefits in joining the Navy?, (2) What are the requirements for joining the Navy?, versus (3) a no leading question control condition. There were web pages that included information that answered the first question, some pages that addressed the second, some pages that addressed both questions, and some pages that addressed neither question. According to the QUEST model of question answering, the orienting questions were expected to systematically influence the length of time that a screen was read and also the fixation durations on particular AOI's on the screen that were relevant versus irrelevant to the question.

The predictions of the focus assumption and the QUEST model were indeed confirmed. There was a significant interaction between the 3 conditions and the 4 categories of web pages, $F(6, 72) = 2.46$, $p < .05$. Planned comparisons confirmed that pages were read longer if there was relevant information that answered the orienting question than if the pages had no relevant information, 159 versus 110 seconds, respectively. We identified AOI's on the web pages that had information that directly answered the orienting question, as opposed to those AOI's with no relevant information. The initial fixation times on AOI's (i.e., not including re-fixations) were 209 milliseconds longer for the AOI's with answer information, which supports prediction 1 of the focus assumption. Moreover, comparisons to the control condition showed that more time is spent on relevant AOI's that answer the questions in the two question conditions (which supports prediction 2) and less time is spent processing irrelevant information (which supports prediction 3). In summary, this experiment on Navy websites supported all three predictions of the focus assumption. These results are also compatible with the adjunct question paradigm that assesses memory or comprehension tests on information that is relevant versus not relevant to the orienting question presented prior to the text that is read (Guthrie, Van Meter, Hancock, Alao, Anderson, & McCann, 1998; Hamaker, 1986).

How Are Questions Generated During Comprehension?

The previous section focused on top-down influences of questions on comprehension. This section addresses how questions are triggered bottom-up during the process of reading text. We need to know how questions are generated by the reader in order to fully understand the mechanisms in question-generation comprehension.

There is an idealistic vision that students are curious and actively generate questions during reading. That is, they identify their own knowledge deficits, ask questions that focus on these deficits, and answer the questions by exploring reliable information sources. In actuality, this view of comprehension is overly optimistic. Readers in fact have trouble identifying their own knowledge deficits (Hacker et al., 2009) and ask very few questions (Dillon, 1988; Good, Slavings, Harel, Emerson, 1987; Graesser & Person, 1994). Given the poverty of student questions, researchers in cognitive science and education have advocated learning environments that train students how to ask questions or that find ways to stimulate inquiry (Beck et al., 1997; Edelson, Gordin, & Pea, 1999; King, 1989, 1992; Palincsar & Brown, 1984; Pressley & Forrest-Pressley, 1985; van der Meij, 1994).

Empirical evidence supports the claim that improvements in the comprehension, learning, and memory of technical material can be achieved by training students to ask questions during comprehension (King, 1989, 1994; Palincsar & Brown, 1984; Rosenshine et al., 1996; van der Meij, 1994; Wong, 1985). Rosenshine et al. (1996) provided the most comprehensive analysis of the impact of question generation on learning in their meta-analysis of 26 empirical studies that compared question generation learning to conditions with appropriate controls. The outcome measures in these studies included standardized tests, short-answer or multiple-choice questions prepared by experimenters, and summaries of the texts. The median effect size was .36 for the standardized tests, .87 for the experimenter-generated tests, and .85 for the summary tests.

One informative result of the Rosenshine et al. meta-analysis was that the question format was important when training the learners how to ask questions. The analysis compared training with signal words (*who, what, when, where, why,* and *how*), training with generic question stems (*How is X like Y?, Why is X important?, What conclusions can you draw about X?*), and training with main idea prompts (*What is the main idea of paragraph X*). The generic question prompts were the best (see also King & Rosenshine, 1993) perhaps because they give the learner more direction, are more concrete, and are easier to teach and apply. This result is informative because it suggests that the specificity of the question has a large impact on comprehension.

The nature of the text is no doubt important in triggering questions in a bottom-up fashion. Graesser and his colleagues have developed a cognitive computational model of question asking that attempts to achieve this objective (Graesser, Olde, Pomeroy, Whitten, Lu, & Craig, 2005; Otero & Graesser, 2001). The model is called PREG, which is a root morpheme for “question” in the Spanish language. According to the PREG model, cognitive disequilibrium drives the asking of genuine questions (Chinn & Brewer, 1993; Festinger, 1957; Flammer, 1981; Graesser et al., 1996; Graesser & McMahen, 1993; Graesser & Person, 1994; Schank, 1999). That is, questions are asked when individuals are confronted with obstacles to goals, anomalous events, contradictions, discrepancies, salient contrasts, obvious gaps in knowledge, expectation violations, and discrimination among a set of equally attractive alternatives. The answers to such questions are expected to restore equilibrium (homeostatic balance).

Otero and Graesser (2001) developed a set of production rules that specify the categories of questions that are asked under particular conditions (i.e., content features of text and knowledge states of individuals). The predicted questions are sensitive to four information sources or processing components: (1) the explicit text, (2) the reader's world knowledge about the topics in the text, (3) the reader's metacognitive skills, and (4) the reader’s knowledge about the pragmatics of communication. It often takes a large amount of knowledge to identify such clashes and gaps in knowledge. Miyake and Norman (1979) presented the argument over 20 years ago that “to ask a question, one must know enough to know what is not known.”

The PREG model adopts a theory of knowledge representation that operates in conjunction with production rules. Both the explicit text and the world knowledge are represented as conceptual graph structures (Graesser, Gordon, & Brainerd, 1992). These structures map out the causal chains, goal hierarchies, taxonomic hierarchies, spatial composition, and properties of the domain knowledge under consideration. A production rule is an "IF <condition> THEN <action>" formalism which specifies the particular cognitive or behavioral actions that are activated when particular conditions exist in the system (Anderson, 1990). The conceptual graph structures and production rules together provide a sufficient level of analytical detail to capture the systematic mechanism of question asking.

A small number of production rules should be sufficient to convey the flavor of the production rules.

(A) Unknown word. A reader may be ignorant of the meaning of a word.

IF A content word W (noun, main verb, or adjective) in the text is not known

THEN Ask: "What does W mean?"

(B) Unknown referent. The explicit text mentions a noun or pronoun N, but it is difficult to construct or identify a referent in the mental model that corresponds to N.

IF A referent of a noun or pronoun N is not known

THEN Ask: "What/which N?"

(C) Discrepant Statement. An explicit statement S in the text is discrepant with a reader's knowledge of the prior explicit text or with world knowledge.

IF statement S clashes with prior text or with world knowledge

& no relation in the explicit text is linked to and accounts for S

THEN Ask: "Why did S occur/exist?", "How did S occur/exist?", or

"Why does the author say S?"

There are dozens of these production rules, but it is beyond the scope of this chapter to present an exhaustive inventory of the knowledge structures and production rules.

The ability to detect cognitive disequilibrium at appropriate points while reading is an excellent index of whether a person understands technical text (Baker, 1985; Burbules & Linn, 1988; Kintsch, 1998; Otero & Campanario, 1990). For example, if there is a direct contradiction in the text, this should be noticed. Poor comprehenders gloss over such contradictions and sustain an "illusion of comprehension." A deep comprehender, on the other hand, actively seeks possible contradictions, clashes with world knowledge, and gaps in background knowledge (Beck et al., 1997; Hacker et al., 2009). The detection of cognitive disequilibrium can be manifested in several ways. Reading time slows down. Eye movements regress to previous sections of text, or between contradictory constituents. And of course, one obvious manifestation is that the learner asks questions (Graesser, Lu et al., 2005; Graesser & McMahen, 1993; Graesser & Olde, 2003; Otero & Graesser, 2001).

The detection of cognitive disequilibrium alone is not sufficient for question generation. According to the research conducted by Graesser and McMahen (1993), the potential question asker must pass two additional hurdles after the detection of disequilibrium: articulation of the question in words (called *verbal coding*) and the courage to express the question in a social setting (called *social editing*). Thus, three stages need to be intact for a question to be produced (disequilibrium detection, verbal coding, and social editing). Graesser and McMahen investigated this by having college students read different versions of stories and mathematical word problems: *contradictions* between text statements, *deletion* of critical information, insertion of *irrelevant* information, and *control* (no anomalies). The likelihood of generating questions was higher in most of the anomaly conditions than in the control condition when subjects were instructed to generate questions, as would be predicted by the PREG model. It is informative to note that the likelihood that students asked questions was extremely low (.04) when they were not instructed to ask questions, but were merely permitted to ask questions of an experimenter in an adjacent room. Thus, questions do not surface when it is physically or socially effortful to ask them. It is important to minimize these barriers in learning and information systems.

Graesser, Person, and Huber (1992) identified four very different types of question generation mechanisms that occur in naturalistic settings. The first category consists of bona fide *knowledge deficit* questions, whereas the other three mechanisms addressed communication and social interaction processes. *Common ground* questions are asked when the questioner wants to establish or confirm whether knowledge is shared between participants in the conversation (such as "Are we working on the fourth problem?", "Did you mean the correlation between variables?"). *Social coordination* questions are indirect requests for the addressee to perform an action or for the questioner to have permission to perform an action in a collaborative activity (e.g., "Could you graph these numbers?", "Can we take a break now?"). *Conversation-control* questions are asked to manipulate the flow of conversation or the attention of the speech participants (e.g., "Can I ask you a question?"). Sometimes a student's question is ambiguous as to whether it is a knowledge deficit question or an attempt to get attention from a teacher, tutor, or peer. The social and pragmatic mechanisms that underlie questions are sometimes important in education on dimensions other than deep learning of an academic subject matter.

Final Comments

In this chapter we have argued that it is worthwhile to take question-driven approach to comprehension. Behind every goal there is a question. These questions are sometimes directly presented to the student as adjunct questions, are sometimes triggered by the text (particularly when there is cognitive disequilibrium), and are sometimes generated by the student autonomously in a top town fashion. Thus, we believe that goals and questions are directly related. Research on goal-focusing instructions has provided some successful, but mixed findings, whereas research on the utility of orienting questions in reading comprehension allegedly has shown greater consistency. Questions posed at varying locations of the text and of varying specificity influence the way text is comprehended and what information is attended to by the reader.

When considering real world educational activities, distinctions between questions and goals are sometimes minimal, if not artificial. Students are often given a reading assignment with an associated worksheet or short-essay prompt that is essentially a set of questions. The student's goal is to fully understand the text, but in reality the goal has shifted to completing the assignment by answering specific questions.

Orienting questions and goal-focused instructions have been shown to influence what information is attended to and ultimately what information is learned. In a world where task demands are increasing at a dramatic rate and attention spans are shrinking, it has become increasingly important to help students read texts in a manner that maximizes comprehension on relevant information. Students need to learn how to cast a net that intelligently targets information in a fashion that is both relevant and deep, not indiscriminate and shallow. And we know, after decades of research, that this is not a skill that comes naturally for most students in K12, college, and the workforce.

References

Anderson, J.R. (1990). *The adaptive character of thought*. Hillsdale, NJ: Lawrence Erlbaum Associates.

Andre, T. (1979). Does answering higher-level questions while reading facilitate productive learning? *Review of Educational Research*, *49*, 280-318.

Baker, L. (1985). How do we know when we don't understand? Standards for evaluating text comprehension. In D.L. Forrest-Pressley, G.E. Mackinnon, T.G. Waller (Eds) *Metacognition, cognition and human performance* (pp. 155-205). New York: Academic Press.

Beck, I.L., McKeown, M.G., Hamilton, R.L., & Kucan, L. (1997). *Questioning the Author: An approach for enhancing student engagement with text*. Delaware: International Reading Association.

Bloom, B.S. (1956). *Taxonomy of educational objectives: The classification of educational goals. Handbook I: Cognitive Domain*. New York: McKay.

Burbules, N.C., & Linn, M.C. (1988). Response to contradiction: Scientific reasoning during adolescence. *Journal of Educational Psychology, 80,* 67–75.

Chinn, C., & Brewer, W. (1993) The role of anomalous data in knowledge acquisition: A theoretical framework and implications for science instruction. *Review of Educational Research, 63*, 1-49.

D'Mello, S., & Graesser, A.C. (in press). Multimodal semi-automated affect detection from conversational cues, gross body language, and facial features. *User Modeling and User-adapted Interaction*.

Davey, B., & McBride, S. (1986). Effects of question generation on reading comprehension. *Journal of Educational Psychology, 78*, 256-262.

Dillon, J. (1988). *Questioning and teaching: A manual of practice*. New York: Teachers College Press.

Edelson, D.C., Gordin, D.N., & Pea, R.D. (1999). Addressing the challenges of inquiry-based learning through technology and curriculum design. *The Journal of the Learning Sciences, 8,* 391-450.

Festinger, L. (1957). *A theory of cognitive dissonance*. Evanston, IL: Row, Peterson.

Flammer, A. (1981). Towards a theory of question asking. *Psychological Research, 43*, 407-420.

Glenberg, A.M. & Epstein, W. (1985). Calibration of comprehension. *Journal of Experimental Psychology: Learning, Memory, Cognition*, *11*, 702-718.

Glenberg, A.M., Sanocki, T., Epstein, W., & Morris, C. (1987). Enhancing calibration of comprehension. *Journal of Experimental Psychology: General*, *116*, 119-136.

Goldman, S.R., Duschl, R.A., Ellenbogen, K., Williams, S., & Tzou, C.T. (2003). Science inquiry in a digital age: Possibilities for making thinking visible. In H. van Oostendorp (Ed.), *Cognition in a digital world* (pp. 253-284). Mahwah, NJ: Erlbaum.

Good, T.L., Slavings, R.L., Harel, K.H., & Emerson, M. (1987). Students' passivity: A study of question asking in K-12 classrooms. *Sociology of Education, 60*, 181-199.

Graesser, A.C., Baggett, W., & Williams, K. (1996). Question-driven explanatory reasoning. *Applied Cognitive Psychology*, *10*, S17-S32.

Graesser, A.C., Gordon, S.E., & Brainerd, L.E. (1992). QUEST: A model of question answering. *Computers and Mathematics with Applications, 23*, 733-745.

Graesser, A.C. & Hemphill, D. (1991). Question answering in the context of scientific mechanisms. *Journal of Memory and Language*, *30*, 186-209.

Graesser, A.C., Higginbotham, M.W., Robertson, S.P., & Smith, W.R. (1978). A natural inquiry into the National Enquirer: Self-induced versus task-induced reading comprehension. *Discourse Processes*, *1*, 355-372.

Graesser, A.C., Lang, K.L., & Roberts, R.M. (1991). Question answering in the context of stories. *Journal of Experimental Psychology: General, 120,* 254-277.

Graesser, A.C., Lu, S., Olde, B.A., Cooper-Pye, E., & Whitten, S. (2005). Question asking and eye tracking during cognitive disequilibrium: Comprehending illustrated texts on devices when the devices break down. *Memory and Cognition, 33*, 1235-1247.

Graesser, A.C., & McMahen, C.L. (1993). Anomalous information triggers questions when adults solve problems and comprehend stories. *Journal of Educational Psychology, 85*, 136-151.

Graesser, A.C., & McNamara, D.S. (in press). Technologies that support reading comprehension. In C. Dede and J. Richards (Eds.), *Digital teaching platforms*.

Graesser, A.C., Millis, K.K., & Zwaan, R.A. (1997). Discourse comprehension. *Annual Review of Psychology, 48*, 163-189.

Graesser, A. C., & Nakamura, G. V. (1982). The impact of schemas on comprehension and memory. In G. H. Bower (Ed.), *The psychology of learning and motivation*, *Vol. 16*. New York: Academic Press.

Graesser, A.C., & Olde, B.A. (2003). How does one know whether a person understands a device? The quality of the questions the person asks when the device breaks down. *Journal of Educational Psychology, 95*, 524-536.

Graesser, A.C., Olde, B., Pomeroy, V., Whitten, S., Lu, S., & Craig, S. (2005). Inferences and questions in science text comprehension. *Tarbiya*, *36*, 103-128.

Graesser, A.C., Ozuro, Y., & Sullins, J. (2010). What is a good question? In M. G. McKeown & L. Kucan (Eds.), *Bringing reading researchers to life: Essays in honor of Isabel Beck* (pp.). New York: Guilford.

Graesser, A.C., & Person, N.K. (1994). Question asking during tutoring. *American Educational Research Journal, 31*, 104-137.

Graesser, A.C., Person, N., & Huber, J. (1992). Mechanisms that generate questions. In T. Lauer, E. Peacock, & A.C. Graesser (Eds.), *Questions and information systems*. Hillsdale, NJ: Erlbaum.

Graesser, A.C., Singer, M., & Trabasso, T. (1994). Constructing inferences during narrative text comprehension. *Psychological Review*, *101*(3), 371-395.

Guthrie, J.T. (1988). Locating information in documents: Examination of a cognitive model. *Reading Research Quarterly, 23,* 178-199.

Guthrie, J.T., Van Meter, P., Hancock, G.R., Alao, S., Anderson, E., & McCann, A. (1998). Does concept-oriented reading instruction increase strategy use and conceptual learning from text? *Journal of Educational Psychology*, *90*, 261-278.

Hacker, D.J., Dunlosky, J., & Graesser, A.C. (Eds.) (2009). *Handbook of metacognition in education.* Mahwah, NJ: Taylor & Francis.

Hamaker, C. (1986). The effects of adjunct questions on prose learning. *Review of Educational Research*, *56*(2), 212-242.

Holliday, W.G., & McGuire, B. (2006). How can comprehension adjunct questions focus students' attention and enhance concept learning of a computer-animated science lesson? *Journal of Research in Science Teaching*, *29*(1), 3-15.

Juvina, I. (2006). Development of a cognitive model for navigating on the web. Doctoral Dissertation, Utrecht University.

King, A. (1989). Effects of self-questioning training on college students' comprehension of lectures. *Contemporary Educational Psychology, 14*, 366-381.

King A. (1994). Guiding knowledge construction in the classroom: Effects of teaching children how to question and how to explain. *American Educational Research Journal, 31,* 338-368.

King, A. & Rosenshine, B. (1993). Effects of guided cooperative questioning on children's knowledge construction. *Journal of Experimental Education*, *61*, 127-148.

Kintsch, E. (2005). Comprehension theory as a guide for the design of thoughtful questions. *Topics in Language Disorders*, *25*(1), 51-64.

Kintsch, W. (1998). *Comprehension: A paradigm for cognition*. Cambridge: Cambridge University Press.

Kyllonen, P.C., & Roberts, R.D. (2003). Cognitive process assessment. In R. Fernandez-Ballesteros (Ed.), *Encyclopedia of psychological assessment* (pp. 200-203). London: Sage.

Lehmann, F. (1992). *Semantic Networks in Artificial Intelligence*. New York: Elsevier Science Inc.

Lehnert, W.G. (1978). *The Process of Question Answering: a computer simulation of cognition.* Lawrence Erlbaum Associates.

Lenat. D.B. (1995). Cyc: A large-scale investment in knowledge infrastructure. *Communications of the ACM*, *38*, 1995.

MacCaulay, D. (1998). *The way things work*. Boston, MA: Houghton Mifflin.

Magliano, J.P., Millis, K.K., Ozuru, Y., & McNamara, D.S. (2007). A multidimensional framework to evaluate assessment tools. In D.S. McNamara (Ed.) *Reading* *comprehension strategies: Theories, interventions, and technologies*, (pp. 107-136). Mahwah, NJ: Erlbaum.

Magliano, J.P., Trabasso, T., & Graesser, A.C. (1999). Strategic processing during comprehension. *Journal of Educational Psychology*, *91*(4), 615-629.

Maki, R.H. (1998). Text predictions over text material: Metacognition in educational theory and practice. In D.J. Hacker, J. Dunlosky, & A.C. Graesser (Eds.), *Metacognition in educational theory and practice* (pp. 117-144). Mahwah, NJ: Lawrence Erlbaum Associates Publisher.

McCrudden, M.T., & Schraw, G. (2007). Relevance and goal-focusing in text processing. *Educational Psychology Review*, *19*, 113-139.

McCrudden, M.T., Schraw, G., & Kambe, G. (2005). The effect of relevance instructions on reading time and learning. *Journal of Educational Psychology*, *97*, 88–102.

Miyake, N., & Norman, D.A. (1979). To ask a question, one must know enough to know what is not known. *Journal of Verbal Learning and Verbal Behavior*, *18*(3), 357-364.

Mosenthal, P. (1996). Understanding the strategies of document literacy and their conditions of use. *Journal of Educational Psychology, 88*, 314-332.

Otero, J.C., & Campanario, J.M. (1990). Comprehension evaluation and regulation in learning from science texts. *Journal of Research in Science Teaching*, *27*(5), 447-460.

Otero, J., & Graesser, A.C. (2001). PREG: Elements of a model of question asking. *Cognition & Instruction, 19*, 143-175.

Palinscar, A.S., & Brown, A. (1984). Reciprocal teaching of comprehension-fostering and comprehension-monitoring activities. *Cognition and Instruction, 1,* 117-175.

Pressley, M., & Forrest-Pressley, D. (1985). Questions and children's cognitive processing. In A.C. Graesser, & J.B. Black (Eds.), *The psychology of questions* (pp. 277-296). Hillsdale, NJ: Erlbaum.

Reder, L. (1987). Strategy selection in question answering. *Cognitive Psychology, 19*, 90-138.

Reynolds, R.E., Trathen, W., Sawyer, M.L., & Shepard, C.R. (1993). Causal and epiphenomenal use of the selective attention strategy in prose comprehension. *Contemporary Educational Psychology*, *18*(2), 258–278.

Rosenshine, B., Meister, C., & Chapman, S. (1996). Teaching students to generate questions: A review of the intervention studies. *Review of Educational Research, 66,* 181-221.

Rothkopf, E.Z., & Billington, M.J. (1979). Goal-guided learning from text: Inferring a descriptive process model from inspection times and eye movements. *Journal of Educational Psychology*, *71*, 310–327.

Rouet, J. (2006). *The skills of document use: From text comprehension to web-based learning.* Mahwah, NJ: Erlbaum.

Rus, V., & Graesser, A.C. (2009). *Workshop report: The question generation task and evaluation challenge*. Institute for Intelligent Systems, Memphis, TN.

Sagaria, S.D., & di Vesta, F.J. (1978). Learner expectations induced by adjunct questions and the retrieval of intentional and incidental information. *Journal of Educational Psychology*, *70*(3), 280-288.

Schank, R. (1999). *Dynamic memory revisited*. New York: Cambridge University Press.

Schraw, G., & Dennison, R. (1994). The effect of reader purpose on interest and recall. *Journal of Reading Behavior, 26*, 1-18.

Singer, M. (2003). Processes of question answering. In G. Rickheit, T. Hermann, & W. Deutsch (Eds.), *Psycholinguistics* (pp.422-431). Berlin: Walter de Gruyter.

Snow, C. (2002). *Reading for understanding: Toward an R&D program in reading comprehension*. Santa Monica, CA: RAND Corporation.

Swenson, I., & Kulhavy, R.W. (1974). Adjunct questions and the comprehension of prose by children. *Journal of Educational Psychology*, *66*(2), 212-215.

van den Broek, P. Lorch, R.F. Jr., Linderholm, T., & Gustafson, M. (2001). The effects of readers' goals on inference generation and memory for texts. *Memory & Cognition*, *29*(8), 1081– 1087.

Van der Meij, H. (1994). Student questioning: A componential analysis. *Learning and Individual Differences, 6*, 137-161.

Wiley, J., Goldman, S.R., Graesser, A.C., Sanchez, C.A., Ash, I.K., & Hemmerich, J.A. (in press). Source evaluation, comprehension, and learning in Internet science inquiry tasks. American Educational Research Journal.

Wisher, R.A., & Graesser, A.C. (2007). Question asking in advanced distributed learning environments. In S.M. Fiore and E. Salas (Eds.), *Toward a science of distributed learning and training* (pp. 209-234). Washington, D.C.: American Psychological Association.

Wong, B.Y.L. (1985). Self-questioning instructional research: A review. *Review of Educational Research, 55*, 227-268.

Zwaan, R. A., Magliano, J. P., & Graesser, A. C. (1995). Dimensions of situation model construction in narrative comprehension. *Journal of Experimental Psychology: Learning*, *Memory*, *and Cognition*, *21*, 386–397.

Zwaan, R.A., & Radvansky, G.A. (1998). Situation models in language comprehension and memory. *Psychological Bulletin*, *123*(2), 162-185.

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Table 1

Question taxonomy proposed by Graesser and Person (1994)

QUESTION CATEGORY	GENERIC QUESTION FRAMES AND EXAMPLES
1. Verification	Is X true or false? Did an event occur? Does a state exist?
2. Disjunctive	Is X, Y, or Z the case?
3. Concept completion	Who? What? When? Where?
4. Example	What is an example or instance of a category?
5. Feature specification	What qualitative properties does entity X have?
6. Quantification	What is the value of a quantative variable? How much? How many? How much? How many?
7. Definition	What does X mean?
8. Comparison	How is X similar to Y? How is X different from Y?
9. Interpretation	What concept or claim can be inferred from a static or active pattern of data?
10. Causal antecedent	What state or event causally led to an event or state? Why did an event occur? Why does a state exist? How did an event occur? How did a state come to exist?
11. Causal consequence	What are te consequences of an event or state? What if X occurred? What if X did not occur?
12. Goal orientation	What are the motives or goals behind an agent's action? Why did an agent do some action?
13. Instrumental/procedural	What plan or instrument allows an agent to accomplish a goal? How did agent do some action?
14. Enablement	What object or resource allows an agent to accomplish a goal?
15. Expectation	Why did some expected event not occur? Why does some expected state not exist?
16. Judgmental	What value does the answerer place on an idea or advice? What do you think of X? How would you rate X?