COMPREHENSION STRATEGIES, WORTH AND CREDIBILITY MONITORING, AND EVALUATIONS: COLD AND HOT COGNITION WHEN EXPERTS READ PROFESSIONAL ARTICLES THAT ARE IMPORTANT TO THEM

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ABSTRACT: Fifteen active social scientists read self-selected professional-level articles pertinent to their interests and professional activities. Verbal protocols were generated during reading. All readers exhibited a number of comprehension strategies normally associated with sophisticated, self-regulated reading. They also monitored the worth and credibility of the texts they were reading. There was a strong association between such monitoring and salient evaluative reactions of the text. Expert reading is both the cold cognition emphasized in previous information-processing analyses and the hot cognition emphasized by scholars of rhetoric who have studied professionals as they read.

What does skilled reading look like? A predominant theoretical view is that it involves strategies, monitoring, and prior knowledge activation (e.g., Baker & Brown 1984). Psychologists and reading researchers interested in information

processing have produced support for this perspective, particularly highlighting the role strategies play in skilled reading.

For example, Lundeberg (1987, descriptive study) had law professors and attorneys read two legal cases. Lundeberg's subjects were active processors as they read such technically demanding material. More than 80% evidenced the following strategies: (a) They attended to important contextual information pertaining to the case, including headings in the writeup, specifications of the parties involved in the case, the type of court, the date, and the name of the judge. (b) The experts previewed the length of the writeup, the facts of the case, the decision, and the actions taken. (c) They reread analytically both the facts and the rules of the case. (d) These experts in the law synthesized the text, integrating the facts, rulings, and rationales, sometimes offering hypothetical alternative outcomes that might have been reached in the case. (e) They evaluated whether they approved or disapproved of the ruling and offered their viewpoints about how this case related to other knowledge they possessed about the law.

Lundeberg's (1987, descriptive study) results are generally consistent with others reported in information processing analyses of reading. Thus, in Wade, Trathen, and Schraw (1990), university students studied a passage from Rachel Carson's (1951) *The Sea Around Us.* Their participants used 14 different strategies: highlighting, underlining, and circling; copying key words, phrases, or sentences; paraphrasing in notes; outlining; diagramming; rote learning of specific information; mental integration; relating information to background knowledge or experience; imaging (visualizing); self-questioning and self-testing; reading only; skimming; reading slowly; and rereading selected portions of the text. Both Afflerbach (1990) and Pritchard (1990) examined use of strategies when prior knowledge related to a text was high and when it was low. Afflerbach (1990) reported much more reliance on prior knowledge strategies in the construction of main ideas from text when chemistry and anthropology doctoral students read in their areas of expertise than when they read in an area of nonexpertise (i.e., anthropology & chemistry respectively). Similarly, Pritchard (1990) observed many more prior knowledge-based strategies and generally more strategically sophisticated reading when readers read information pertaining to their own culture rather than to another culture. Thus, competent adult readers manifest a variety of strategies when they read materials not intended for a specialist audience. Furthermore, strategies that involve relating text to prior knowledge are more salient when readers possess background knowledge relevant to the text than when they do not have related prior knowledge.

When investigators from other perspectives have examined skilled reading, they have focussed on different aspects of it, however. In particular, a number of recent analyses by rhetoricians have documented the evaluative nature of skilled reading, establishing that readers make extensive judgments about the worth and quality of what they read. For example, Geisler (1991) reported that when philosophers read philosophy, they were particularly attuned to the authorship of readings as they critiqued the views expressed in the readings. Their exten-

sive prior knowledge seemed to enable evaluative activities. Wineberg (1991) concluded that as historians read history texts, they looked for the subtext—the authors' "purposes, intentions, and goals (p. 498)," as well as their "assumptions, world views, and beliefs (p. 499)." Haas and Flowers (1987) reported that psychology graduate students evaluate the purposes of authors of psychology texts. Schwegler and Shamoon (1991) analyzed the evaluative critiques of sociologists as they read papers written by sociology students. Although Schwegler and Shamoon noted sociologists' use of strategies to comprehend text, such as imagery and context clues, they, nonetheless, emphasized the interpretive activities of the sociologist readers. Charney (in press) reported that natural scientists in her study analyzed and critiqued the rhetorical devices used in scientific writeups. They also made evaluations about the validity of the claims in texts.

The most frequently cited investigation generated by the rhetoricians is Bazerman (1985) who studied seven physicists as they read. The scientists attended to information that was especially relevant to their interests and needs. Most pertinent here, Bazerman's physicists made trenchant evaluations of what they were reading, especially when reading articles close to their own expertise. His experts frequently made observations such as the following:

> . . . only a careful guy does these things (p. 16). Some . . . experimental sections are crisply clear and little goodies are buried in it, like 'it turns out that one cannot do it this way because' . . .or 'there is a little artifact in these results' and the guy spells out how he avoided it. Very good. This kind of paper you can believe because the guy clearly knows what he is doing (pp. 16–17).

Bazerman (1985) concluded that when scientists read articles of great relevance to them, they often relate the content in the articles to extensive and affect-laden prior knowledge.

There is something of a schizophrenic feeling when the findings produced by psychologically-oriented investigators are juxtaposed with those produced by rhetoricians. Yes, there is some reference to evaluation and "hot" cognition (see Brown, Bransford, Ferrara, & Campione 1983) in the psychological descriptions and occasional references to "cold" (again, Brown et al. 1983) cognitive processes such as comprehension strategies in the rhetoric studies. Nonetheless, the general sense conveyed by the psychologists is that their readers are mostly engaging in comprehension strategies that should increase encoding and memory of author-intended meanings in text. The psychologists do not describe skilled readers as much concerned with evaluating the worth and sensibility of text and certainly not as much so as the rhetoricians.

What is reported here is evidence that both the psychologically-oriented investigators and the rhetoricians provided accurate portrayals of skilled reading. The skilled reading analyzed here involved massive use of strategies and monitoring but also was extremely evaluative. Our analyses permit an integration of the

perspectives emerging from the information-processing-oriented studies of skilled reading and the investigations produced by scholars of the rhetoric.

We reasoned that exceptionally skilled reading might be found in populations who are extremely intelligent, highly motivated, and well read. Thus, professors active in their fields of research were recruited as subjects for this study. An additional assumption was that reading might be especially adept if the reading task was extremely well matched to the knowledge and interest of readers. Thus, the participants in this study read articles selected by them as extremely relevant to their interests and something they should read as part of their work. Because we believed our chances of recognizing highly skilled reading behaviors might be greater with readers who are social scientists (i.e., because we are social scientists and thus familiar with the genres of social science), the focus in this study was on how professional social scientists process text. In order to have some control over the genre read, the participants read journal articles, with all of the disciplines selected for this study adhering to the APA style manual. Thus, the forms of the articles read in this investigation were similar to the form of the article you are now reading.

Because our goal in designing this study was to make it sensitive to the variety of reading processes domain experts might exhibit, we chose to evaluate experts' think-aloud data from the ground up (see Strauss & Corbin 1990), letting the data drive the analyses. On the other hand, we did not come to the data without preconceptions about the nature of skilled reading. Rather we were sensitive throughout the investigation to the possibility of strategic, monitoring, and evaluative reactions. Our view was that the more exhaustive our analyses, the more realistic they would be with respect to the multiple processes used by skilled readers as they attempt to understand expository prose (e.g., see Britton, Glynn, & Smith 1985).

METHOD

PARTICIPANTS

Fifteen social science professors from the Washington, D.C. area were selected based on their high level of academic expertise in a social or behavioral science. All were university faculty with rank of assistant professor or higher. In identifying a pool of potential "expert" participants, the following criteria were applied: (a) The participant possessed a doctorate in a social or behavioral science. (b) The participant had published at least five articles in selective outlets over the last five years. None of the participants, however, had written on reading strategies, nor was there any reason to believe that any had particular scholarly expertise about the nature of skilled reading. (c) No more than two faculty members were selected from a single department of any university. Of 17 experts identified and

contacted about participating in this study, only two did not agree to take part. The participants included 10 males and 5 females.

PROCEDURE

Once a social scientist had agreed to participate in the study, one researcher (out of the six co-authors) was assigned to make all further contacts with that participant. All meetings were held in the participant's own office or home, depending on his or her preference. The main steps in the study were as follows:

1. First Meeting. The participant was told that the aim of the study was "to investigate how experts stay current in their fields of expertise." Participants were asked some general questions about how they stayed current, including questions about the role of reading in staying current and about sources they read for information related to their professional interests. Participants then were asked to select three research articles that they had not yet read but would be interested in reading as part of "staying current in their field." The researcher requested that the participant not begin reading the articles, that they make their selections on the basis of author and title only. The participants were permitted as much time as they needed to find these articles, with most identifying articles within a day or two of the initial interview. The investigator arranged for two copies of each of the three articles to be available for the second meeting.

2. Second Meeting. The entire second session was recorded on audio tape. At the start the investigator explained that the session would be devoted to working with one article. The investigator and subject then chose an article. The initial selection of three articles permitted the researchers to eliminate articles whose format was inappropriate for this study. In several cases, for example, articles were discarded because they lacked a research component. Using a pool of three articles also allowed for the possibility that an article selected on the basis of author and title might prove not to be of interest to the reader once he or she began reading. The one time that occurred, the reader was permitted to stop reading the low interest piece, with think-aloud data then collected on a subsequent article. All of the articles that provided protocol data for this study were published in selective scholarly journals. In all cases but one, the article was the report of original empirical research; in the one outlying case, the article was a position piece on a particular research direction.

Participants were directed to "read the article as they normally would." They were encouraged to think aloud as they went through the article, offering any comments or explanations they wished. Using the duplicate copy of the article, the investigator followed the participant actions, making notes on any aspect of the participant's behavior that pertained to processing of the article. For example, the researcher noted indications of the reading path taken through the article—when different sections were begun, pages turned, text underlined,

verbatim statements made, and so on. Observations of participant's nonverbal behaviors also were noted on the researcher's copy. If more than two minutes passed without any verbal comment from the reader, the investigator prompted the reader with the question "What are you doing now?" At the end of the session, the researcher collected the participant's copy of the article so that any markings the participant made could be analyzed further. Reading during this session took from approximately 45 minutes to 2 hours. Much of the variability in total reading time was due to differences in the lengths of articles selected by the various participants.

3. Documentation of the Think-Aloud. Records of the second meeting were expanded into a comprehensive chronological description of the participant's activities while reading the article. In this process, the researcher's notes, audio recording, and any annotations on the participant's copy of the article were combined to generate a thick description of the participant's reading behavior.

Third Meeting. In the third and final participant-investigator meeting, the investigator gave the participant a copy of the protocol and Reading Strategies Inventory for discussion. This provided an opportunity for participants to identify problems in the description and analysis of their reading strategies. When the participant disagreed with the description or analysis (which was extremely rare and never with respect to a major conclusion in the protocol), the disagreement was noted and an adjustment in the protocol considered later by the researcher following additional review of the raw data.

The entire cycle of three meetings extended from 3–4 weeks to several months, since meetings were scheduled at the participant's convenience. The interval between the second and third meeting was determined principally by how long it took to generate a protocol from the information collected during the read-aloud.

DEVELOPMENT OF A READING BEHAVIORS INVENTORY

There were three main stages in the development of the Reading Strategies Inventory, which specified the categories of strategic behaviors used to code the data collected in this study: (a) In the preliminary phase, five members of the research team each worked with their first participant's protocol and began an analysis of the observed reading behaviors, following a modified version of the method of constant comparison (Strauss & Corbin 1990). That is, they examined and re-examined their protocols, attempting to identify categories that exhaustively accounted for the behaviors in their protocol. (b) The members of the research team met and compared categories they had observed and then re-examined data generated by their own participant in light of categories identified by their co-workers. Over the course of several meetings, analysis and discussion of strategies used by these first 5 participants resulted in a long list of individual strategic behaviors. Additional meetings then occurred, each one followed by re-analysis of the reading protocols of the first 5 participants and

reflection on the categories of reading behaviors that typified what was observed in the reading of the first participants. (c) After about eight weeks of reanalyses and reflection, the six co-investigators were satisfied that the most critical reading behaviors were captured adequately by the categories summarized in Appendix A. The scoring categories were grouped into theory-based sets and subsets as reflected in the organization of Appendix A.

PROTOCOL SCORING

The Appendix A version of the Reading Strategies Inventory was applied to all 15 protocols collected in the study. Two researchers scored each protocol, the researcher who had had face-to-face contact with the participant and one other member of the research team. Each of the 6 members of the research team scored between 2 to 4 protocols they had collected and another 2 to 4 protocols collected by others. The team continued to meet frequently to assess whether the existing set of reading strategies needed to be modified. There were very few behaviors (and no potentially important ones in our view) produced by the 15 participants that were not consistent with the Appendix A categories. In general, there was high agreement between the two raters with respect to categorization of the reading behaviors that occurred (i.e., always 85% or higher). The disagreements that did occur were resolved readily by discussion, informed by re-examination of the raw data. In the results section that follows, participants' behaviors were categorized as never occurring, occurring once, occurring 2 to 4 times during the session, or occurring 5 or more times. At this level of detail, there was little disagreement at all between raters (i.e., although the two raters might disagree whether 7 or 8 instances of a behavior occurred, this made no difference when the response classification was that the behavior occurred "5 or more times").

RESULTS

GENERAL SUMMARY OF THE BEHAVIORS EXHIBITED BY READERS

Much of the reading behavior could be summarized with a few descriptive statements. Approximately half of the readers surveyed the text before reading it (8 of 15 did so) and the remaining readers (n = 7) did not. The majority of participants (11 of 15) generally read the article from front to back. Even in those cases where reading was not strictly front to back, readers read large sections of the text from beginning to end (all 15 readers did so). Eight of the 15 readers did not skip over or leave out any large sections of text as they read (although they may have skipped ahead or backward at some point to locate particular information). The strategies, monitoring processes, and types of evaluation that occurred at least once for 80% or more of the participants are recorded in Table 1.

The portrait of our typical reader that emerges from Table 1 is an active reader who (a) uses well-regarded comprehension strategies such as predicting and

TABLE 1
Frequent Reading Behaviors

Behavior	*Number of Readers (of 15 Total) Exhibiting Behavior*			
	0 Times	*1 Time*	*2–4 Times*	*5+ Times*
Strategies				
Anticipates/predicts information that will be presented; tests predictions.	3	2	4	6
Indicates looking for information relevant to personal and/or professional goals (own research, writing, teaching, bibliography).	3	2	7	3
Jumps forward (at least 30 secs); looks forward in text for particular information and returns.	1	1	6	7
Jumps back (at least 30 secs); looks back for particular information and returns.	2	1	7	5
Rapidly goes back and forth in text (to go to table or figure, to guide further reading of the article, to compare table or figure with text, or to integrate across different parts of text).	1	4	4	6
Backtracks (rereads a sentence for clarification).	3	2	7	3
Attends closely to figures or tables	3	4	6	2
Varies reading style according to relevance of text to reading goals.	2	0	3	10
Constructs paraphrases/explanations of what is in the text and/or gives examples.	1	1	2	11
Constructs conclusions or summary interpretations beyond information provided in article (e.g., summary of results, tables, discussion, conclusions).	3	2	4	6
Monitoring				
Explicitly notes how difficult the text is to read (reading is easy, difficult, she/he does not understand text, something in text is puzzling).	2	3	3	7
Explicitly notes when something in text is already known or not known.	3	2	3	7
Evaluates relevance to goals (Is what is being read the specific information sought from the article? Is this relevant to own research, writing, teaching, bibliography?)	3	1	4	7
Evaluations				
Reacts evaluatively to information based on own knowledge.	0	0	3	12
Reacts to information based on very personal prior knowledge (e.g., own theories, own writing, knows author personally).	3	1	4	7
Evaluates the text (quality of lit. review and citations, theoretical perspective, methods, analyses, results such as the novelty of findings, conclusions, discussion, writing/editing style, biases of author).	0	0	2	13
Expresses negative affective reactions (e.g., anger, weariness, or boredom).	3	1	6	5
Expresses interest.	2	3	6	4

verifying predictions, summarizing, elaborating on text, seeking clarification, and reading selectively; (b) monitors comprehension and important characteristics of the text, such as its difficulty level and relevance to reading goals; and (c) evaluates the adequacy of text form and content. One of the most striking aspects of the results recorded in Table 1 is that every participant evaluated the text they read.

The prevalence of the 18 frequent behaviors (from Table 1) in the behavior of the 15 individual participants is recorded in Table 2. The majority of the 18 behaviors were observed in all readers: Five readers exhibited all 18 frequent behaviors; two exhibited 16 of 18 of the behaviors; two exhibited 15 of the 18 frequent behaviors; two exhibited 14 of the behaviors; one each exhibited 9, 11, 12, or 13 of the 18 behaviors. Other behaviors that occurred less frequently are summarized in Table 3, along with the number of participants exhibiting the behavior one or more times. The collection of diverse reactions summarized in Table 3 reveals that, whereas there was commonality in the behaviors of our participants as reflected in the Table 1 data, there was plenty of individuality as well. In closing this subsection, we emphasize that it was particularly striking that every participant in the sample used strategies, monitored understanding, and evaluated the article they were reading.

A Sample Protocol. Both the orderliness and the complexity of reading professional text was obvious in every protocol generated in this study. For example, JK, a professor in education, interwove strategic, monitoring, and evaluative reactions with other behaviors to make sense of the journal article he was reading. In order to illustrate the quality of commentary that readers were able to provide to us while they read text, a number of JK's observations are presented in his own words. We emphasize that JK is illustrative and that every participant in this study provided protocols that were arguably as lucid and clear as this one. For organizational clarity and explanatory value, this section is arranged in parallel to the coding scheme detailed in Appendix A.

Linearity and Nonlinearity of Reading. The researcher working with JK kept track of linearity of his reading by periodically recording where JK was looking in the article, especially when he moved from one section of the paper to another. These observations were not fine-tuned, but even at a paragraph or section level, they helped establish patterns of movement in text. For example, when JK began reading the article, he selectively skipped the abstract. He related the following to the researcher at the moment he decided to pass over the abstract:

> I tend to ignore abstracts. I don't know why; I just do. Uh, sometimes because they're so short that it doesn't tell me much.

Before reading the article carefully, JK briefly surveyed it. Following the survey, JK's overall reading pattern was front-to-back, line-by-line. Within this pattern of linear reading, however, there were many specific instances where JK

TABLE 2
Individual Subject Data for Frequent Behaviors

				Reader				
Behavior	*F1*	*M1* *(JK)*	*M2*	*M3*	*F2*	*F3*	*F4*	*M4*
Strategies								
Predicts	2–4	5+	0	5+	2–4	2–4	0	5+
Looks	5+	5+	1	2–4	2–4	2–4	2–4	1
Jumps Forward	2–4	5+	5+	0	2–4	5+	2–4	5+
Jumps Backward	2–4	5+	5+	0	2–4	2–4	2–4	2–4
Jumps Back & Forth	5+	5+	5+	2–4	5+	1	1	0
Backtracks	2–4	5+	1	1	2–4	0	2–4	0
Varies Reading Style	5+	5+	2–4	5+	5+	0	2–4	5+
Attends Tables/Figures	2–4	2–4	5+	1	2–4	2–4	1	5+
Constructs Paraphrases	1	5+	0	5+	2–4	5+	5+	5+
Constructs Conclusions	2–4	5+	0	2–4	2–4	5+	2–4	5+
Monitoring								
Notes Difficulty	1	2–4	5+	0	5+	0	5+	5+
Notes What is Known	5+	5+	0	2–4	1	5+	2–4	2–4
Evaluates Relevance	5+	5+	0	2–4	2–4	5+	5+	1
Evaluations								
Reacts Evaluatively Based on Own Knowledge	5+	5+	2–4	5+	5+	5+	2–4	5+
Reacts Based on Very Personal Prior Knowledge	2–4	5+	0	5+	2–4	5+	2–4	0
Evaluates the Text	2–4	5+	5+	5+	5+	5+	5+	5+
Negative Affective Reaction	5+	5+	0	2–4	2–4	5+	2–4	0
Expresses Interest	5+	2–4	0	1	1	1	5+	2–4

				Reader			
Behavior	*M5*	*F5*	*M6*	*M7*	*M8*	*M9*	*M10*
Strategies							
Predicts	5+	0	1	5+	5+	2–4	1
Looks	0	0	2–4	0	2–4	2–4	5+
Jumps Forward	5+	2–4	1	2–4	2–4	5+	5+
Jumps Backward	0	2–4	2–4	5+	1	5+	5+
Jumps Back & forth	2–4	1	2–4	5+	2–4	5+	1
Backtracks	2–4	5+	0	2–4	2–4	5+	2–4
Varies Reading Style	5+	5+	2–4	0	5+	5+	5+
Attends Tables/Figures	1	1	0	2–4	0	2–4	0
Constructs Paraphrases	5+	5+	5+	5+	2–4	5+	5+
Constructs Conclusions	5+	5+	0	5+	1	1	0
Monitoring							
Notes Difficulty	5+	5+	1	2–4	2–4	5+	1
Notes What is Known	0	5+	5+	0	5+	1	5+
Evaluates Relevance	0	2–4	5+	0	2–4	5+	5+
Evaluations							

TABLE 2
(Continued)

Behavior	Reader						
	M5	F5	M6	M7	M8	M9	M10
Reacts Evaluatively Based on Own Knowledge	5+	5+	5+	5+	5+	5+	2–4
Reacts Based on Very Personal Prior Knowledge	5+	1	5+	0	5+	2–4	5+
Evaluates the Text	5+	5+	2–4	5+	5+	5+	5+
Negative Affective Reaction	5+	2–4	2–4	0	5+	1	2–4
Expresses Interest	0	5+	2–4	5+	2–4	2–4	2–4

Notes: Females partipants denoted with F and males with M. The first male is JK, whose protocol was discussed in the text. Subjects presented in order of participation in the study. Frequencies are presented as 0, 1, 2–4, and 5+ rather than an exact number because coding was highly reliable (95% of higher) at this level of detail. Because articles differed in length, differences in the absolute number of responses made by participants should not be interpreted.

jumped ahead or back, sometimes briefly and sometimes for a longer period of time (i.e., several minutes). JK reported skipping around in order to look for information in another section of the article or to clarify a statement he had just read.

Goal Awareness. JK frequently mentioned specific information he was looking for in the article. For example, he looked for information in the introduction, references, and results sections; JK also evaluated whether what he was reading was the information he was seeking. Furthermore, JK frequently mentioned looking for information relevant to his professional writing, and he evaluated whether the article was relevant to his own writing. This comment is typical of the goal awareness statements made by JK:

> One of the reasons that I'm reading this paper is so that I can write . . . [a] paper, looking at how they're defining problem-solving, which is right down here.

Awareness. JK expressed self-awareness about his reading. For example, he talked about his personal reading strengths, such as interpreting tables:

> I can usually get a lot by looking at tables, and so I typically look at tables.

JK also talked about things he typically does when he reads, showing his awareness of his reading habits:

> Sometimes what I do is just what I did right now, is I sort of scan; I scan it, and I try to pick up major authors.

TABLE 3
Reading Behaviors Exhibited by Fewer than 80% of Participants

Behavior	Number of Readers (of 15 Total) Exhibiting Behavior
Strategies	
Indicates from outset that very specific information is being sought and looks for it	10
Notes parts of text to be read later (or citations to be read later) or to remember for future reference	10
Verbally relating material from different parts of the text	10
Watches for particular information throughout reading	9
Reading the reference list to activate prior knowledge	9
Expresses intention to read parts of text in particular order	8
Noting relations among different parts of a section or an argument	8
Highlighting with underlining or other markings	8
Reading aloud	6
Deciding to look (later) at materials that are related to what is read in the text	5
Exploiting personal strengths (e.g., paying more attention to tables because reader believes she/he is better at comprehending tables than text)	4
Summarizing the entire paper after reading it	4
Writing elaborations of ideas in the text on the text	3
Writing notes pertaining to the text on separate pieces of paper (or microcomputer file)	3
Explicitly making notes on a figure or table	1
Monitoring	
Indicates awareness of personal biases and expectations of text	11
Explicitly notes when something is worth or not worth knowing	10
Explicitly notes when something is taken from another source	9
Adjusts attention to text depending on relevance to reading goals	9
Noting that the text contradicts a belief held by a reader	7
Evaluations	
Expressing surprise by what is in text	11
Responding nonverbally (laughs, looks puzzled, makes gestures, gives raspberry, scratches chin, slaps forehead)	10
Expressing boredom	9
Swearing in reaction to text content	9
Expressing positive affect	8

JK showed awareness of differences in importance of parts of the text, carefully reading some parts of the article but skimming others, depending on relevance to his reading goals. JK talked about his expectations of the text and mentioned a bias he had toward the text:

> So, my guess is that this isn't the same paradigm that I work out of. I think it's an old paradigm; I don't think it's very fruitful to keep investigating this.

Although JK often read aloud, the researcher could not tell whether he did so to clarify the article for the researcher or for himself.

Planful. Before and during reading, JK made conscious decisions about how he was going to read the text. For example, he mentioned specific information he would be watching for throughout the article. He also mentioned his intention to read sections in a specific order:

> So what I'm going to do is I'm gonna start looking at the background and theory because I want to see what kind of a, where this person comes at from his theoretical perspective.

More than once, JK anticipated information that would appear in the text, including anticipating where he might find information if he looked back in the article. JK also studied tables and noted parts of text that he might go back to later if he wanted more information or clarification. JK adjusted his attention to the text, reading more slowly when he came to a part that seemed relevant to one of his goals. During the reading, JK often explicitly decided to continue reading although he said in other circumstances (i.e., if he did not have the pressure of writing a chapter hanging over him), he might have stopped, based on what he had seen so far:

> So that tells me something real quickly about the theoretical background which might tell me that I don't know if I really want to get involved in this thing. But anyway, I'm gonna now go ahead and read it. I'll skim parts of this just to see what they have to say because it's so important for me to know what this article is about, because of this chapter that I'm gonna write this critique for.

Monitoring. Although the researcher could not tell from the data if JK reread for clarification sentences that had just been read, JK did backtrack to other sections for clarification:

> So now that I looked at the instruments they used, I'm gonna go back and look at the design a little bit more because I didn't really look very closely at the design or at the instruction. So I went back.

On multiple occasions, JK mentioned whether he understood the text, whether it was puzzling, whether he knew it before, whether it was worth knowing, or whether the information was based on another source.

Relating Information to Prior Knowledge Base and Evaluative Reactions. JK often evaluated the text negatively, based on his background knowledge; he reacted to knowledge from his personal experiences, and he noted when the article contradicted his beliefs:

> And so, you know, I'm sitting here now thinking this paper does everything that I think it shouldn't do. For instance, it really doesn't measure in any kind of detail the students' conceptual understandings.

JK frequently evaluated the paper's theoretical perspective and methods. He commented on some statements in the results and the discussion sections. His prior knowledge of methods in the discipline was his main basis for evaluation:

> Not only that, so this thing does not measure the impact of conceptual knowledge, but then they sort of ignored treatment. And the treatment that they do is fairly terrible.

Going Beyond the Information Given (Elaboration). JK elaborated on the text by constructing conclusions beyond those provided in the article. He frequently explained and paraphrased parts of the text, interpreted results and tables, gave examples to elaborate on the article, and made summary interpretations of issues in the text:

> And I'm looking at the scores on the prior knowledge test. And you'll notice they're fairly high. It's 13 out of a possible 15. So, you know, you wonder: What did that really measure? Looks like it kinda topped out.

JK also went beyond the information given by looking at the article from other people's perspectives:

> I'm wondering to myself why they would do this—these guys are some fairly good researchers—why they're using this instrument.

Integration. JK often integrated information from different parts of the text. For example, he used information he had just read to anticipate information that might appear elsewhere in the text. JK moved back and forth in the text to make sense of the information. JK also compared the text to the tables and verbally connected different parts of the text:

> I'm looking at table six. I believe it's that regression equation that they were talking about where it came out that, uh, the only significant F was the pretest variable.

Written Responses. JK did little in-text writing in response to the text, writing only one brief marginal note. After reading, however, JK wrote many notes on a computer in reaction to the entire paper:

> I'm here now behind my computer, which I usually do. I, typically, I never write with a pen or pencil and paper because if I do I can't read it the next day. I usually sit down behind my computer and I develop some key points. But anyways, I'm sitting here thinking right now about what are the main points

that are in the [says authors' names] article related to this review that I'm doing.

Affective Reactions and Nonverbal Responses. During reading, JK sometimes expressed emotions such as surprise, interest, anger, and fatigue. A few times, JK mentioned interest or lack of interest in parts of the article. He said he was surprised at something in the research methods. When he decided to stop reading the article, he said he was tired. During the reading, JK often expressed negative reactions. For example, he often seemed angry about the research methods used in the study:

> And it sort of gets me angry that we don't use better instruments.

JK expressed his affective reactions both verbally and nonverbally. He gestured, throwing his hands in the air. He gave a raspberry to something in the text. And he frequently used slang or swore when talking about the text:

> You know, so they know very little about balancing equations before and very much after. Well, that's baloney. They know how to mechanically solve those problems afterwards. It's not that they know a lot afterwards.

Summary. JK experienced little difficulty in generating protocol information while reading an article that was important to him. The researcher who met with JK experienced little difficulty in coding his reading behaviors, with the second rater easily able to confirm the classifications based on JK's comments. JK's reading was active and strategic, with monitoring enabled by extensive prior knowledge permitting ready evaluation of the text in a fine-grained fashion (e.g., evaluation of particular methods used, particular authors cited, etc.). (Those desiring to read another detailed protocol from this study, see Pressley et al. 1992.)

CORRELATIONAL ANALYSES

If evaluations are the product of either use of comprehension strategies or monitoring, then correlations between strategies and/or monitoring and evaluative activities would be expected. In order to assess these possibilities, a strategies score, monitoring score, and evaluation score was generated for each participant. Scores were based on *all* (frequent and infrequent) strategic, monitoring, and evaluative behaviors summarized in Tables 1 and 3. For each category (e.g., anticipates/predicts information that will be presented; tests predictions), a subject was assigned a score from 0 to 4 depending on the frequency of the behavior in their protocol: 0 for no instances of the behavior, 1 for 1 instance, 2 for 2 to 4 instances, and 3 for 5 or more instances. Then, total strategies, monitoring, and evaluation scores per subject were calculated by summing over all of the strategies, monitoring, and evaluation categories re-

spectively for each subject. Across all subjects, the mean strategies score was 26.86 (S. D. = 6.95) out of a possible 75, the mean monitoring score was 11.73 (S. D. = 4.64) out of a possible 24, and the mean evaluations score was 17.73 (S. D. = 4.46) out of a possible 30. The correlation between strategies and monitoring was $r = .34$, $p > .10$; strategies and evaluation, $r = .45$, $p > .05$; and monitoring and evaluation, $r = .77$, $p < .001$. Notably, when the effects of strategies were controlled statistically, there was very little reduction in the monitoring and evaluation association, partial $r = .74$, $p < .001$; in contrast, there was descriptively greater reduction in the strategies and evaluation association when the effects of monitoring were controlled statistically, partial $r = .31$, $p > .10$. Once monitoring was entered into a regression equation as the better predictor of evaluation behaviors (which it entered at $p < .005$), strategies could not enter as a significant predictor ($p > .25$). The strong association between monitoring and evaluation will be taken up in detail in the discussion, since this association potentially permits reconciliation of the psychologically-oriented descriptions of skilled reading and the descriptions produced by rhetoricians.

DISCUSSION

Although this study seemed to capture a greater diversity of reading behaviors than previous think-aloud reports (i.e., in contrast to information-processing analyses that are mostly strategies and monitoring with little evaluation and in contrast to rhetoricians' accounts which focus on evaluations), it was possible to discern order in the data and answer an important question: What do highly competent social scientists do when they read social science journal articles? In many ways these readers seemed like the ideal described by Baker and Brown (1984): (a) They apply some of the strategies that are useful in understanding all types of text, including anticipating and predicting what will be in text, reading selectively to identify information relevant to one's reading goals, moving back and forth in text to find important information, rereading when confused, varying reading style according to reading goals and the relevance of parts of text to those goals, and summarizing. (b) They pay close attention to some features of research articles unique to the genre, such as tables, figures and reference lists. (c) They monitor the difficulty of a text, whether the content covered in the text is known or unknown, and whether the material currently being read is relevant to reading goals or otherwise worthwhile to know. (d) They do not accept the content of research articles at their face value. Rather, they evaluate whether articles are consistent with their prior knowledge, assessing the credibility of the new information in light of prior knowledge and beliefs. Skeptical reactions are common. (e) They follow no hard and fast rules with respect to order of application of strategies or the timing of monitoring and evaluations. Rather, social scientists read flexibly, with their processing largely in reaction to particular pieces of information in text.

Although strategies, monitoring, and evaluation are part of skilled reading by social scientists, how these are manifested vary tremendously, from reader to reader and probably from article to article. Skilled reading by social scientists involves complex intermingling of attempts to understand text (i.e., strategies), regulation of those attempts (i.e., monitoring), and judgments about what has been read (i.e., evaluations). This very active reading by experts contrasts with passive and uncritical acceptance of information, which typifies the reading of young adults reading advanced text (e.g., Haas & Flower 1987; Wineberg 1991). The research tactic taken here of asking experts to read an article of great interest to them in an area of high and very particular expertise (e.g., science education from a cognitive developmental perspective, social psychology of communications) paid off. It provided a window on the active construction of meanings from advanced-level texts, processing that is expert reading of social science content.

One of the most important results in this study was the identification of a very clear association between monitoring activities and evaluations, suggesting that these measurements are possibly two sides of a coin. What a purely information-processing analysis would have been sensitive to would have been the monitoring processes, whereas a rhetorical analysis would have been sensitive to the evaluations. By capturing both monitoring processes and the valuations in the same analyses, an explanatory hypothesis emerged: The evaluations so prominently documented by rhetoricians are the result of complex and multifaceted monitoring of the worth and credibility of text being read. These worth and credibility monitoring activities can be summarized as a series of questions that social scientists considered as they read text:

- Is this text relevant to my purpose? Is the whole article relevant? Are parts of it more relevant than others?

- Is the content of this article already known to me?

- Has the information in the text been taken from a different source? Is it consistent with other sources?

- Is what is being read worth knowing? Is the whole article worthwhile? Are parts of it more worthwhile than others?

- Is the text difficult or easy to read?

- Is the text consistent with my biases, beliefs, and expectations?

The data reported here rule out the possibility that evaluations are simply consequences of applying the comprehension strategies summarized in the strategies section of Table 1: That associations between monitoring and evaluation were very large relative to the associations between the strategies, monitoring, and evaluation data bolsters confidence that the large correlation between monitoring and evaluation is interpretable. Specifically, the pattern eliminates

an alternative explanation that the high monitoring and evaluation correlation might have been produced by some subjects doing more talking aloud than others as they read. If the relative verbosity of participants could explain the monitoring-evaluation association, however, it would be expected that all three of the correlations between strategies, monitoring, and evaluations would have been high, since measures of strategies, monitoring, and evaluations all would be expected to vary with verbosity. That was not the case.

In summary, the grounded theoretical approach taken here did exactly what it is intended to do. It produced a theory that potentially explains a behavior prominently reported in other studies: The propensity of experts to generate evaluations while they read may be due to extensive worth and credibility monitoring as part of text processing. Whether this theory can be tested in a manipulative study remains to be seen. Such a test could only be conducted with readers possessing extensive prior knowledge in the area being read, for only people knowledgeable about the domain of a piece being read could appraise the piece on the dimensions of worth and credibility used by the readers in this study. If the number and quality of evaluations by expert readers can be affected by directions or other manipulations that increase or decrease worth and credibility monitoring behaviors, it would be powerful evidence that worth and credibility monitoring is a causal factor in production of evaluations of text. That is, the possibility that extensive monitoring is somehow stimulated by evaluations could be ruled out by a manipulative study. So could the possibility that the relationship between worth/credibility monitoring and evaluations is caused by some other third factor besides use of strategies or verbosity, such as general intelligence. The determination in this study, however, of a clear correlation between worth and credibility monitoring and evaluations is an important (and some would claim, necessary; see Underwood 1975) first step in the study of a potential causal process in skilled reading.

The findings reported here on domain experts' reading behaviors complement well the many studies of problem-solving by domain experts (e.g., see Chi, Glaser, & Farr 1988; Lesgold et al. 1988): (a) Domain experts use their prior knowledge extensively during problem solving, recognizing large patterns and strong connections with previous experience. So it was here, for example, when JK recognized the weakness of the research reported in the article he read. (b) Experts are opportunistic, using clues they encounter while solving a problem to assist in deciding next moves. So it was here—for example, when readers moved forward and backward in text to find particular pieces of information that they considered important as part of processing the text. (c) Experts exhibit flexibility as they solve problems. So it was here, with diverse tactics used to come to terms with text. (d) Experts monitor their performances. So it was here, with monitoring of understanding, difficulty of text, and pertinence of the text to the reader's goals. (e) Experts process very "deeply" as they solve problems; that is, expertise in problem solving produces a complex thinker who does not simply apply readily available prior knowledge to a problem but rather uses prior

knowledge in conjunction with strategies, continually monitoring progress in understanding problems. So it was here as experts read text.

The high degree of commonality in strategies, monitoring, and evaluations obtained in this investigation is striking given that the readers represented different areas of the social and behavioral sciences and were reading different texts. When common reactions across subjects have been obtained previously in studies in which think-aloud data have been collected (e.g., many of the studies of expert problem-solving summarized in the last paragraph), subjects reacted to a common problem, task, or text, opening up the possibility that the similarities in patterns of thinking might be artifacts of the particular content processed. That commonalities in processing were observed here despite diversity of materials increases confidence in the generality of the conclusions offered here, at least with respect to reading research articles in the social sciences.

In summary, there was "hot" cognition observed in this study, reading charged with strong reactions. Despite the presence of strong reactions, however, the rhetoricians' emphasis on interpretive and evaluative activities of readers is somewhat misleading: Our readers also made sophisticated efforts to understand the literal meanings. Balanced descriptions of expert reading require documentation of both "cold" literal and "hot" interpretive-evaluative processing (Black 1985). There is nothing schizophrenic about professionals when they are reading for information processing-oriented reading researchers versus interpretively-oriented scholars in the humanities. The expert head does things both hot and cold as it reads, with the possibility suggested here that some of the cold cognition that is monitoring is the cause of hot cognitions that are evaluations.

APPENDIX A: READING BEHAVIORS INVENTORY

Linearity and Nonlinearity of Reading

Y   N   Surveys text before reading it.

Y   N   Generally reads article from front to back.

Y   N   Reads large section of article in a linear fashion.

Frequency   Jumps forward (Jumps ahead to another section, staying at least 30 seconds) or looks forward in text for particular pieces of information (e.g., footnotes, results, references) and returns.

Frequency   Jumps back (Jumps back to another section, staying at least 30 seconds) or looks back in text for particular pieces of information and returns.

Frequency   Reads selectively in linear fashion (skips some information, then reads closely)

Frequency   • abstract

Frequency   • introduction

Frequency   • methods

Frequency   • results

Frequency   • discussion/conclusion

Frequency   • references

Goal Awareness

Frequency   Highly aware (before reading) of specific information being sought from the article and looks for such information.

Frequency   Looks for information relevant to personal and/or professional goals (own research, writing, teaching, bibliography).

Awareness

Frequency   Reads aloud (and reports would do this if reading alone).

Frequency   Exploits personal strengths (e.g., says can understand tables better than text, so more attention to tables, or *vice versa*).

Frequency   Closely attends to tables/figures.

Frequency   Talks about things, "I typically do when I read."

Frequency   Varies reading style according to relevance of text to reading goals. (Style includes slowing for careful reading, skimming, and very fast skimming.)

Frequency   Expresses own biases/expectations toward text.

Planful

Frequency   Watches for particular information throughout reading.

Frequency   Decides whether to continue reading (based on the abstract or something other than abstract).

Frequency   Intends to read section in specific order.

Frequency   Adjusts attention to material depending on relevance to reading goals.

Frequency   Notes parts of text (e.g., references) to read later or to remember for future reference.

Monitoring

Frequency Backtracks. (Rereads a sentence for clarification or backtracks for stated purpose of clarification.)

Frequency Explicitly notes how difficult the text is to read (reading is easy, difficult, she/he does not understand the text, something in text is puzzling).

Frequency Explicitly notes when something in text is worth or not worth noting.

Frequency Explicitly notes when something in text is already known or not known to him/her.

Frequency Explicitly notes when something is taken from another source (e.g., from a named researcher's work).

Relating Information to Prior Knowledge Base

Frequency Reads reference list to activate prior knowledge.

Frequency Anticipates/predicts information that will be presented; tests predictions.

Frequency *Reacts* to information based on own knowledge (including reactions to the author being read, other authors cited in the text, methods, analyses, content, discussion, or text structure of the paper).

Frequency *Reacts* based on very personal prior knowledge (e.g., own theories, own writing, knows author personally).

Frequency Notes that text contradicts a belief held by the reader.

Evaluative Reactions

Frequency Evaluates relevance to goals.

Frequency • Evaluates whether what is being read is the specific information being sought from the article.

Frequency • Evaluates whether information is relevant to personal and/or professional goals (own research, writing, teaching, bibliography).

Frequency Evaluates the text (including reactions to literature review, particular citations, theoretical perspectives, methods, analyses, results including the novelty of findings, conclusions, discussions, implications, writing/editing style, and biases of the author).

Going Beyond the Information Given (Elaborations)

Frequency   Constructs conclusions or summary interpretations beyond information provided in article. (Comes up with summary interpretation of results, tables, or discussion/conclusion.)

Frequency   Constructs paraphrases/explanations of what is in the text and/or gives examples.

Integration

Frequency   Goes back and forth in text (to go to table or figures or to guide further reading in this article). Goes back and forth between figures/tables and text or compares figures/tables with one another to integrate.

Frequency   Explicitly gets information from text on figure or information from figure on side of text or side of figure.

Frequency   Verbally relates material from different parts of text.

Frequency   Summarizes the whole paper after reading it.

Frequency   Indicates she or he will be looking at other materials later with eye to relating to what is in this text.

Elucidation of Discourse Structure

Frequency   Mentions division or relations among different parts of a section or marks major divisions of an argument (e.g., by writing brief title for division, numbering steps).

Written Responses

Frequency   Highlights (Frequent marking of text to highlight, including underlining, check marks, arrows, brackets, boxes) and marks references/terms to find later.

Frequency   Elaborates (Makes brief summaries of text including marginal notes); sketches the design of the experiment in writing; relabels figures/tables; adds more information to figures/tables; rewrites some information in clearer, more memorable form.

Frequency   Write notes on separate piece of paper or computer.

Affective Reactions

Frequency   Expresses positive affective reactions.

Frequency Expresses negative affective reactions (including anger, tired, or bored).

Frequency Expresses interest.

Frequency Expresses lack of interest.

Frequency Expresses surprise.

Frequency Uses expletives or slang.

Nonverbal Responses

Frequency Laughs, looks puzzled, gestures, gives raspberry, scratches chin, puts hands on forehead.

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