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Construing Constructivism: Reading Research in the United States

Nancy Nelson Spivey

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Abstract

The constructivist tradition in reading research, begun by Bartlett early in the century and reinitiated about fifteen years ago, is producing new insights into discourse comprehension as part of the "cognitive revolution." Constructivism, which provides a coherent framework for studying the reading process, portrays the reader as building a mental representation from textual cues by organizing, selecting, and connecting content. This article reviews research into the organizational, selective, and connective aspects of reading and then assesses the impact of constructivism on four reading-related issues in the United States: readability of texts, assessment of reading ability, instruction in reading, and conception of literacy.

Construing Constructivism:
Reading Research in the United States

By

Nancy Nelson Spivey
Carnegie Mellon

In The Mind's New Science Howard Gardner (1985) maintains that the major accomplishment of the cognitive revolution has been

> the clear demonstration of the validity of positing a mental representation: a set of constructs that can be invoked for the explanation of cognitive phenomena, ranging from visual perception to story comprehension. Where forty years ago, at the height of the behaviorist era, few scientists dared to speak of schemas, images, rules, transformations, and other mental structures and operations, these representational assumptions are now taken for granted and permeate the cognitive sciences. (p. 383)

Certainly in the forefront of the cognitive revolution is research focused on discourse comprehension and thus focused also on the mental representations constructed by readers as they interact with written texts. This new attempt to understand the process of reading has been an interdisciplinary effort, undertaken by researchers from various disciplines, including psychology, linguistics, artificial intelligence, and education —- all of whose contributions are being made within the broad framework of the constructivist tradition. This tradition is both a way of thinking about reading and a way of studying the process of reading.

It is difficult to determine when constructivism began to take hold in the United States. Sometime in the early 1970s cognitive psychologists moved beyond words and sentences to texts as they studied the mental processes involved in human memory and understanding. Some psychologists were beginning to argue constructivist notions: that people, rather than texts, carry meaning and that linguistic inputs merely provide "cues" that readers use along with their knowledge of the world to construct meaning (Bransford, Barclay, & Franks, 1972). American linguists, influenced by the textlinguistic movement in Europe, also began giving more attention to intact texts—applying various discourse analysis procedures as they examined texts as large linguistic units. Researchers in artificial intelligence, intent on programming computers to understand language, even simple stories, were studying the knowledge of text structure and general knowledge of the world that were required for discourse understanding. At the same time, educators were growing disenchanted with rigid taxonomies of discrete reading skills and were listening to radical new ideas about the reader's active role in making meaning from text. Though constructivism would eventually provide a framework for knowledge about reading, in the early 1970s research in reading, especially reading comprehension, was fragmented and lacked a coherent theory. This fact was pointed out by the National Institute of Education when it was created in 1972 (cf. Miller, 1973) and again, four years later, when it established the national Center for the Study of Reading with a leader in constructivist theory as its head and a group of interdisciplinary researchers as its staff—a move that chagrined many reading educators who held different notions about the nature of reading.

Interestingly, American researchers studying discourse comprehension in the 1970s began citing the work of a British psychologist who had studied the reading of texts earlier in the century but whose work had been largely overlooked during the preoccupation with behaviorism and nonsense syllables. They resurrected the ideas and the research approach of Sir Frederic Bartlett,

who reported twenty years of research in the 1932 book, *Remembering: A Study in Experimental and* Social Psychology. Bartlett had his subjects read connected text—most notably, "The War of the Ghosts," a North American Indian tale—and then, after various periods of time, write recalls of what they had read. He studied his subjects' written recalls for deviations from the original material and found modifications, regroupings, and simplifications. Similar methods had been used before by other researchers (Binet & Henri, 1894; Henderson, 1903; Philippe, 1897), but it was Bartlett who proposed a constructivist explanation for the transformations that occurred in recall. He suggested that the changes were due to constructive processing that resulted from his subjects' "effort after meaning" to relate the new information to previously existing knowledge structures. He proposed the notion of *schema* to signify a hypothetical cognitive structure that was

> an active organization of past reactions or experiences, which must always be supposed to be operating in a well organized organic response. That is, whenever there is an order or regularity to behavior, a particular response is possible because it is related to similar responses, which have been serially organized, yet which operate not as individual members coming one after another but as a unitary mass. (p. 201)

Attempting to understand these organized knowledge structures, present-day researchers and theorists have revived, redefined, and expanded "schema theory" and related ideas (cf. R. C. Anderson 1977, 1978; R. C. Anderson & Pearson, 1984; Rumelhart, 1980, 1984; Rumelhart & Ortony 1977; Schallert, 1982; Spiro, 1977, 1980b). A schema (the plural is *schemata) is* conceived to be a global, generic structure in memory that has been abstracted by induction from experience. Hierarchical in nature, it has constituent variables that become slots to fill, or instantiate, in learning. Schemata have been called the "building blocks of cognition" and "the fundamental elements upon which all information processing depends" (Rumelhart, 1980, P. 33). They are thought to play important roles in discourse comprehension and memory, since comprehending involves finding a configuration of knowledge that accounts for aspects of content in a text (Bransford & Johnson, 1972), and remembering sometimes involves reconstructing an interpretation on the basis of a knowledge structure in memory (Spiro, 1980a). Although the term *schemata* encompasses various types of global structures, some distinct types have been suggested: *frames* (Minsky, 1975), plans (Schank & Abelson, 1977), scripts (Schank & Abelson, 1977), and memory *organization packets* (Schank, 1980). Some researchers (e.g., Chiesi, Spilich, & Voss, 1979) have even attempted to map the structure of domains of knowledge.

It is not only Bartlett's concept of organized knowledge structures but also his research approach that characterizes the constructivist tradition today. In his research Bartlett was using the text as a template—a pattern against which he could compare his subjects' recalls and identify the changes they were *making.* And Bartlett's template approach continues to be used today, though in more precise forms *and in* more carefully designed studies. Just as Bartlett was looking for changes made by his readers, researchers today are studying evidence of readers' constructivity. Often using detailed templates of propositions from the text base (cf. Frederiksen, 1975b; Kintsch, 1974; Meyer, 1975), they seek insights into the nature of the mental representation by having subjects recall, as Bartlett's subjects did, what they remember from the text and then comparing the semantic content and/or structure of the recall against the template to see what is transformed, added, or deleted. Recalls, labeled "second-order discourses" (Kintsch & van Dijk, 1978) because of their close connections to other texts, have been a common source, but not the only source, of data in discourse research. Others include, for instance, recognition tests and question-answering to study inferencing, eye movement patterns and think-aloud protocols to study on-line interactions with texts, and reaction times to study

cognitive capacity during reading (cf. Britton & Black, 1985; Kieras & Just, 1984). No matter what measure is used, however, the focus of the research is on what is constructed and how it is constructed.

My attempt here to construe constructivism is organized into two parts. The first part briefly synthesizes findings of research in the constructivist tradition conducted during the past decade and a half. It looks at organizational aspects of constructivity, selective aspects of constructivity, and connective aspects of constructivity. Though the emphasis in this review is on research in the United States, it is impossible to exclude contributions of researchers from other countries. The constructivist tradition is not only interdisciplinary; it is also international. The second part considers the impact of the constructivist tradition—the "revolution" —on four issues of social and political importance in the United States: readability of texts, assessment of reading ability, instruction in reading, and conception of literacy.

CONSTRUCTIVIST PERSPECTIVES

Constructivism portrays the reader as actively building a mental representation by combining new information from the text with previously acquired knowledge. The reader constructs meaning by *organizing* the content according to the structure of the text or according to another structure generated from a cognitive repertoire, by *selecting* content on the basis of some principle of importance, and by *connecting_content through* the making of inferences and elaborations. As to the nature of the mental representation, there appears to be no consensus among theorists (cf. J. R. Anderson, 1983; Johnson-Laird, 1983; Kintsch, 1974), since the "representational assumptions" mentioned by Gardner remain just that- -assumptions. At this point, it seems fairly safe to say that the representation is probably multidimensional, or at least has the potential for taking more than one form, most usually propositional (Kintsch, 1974) but perhaps having also some vestiges of the surface linguistic form (Brewer & Hay, 1984), sometimes taking also the form of a structural analogue—a "mental model" (Ehrlich & Johnson-Laird, 1982; Johnson-Laird, 1983) or a "situational model" (Perrig & Kintsch, 1985; van Dijk & Kintsch 1983)—and sometimes even taking the form of imagery (Denis, 1984). The constructive activity involves applying both top-down (knowledge-driven) and bottom-up (text-driven) processes (Kintsch & van Dijk, 1978; Rumelhart, 1977; van Dijk & Kintsch, 1983) in an interactive fashion.

Constructivity and Organization

Central to the constructivist view is the concept of organization—not only organization of the knowledge that readers bring with them, such as schemata, frames, and scripts, but also the organization of the text and of the mental representation built from reading the text. Readers are thought to approach texts knowing how texts are conventionally organized and knowing how to use text structure in forming representations.

Some texts, such as folktale-like stories, have typical constituents and an expected, or canonical, order for we appearance of the constituents. Such stones appear to be schematic, in Beaugrande and Dressler's (1981) sense, " ordered sequences linked by time proximity and causality" (p. 90). Story grammarians (Mandler & Johnson, 1977; Rumelhart, 1975; Stein & Glenn, 1979; Thorndyke, 1977) have developed formal procedures for specifying the constituents (e.g., setting, episode) of a story and have developed rules for generating their sequence as well as their causal and temporal relations. The story grammar, a descriptive device, is a means for investigating the characteristics of the story schema, a hypothesized mental structure, and for testing predictions about story processing (cf. Gee & Grosjean, 1984; Mandler

& Goodman 1982). Some researchers (Brewer, 1986; Lichtenstein & Brewer, 1980), though, have argued that a person has a schema for the structure of events and the story is simply a certain kind of event.

Some identifiable structures supply organization to expository texts. Although various classification systems exist (cf. Brewer, 1980; Bromage & Mayer, 1981; Kinneavy, 1971; Mosenthal, 1985), the most productive line of inquiry with expository texts thus far has probably been that of Meyer (1975; Meyer, Brandt, & Bluth, 1980; Meyer & Freedle, 1984), who has successfully adopted in her own research the rhetorical predicates proposed by Grimes (1975). Meyer (1985) has recently collapsed Grimes' original list into five types of text organization: *collection,* a grouping of information on the basis of some commonality; causal, a relation composed of one idea as the antecedent or cause and the other as the consequent or effect; *response,* a pattern resulting from the components of problem and solution or from the components of question and answer; comparison., an organization based on differences and similarities between two or more topics; and *description, a* presentation of attributes and specifics about a topic. Though Meyer has used texts with clearly identifiable top-level structures in her own research, many—if not most—expository texts reflect more than one of these organizational patterns, which can be combined in various ways. These text structures appear to vary in their capacity to hold together the content in a memorable way, with the descriptive pattern evidently being the weakest (Brandt, 1978; Meyer & Freedle, 1984). However, even a particular structure, such as comparison, can vary in the way that the content is arranged and the permutations can produce differential processing (cf. Schnotz, 1984).

Research in discourse comprehension has thus far emphasized readers' using their knowledge of text structure to guide their understanding. If the original texts are well organized and if the readers have no overriding purpose or perspective, skilled readers tend to construct mental representations with the same organizations as those of the texts. Such has been the case for stories in research conducted by the story grammarians and for expository texts in research conducted by Meyer and her colleagues. Meyer (1985) calls this process of looking for and using the author's organization the "structure strategy." Readers' constructivity is also evident in studies of the restructuring of texts that have their constituent order scrambled by the experimenter. Most of the research of this type has been with scrambled stories, which skilled readers tend to change to make conform to what they have internalized in their repertoires as story patterns (e.g., Kintsch & van Dijk, 1975; Mandler, 1978; Stein & Nezworski, 1978; Thorndyke, 1977). In constructivist research thus far, most restructuring of expository texts has been found in the processing of unskilled readers, who tend to use list-like, unconnected structures in recalling even well-organized texts (e.g., Marshall & Glock, 1978-79; Meyer, Brandt, & Bluth, 1980). There is also some evidence, though, of intentional restructuring of expository texts when people disagree with the message (cf. Meyer & Freedle, 1984).

Constructivity and Selection

Since readers cannot store all the information from the texts that they read, their reading must be a selective process. They often make these selections using an importance principle based on what is given prominence in the text by the author. Expository texts tend to have hierarchical structures with various levels of importance, in the propositional content (cf. Kieras, 1985; Kintsch & van Dijk, 1978; McKoon 1977; Meyer, 1975). With stories, importance of a unit seems to be determined by a combination of factors: not only its placement in a story grammar constituency but also its presence in a causal sequence and its number of causal connections (Black & Bern, 198 1; Trabasso & van den Broek, 1985; van den Broek & Trabasso, 1986).

This "levels effect" occurs when units prominently placed in the text are selected by the reader (e.g., Cirilo & Foss, 1980; McKoon, 1977; Meyer, 1975; Meyer & McConkie, 1973). It is unclear at this time why the higher level units are differentially selected (cf. Anderson, 1976; Britton, Meyer, Hodge, & Glynn, 1980; Cirilo & Foss, 1980; Kintsch & van Dijk, 1978). An element of constructivity is present, however, even in this abstracting process, since the reader is using knowledge of text and content in selecting some units and rejecting others, relying on such factors as the importance of the unit in the text and its serial position (Freebody & Anderson, 1986; Kieras, 1980).

The constructive element in selecting is especially evident when one examines research of Kintsch and van Dijk (1978; van Dijk & Kintsch, 1983) on the reader's formation of a macrostructure, or gist, of the most central content of the text. For texts that do not have an explicit statement of macrostructure, a reader generates a macrostructure by recursively applying macrorules (van Dijk, 1977, 1980). These rules compress the text into the gist by eliminating some information in the content structure, by combining elements into new, more complex units, and by tying together a whole sequence of propositions. Macroprocessing appears to be an integral part of comprehension (Guindon & Kintsch, 1984), and there is some evidence that mature readers using "shallow semantics" can still derive the gist even if they have limited understanding of the content of the text (Kieras, 1982, 1985).

Of course, in addition to the text factors there can be overriding reader and context factors that determine what is important to select for memory. Studies of such factors in the constructivist tradition include work on the perspectives from which the text is read (R. C. Anderson & Pichert, 1978; Bower, 1978; Goetz, Schallert, Reynolds, & Radin, 1983; Pichert & R. C. Anderson, 1977); goals set by the reader and/or tasks given to the reader (Frederiksen 1975a; Just & Carpenter, 1980; Mayer, 1985); and attitudes toward the content of the text (Meyer & Freedle, 1984; Tyler & Voss, 1984). Surely another important factor that influences selection *is interestingness,* which has elicited speculations (Kintsch, 1980; Schank, 1979) and some research (Hidi, Baird, & Hildyard, 1982; Walker & Kintsch, 1986).

Constructivity and Connection

Reading connected text, of course, involves making connections of various kinds. Although written texts provide cues for readers in making interconnections, readers use previously acquired knowledge to make many more connections in the form of inferences.

One important kind of connectedness is global coherence (van Dijk, 1980, 1985), the overall unity of the text and of its cognitive counterpart, the mental representation. Two factors already discussed contribute to this global coherence: organizational structure and macrostructure (gist), since they hold together the total content. Another way of thinking about global coherence is in terms of theme or topic (Kieras, 198l)—what the discourse is about—since global coherence involves thematic unity. Also contributing to coherence in the reading of some texts may be the formation of a structural analogue: Johnson-Laird (1983) argues that the coherence of discourse is determined by being able to "construct a single mental model for it" (p. 370).

In addition to this global coherence, there must be connections at the local level as the reader builds a mental representation of the textual content. These local-level connections tend to be linear relations between subsequent semantic units. Discourse analysis procedures have specified various kinds of links provided in the texts: logical connectives (Frederiksen, 1975b),

linguistic cohesion (Halliday & Hasan, 1976), topic-comment structure (Danes, 1974; Witte, 1983), given-new placement of information (Clark & Haviland, 1977), and referential overlap (Kintsch & van Dijk, 1978). Constructivist research indicates that these local kinds of linkages influence the nature of discourse processing. For instance, people tend to spend more time reading when the connections are not clear (Carpenter & Just, 1977; Kintsch, Kozminsky, Streby, McKoon, & Keenan, 1975) and readers can have considerable difficulty in building mental representations when the text is unusually disconnected (Marshall & Glock, 1978-79).

However, since reading is a constructive process, readers do read between the lines and make their own connections. This inference-making ability allows discourse to be rather sketchy, since readers can fill in gaps and can supply links in the propositional content, often on the basis of schematic knowledge structures (e.g., Abbott, Black, & Smith, 1985). Inferences constructed during reading often appear to become an integral and indistinguishable part of memory for the text:

> when subjects read a text, they store in memory a propositional representation of that text which is not necessarily a precise copy of the text base from which the text had been generated in the first place. Specifically, if there were some propositions in the original text base that were not expressed explicitly in the text itself, the reader will infer those propositions and store them in memory in the same way as other propositions that were represented explicitly in the text. (Kintsch, 1974: pp. 153-154)

Various types of inferences have been identified (cf. Beaugrande, 1980; Crothers, 1979; Mann & Thompson, 1986; Seifert, Robertson, & Black, 1985), and some types seem to be more important than others in the reading of particular kinds of texts, such as causal inferences for stories (Kemper, 1982). Readers also make inferential connections that are not absolutely necessary for their discourse understanding; they make elaborative links with stored knowledge—embellishments, that have beneficial effects on memory (Reder, Charney, & Morgan, 1986; Weinstein, 1978). These embellishments tend to be idiosyncratic, since they are based on an individual's experience with related situations (Reder, 1980). Some elaborative constructions take the form of imagery, especially in the reading of texts containing concrete descriptions and episodes (Denis, 1982; Marschark, 1985).

RESPONSE TO ISSUES

As we have seen, during the past fifteen years the constructivist tradition has begun to provide a theoretical framework for reading research and has generated a coherent body of knowledge about the organizational, selective, and connective aspects of constructivity in reading. But has constructivism thus far effected changes beyond this building of theory? What I kind of an impact is it having on issues of general concern in American society? I turn now to four issues—readability of texts, assessment of reading ability, reading instruction, and conception of literacy—to consider what, if any, broader "revolution" has taken place with the rise of constructivism.

Readability of Texts

For at least sixty years, efforts have been directed at determining the characteristics of text that affect ease or difficulty in reading (see reviews by Davison, 1984; Klare, 1974, 1984). The quest is a significant one:

> Identifying the qualities that make a text easy or hard to read is not only a fascinating intellectual puzzle and a challenge to current theories of reading, but is also a problem of great social importance. For our society to function, people have to be able to understand what they read, and documents, instructions, and explanations must be written in such a way that people can understand them. (Kintsch & Miller, 1984,p.200)

In the United States the new constructivist theory is challenging the most common and firmly entrenched means of assessing difficulty, the readability formula. In the American public schools readability ratings based on formulas are widely used in textbook selection procedures (Vaughan, 1976). Some states set formula-based requirements for the wording of insurance contracts (Bowen, Duffy, & Steinberg, 1986), and the military often employs formulas when setting criteria for the production of technical manuals (Duffy, 1985). Handbooks for technical writers include prescriptive guidelines based on readability formulas (see Selzer, 1983, for a review).

Approximately fifty readability formulas have been developed, but only a few are in major use: Dale-Chall (1948), Flesch (1948), Fry (1968), Gunning (1952), and Spache (1953). A formula typically has two quantitatively measured variables, one for a "syntactic" factor (sentence length) and one for a "semantic" factor (word familiarity/frequency or word length), which together are used to predict a particular reading level, such as tenth grade-third month, for a text. The reading levels are provided by correlation with one of three kinds of criterion measures: another formula; scores on an outdated reading test that was never intended for use as a measure of readability; and scores on cloze tests that tend to measure degree of redundancy of a text, not difficulty. Attention in most research with these formulas has gone to statistical refinement, but little effort has been made through the years to focus on factors other than the surface ones included in the early formulas or to find more adequate criterion measures (Davison, 1984). Current knowledge about the reading process has not had a great impact on readability formulas, which do not consider such important aspects of the text as organization, connectedness, and density of content; nor do they consider the actual processing demands on readers (cf. Huckin, 1983).

Many publishers, especially publishers of educational and technical materials, use the formulas as both prediction and production devices. They depend on the formulas to indicate whether a text is appropriate for a given group of readers. They also often require "writing to formula," or using the formulas to guide rewriting to adjust the level of a text for a particular audience—a use for which the formulas were not intended. As Klare (1984) points out, "merely shortening words and sentences to improve readabilty is like holding a lighted match under a thermometer when you want to make your house warmer" (pp. 717-718). Studies show that shortening sentences does not necessarily improve comprehension (Duffy & Kabance, 1982; Schlesinger, 1968) and can even make reading more difficult (Pearson, 1974-75). When a sentence is divided, the connective words may be omitted and the inferencing burden increased. Substituting short words for longer, more precise words can result in a less informative text (cf. Selzer, 1983), thereby possibly causing the reader more difficulty in constructing meaning. Davison and Kantor (1982) examined revisions undertaken by a publisher to make particular texts easier, including some intended to adjust the formula-based readability level, and found many changes that actually made the texts harder.

Some major efforts based on constructivist notions are being undertaken to identify factors that really do affect ease or difficulty of reading texts. One line of research is that of Kintsch and his colleagues. Kintsch's ideas about readability go beyond his earlier work on factors that influence difficulty, such as propositional density and topical shifts (Kintsch & Keenan, 1973; Kintsch,

Kozminsky, Streby, McKoon & Keenan, 1975). In tests of the Kintsch and van Dijk (1978) processing model of reading, Kintsch and Vipond (1979) have identified important sources of difficulty for readers in constructing mental representations from text: *reinstatement searches.,* which occur when the reader has to access long-term memory because what is being read has no connections with what is in short-term memory, and *inferences.,* which occur when connections are not provided between sections of the text. In related research, Miller and Kintsch (1980) found that inferences and reinstatement searches make large contributions to difficulty whereas the two surface measures commonly used in re adability formulas, word frequency and sentence length, account for very little. Though the results of Kintsch's research thus far seem promising, more research is being done to examine longer texts and to identify other factors that contribute to difficulty (see Kintsch & Miller, 1984). Also pursuing an understanding of text difficulty are researchers at the Center for the Study of Reading. As part of their examination of the "readability" of textbooks, they have appropriated Grice's (1975) "cooperativeness principle" with constructivist findings about reading to develop the concept of *considerateness* (Kantor, 1978). Considerate qualities of textbooks include clarity of text structure, coherent relations among concepts, unity of purpose, and appropriate content for intended audience (T.H. Anderson & Armbruster, 1986; Armbruster, 1984).

Instead of attempting to identify factors that generalize across texts, other researchers study text difficulty by testing *specific* texts with actual users (see Schriver, Hayes, & Langston, 1986, for a review of different methods of user-testing). Especially promising is the think-aloud methodology (Ericsson & Simon, 1984), which has readers verbalize their thoughts as they interact with texts. Recordings of think-aloud sessions provide reader protocols, which reveal areas of difficulty in particular texts. Research of this type, conducted initially for the national Document Design Project and continuing at the Communication Design Center at Carnegie Mellon University, has led to Protocol-Aided Revision (e.g., Schriver, 1986; Swaney, Janik, Bond, & Hayes, 198 1), the use of think-aloud protocols to guide rewriting.

In various ways, then, readability is being reconceptualized, but clear answers are not yet available. Because of the complexity of the reading process, valid measures of readability may never be simple. At least, though, current research is calling into question the predominant superficial approaches. Not simply a set of text characteristics, readability comes from a reader's ease or difficulty in constructing meaning from a particular text. To understand readability, one must look at text features in relation to the reader, since readability is the result of the interaction between reader and text.

Assessment of Reading Ability

With renewed and emphatic emphasis on educational accountability *(A Nation at Risk,* 1983), testing is gaining in social and political importance in the United States. Educational assessment is a big industry, and much time and money are expended in the public schools on various kinds of achievement tests, including tests intended to measure reading ability (B. Anderson, 1982). However, current reading comprehension tests, typically composed of passages to be read and multiple-choice questions to be answered, are clearly inadequate when one examines the task and the texts from a constructivist perspective.

The problem is that current standardized reading tests—social artifacts, as Haney (198 1) calls many American test s—are still based on discredited, preconstructivist notions of reading. Very similar to tests developed in the 1920s (Farr & Carey, 1986; Farr, Carey, & Tone, 1986), current tests do not reflect an understanding of the constructive, interactive nature of the readingprocess. In their technical manuals, test-makers do not discuss the processing demands

required by the particular texts and questions that they include on their tests. Instead of addressing construct validity—whether or not the test measures what is really involved in reading—they tend to emphasize criterion-related validity—how well the test correlates with other tests. According to Fillmore and Kay (1983), "Research on the evaluation of reading comprehension has not for themost part been conducted within the framework of a theory of reading comprehension, nor even, as far as we have been able to tell, has such work been conducted with attempts to develop sucha theory" (p. 3).

One major difficulty for developers of reading comprehension tests is presented by readers' prior knowledge of the content of the passages. It is well known that background knowledge can bias the results of testing, since knowledge as well as the ability to comprehend is being measured. Test-makers currently use three approaches to try to diminish the effects of the bias: broad topic coverage, which is inadequate because it merely ensures that those with greater general knowledge do better; elimination of questions that students with greater knowledge can answer without reading the passages, which fails because prior knowledge has more extensive effects than can be controlled in this way; and use of statistical models based on estimates of subgroups' knowledge of the included topics, which does not control for differences between individuals (Johnston, 1983, 1984). Although the biasing effect of topic knowledge has long been recognized, constructivist research has demonstrated that prior knowledge is a bias that cannot be removed, for it is an integral part of comprehension. Johnston (1984) argues that, instead of vying to do the impossible—eliminate the effect of prior knowledge—test-makers should somehow assess the extent of a reader's knowledge of the topic and integrate the prior knowledge factor into the test.

Another major weakness in current reading tests lies in the passages that are used—a weakness that is evident when passages from major tests are studied with discourse analysis procedures. In an extensive examination of reading test passages as texts, Fillmore and Kay (1983) concluded that they generally fail as representatives of English writing. The texts have characteristics, such as unclear referents, inconsistencies, and conflicts, that predispose readers to misread them and to derive the wrong responses to questions about them. In a related study, Langer (1987) found not only weak organization and other features of poor writing but also some texts that are of pseudo-genres, pretending to be representatives of a particular genre but not meeting expectations for characteristics of the genre. She also found that some test passages make unbelievable assertions that conflict with readers' knowledge. To succeed on some items, then, readers have to suspend their knowledge of text organization and avoid integration with previously acquired topic knowledge. On tests, it seems, readers often have to use strategies other than those that constructivist research shows are normally involved in making meaning from text.

So reading tests too are being challenged by new understandings of the processes involved in constructing mental representations. Also up for criticism is the prevailing "deficit model" of reading disability based on testing and diagnosis (see critique by Coles, 1978). Constructivism offers a new perspective for viewing difficulties in reading: A reading difficulty must be considered a result of the reader-text interaction instead of being solely a deficit of the reader (cf. Blachowicz, 1984; Lipson & Wixson, 1986).

Instruction in Reading

Until recently not much attention in American schools has gone to teaching students how to understand texts. Instead of emphasizing *how* to build meaning from texts, the predominant approach to instruction in reading comprehension has been for the teacher to ask questions about

what is read and for the students to answer them, always with an emphasis on getting the " correct" answer (Durkin, 1979). Reading comprehension instruction has also been influenced by the old conception of reading as a set of discrete skills to be taught separately rather than as an interactive process that is both knowledge-driven and text-driven in the construction of mental representations. However, as Pearson (1985) claims, new insights about reading hold potential for "changing the face of reading comprehension instruction."

Many of the new insights have come from research with instructional methods that show students how they can construct meaning from the texts that they read. Consistent with constructivist theory, these methods emphasize organizing content, selecting content, and connecting content. Students are taught, for instance, how they can perceive organizational structures of text and use them to guide their reading (Brandt, 1978; Horowitz, 1985a, 1985b) and how they can restructure the content of a text by applying a new organizing schema (Brooks, & Dansereau, 1983) from their repertoire. They are taught to use a set of summarizing rules (Brown, & Day, 1983; Hare & Borchardt, 1984) or a procedure of hierarchical mapping (Taylor & Beach, 1984) for constructing the mental gist from a text. They are taught to perceive—and map—the relations among ideas in a text (Armbruster & T. H. Anderson, 198 1; Dansereau, 1979) and to integrate and elaborate what they read (Langer, 1984).

One of the forces promoting the constructivist view of reading among educators and policymakers is the aforementioned Center for the Study of Reading. Constructivist theory has undergirded the work of the Center since its inception in 1976, when the contract from the National Institute of Education went to the University of Illinois with a major subcontract going to Bolt, Beranek and Newman of Cambridge, Massachusetts. Under the direction of Richard C. Anderson—one of the pioneers of constructivism. in the early 1970s and an active researcher today—the Center staff have conducted significant basic research into the process of reading as well as applied research into reading instruction and textbook quality (including the work cited earlier). Research at the Center has led to more than 400 Technical and Reading Education Reports, which are written by researchers at the Center and read by educators, policymakers, and other researchers in the U.S. and elsewhere.

Constructivist findings permeate the recent educational report, *Becoming a Nation of Readers (R.C.* Anderson, Hiebert, Scott, & Wilkinson, 1985) produced by the National Commission on Reading, which was chaired by Richard Anderson. This report, prepared under the auspices of the National Academy of Education and sponsored by the National Institute of Education, is a synthesis of research findings intended to guide educational clearly presents reading from a constructivist, perspective, as these excerpts from the beginning of the document illustrate:

> Reading is the process of constructing meaning from written texts. It is a complex skill requiring the coordination of a number of interrelated sources of information. (p. 7)
>
> Reading is a process in which information from the text and knowledge possessed by the reader act together to produce meaning. (p. 8)
>
> No text is completely self-explanatory. In interpreting a text, readers draw on their store of knowledge about the topic of the text. Readers use this prior knowledge to fill in gaps in the message and to integrate the different pieces of information in the message. That is to say, readers "construct" the meaning. (p. 9)

From this constructivist, perspective, then, the report addresses education issues and presents instructional methods consistent with the new research and theory. The impact of this national

report is yet to be seen, although several states are currently using it in teacher preparation, and one state is using it as a guideline for revamping its reading programs.

Conception of Literacy

Constructivism is changing the old bipartite conception of literacy. In the early 1970s a linear-stage model of reading (Gough, 1972) was paired with a linear-stage conception of composing (Rohman & Wlecke, 1964). The processes of composing and comprehending were viewed as inverses of each other (Page, 1974), and they were kept separate in both theory and practice. In the United States the two were not really equal partners in literacy, though, because more attention in research, government funding, school curricula, and teacher preparation was given to reading, as Graves (1978) pointed out in his plea to *Balance the Basics: Let Them Write.*

The constructivist tradition has helped make people aware of the essential interconnectedness of reading and writing. If reading is a constructive process of meaning-making, it must have some parallels with composing, which also involves actively constructing a mental representation (Kucer, 1985; Tierney & Pearson, 1983). As van Dijk and Kintsch (1983) conjecture:

> It seems highly implausible that language users would not have recourse to the same or similar levels, units, categories, rules or strategies in both the productive and receptive processing of discourse: In both they handle surface structure and semantic representations, and many of the rule-governed and the strategic relations between them will feature both in production and comprehension .... [W]e have seen on many occasions that comprehension is not simply a passive or bottom up process. Much of our understanding is active, top-down, constructive and productive. (p. 262)

Even though reading and writing are clearly not isomorphic since they present many different cognitive demands (cf. Bracewell, 1980; Witte, 1985), the two appear to have some similarities in processing.

Research to explore the connections between reading and writing has moved beyond the simple correlations of various measures of ability in reading and writing (cf. Stotsky, 1983). For example, some studies (e.g., Bereiter & Scardamalia, 1984) have demonstrated that schematic patterns associated with genres are internalized through reading and subsequently externalized through writing, and instructional research (e.g., Gordon & Braun, 1982; Taylor & Beach, 1984) has shown that instruction in either reading or writing can, in some instances, have a facilitative effect on performance on the other. Additional studies (Atwell, 1980; Flower, Hayes, Carey, Schriver, & Stratman, 1986; Perl, 1979) have begun to explore the constructive processing that takes place when a writer reads his or her own writing. Interesting questions are being raised about changes in the mental representation that occur as a person reads and revises a piece and about the constructive processes involved in reading to revise—focusing, filling in gaps, forming and reforming a macrostructure (Flower, et al, 1986; Witte, 1985).

Now that the rigid dichotomy is disappearing, educators at all levels of instruction from elementary school (e.g., Graves & Hansen, 1983) through college (e.g., Petrosky, 1982) are seeing new ways to integrate reading and writing. Researchers as well are becoming ‘interested in a whole range of tasks that have characteristics of both comprehension and *composition—hybrid tasks,* as Bracewell, Frederiksen, and Frederiksen (1982) call them. These hybrid tasks would certainly include writing such second-order discourse as summaries and response statements that are based on single textual sources. But they would also include

synthesis-writing, which involves the use of multiple textual sources as one constructs a composite mental representation by combining information drawn from the different sources with previously existing knowledge (Spivey, 1984). Common synthesis tasks, such as report writing are characterized by complex knowledge transformations that occur as information from various texts is integrated and restructured. Multi-text tasks are becoming an important focus for ecologically valid research, such as that being conducted in the Reading-to-Write Project (Flower, et al., 1987) of the Center for the Study of Writing sponsored by the U.S. Office of Educational Research and Improvement (formerly National Institute of Education) and located at the University of California, Berkeley, and Carnegie Mellon University.

CONCLUSION

With its attention on the role of mental structures in reading, the constructivist tradition has dramatically changed theory and research in reading during the past fifteen years. New understandings about the reading process have also begun to affect American society in general. Constructivism is raising questions about text quality and about reading abilities—questions that challenge previously accepted ways of viewing text and reader—and it is promoting real changes in pedagogy and a new integrated conception of literacy. However, as in other areas of research in the cognitive revolution, reading research to date has been limited: it has focused on materials, tasks, and contexts (e.g., rather brief texts often read in a controlled setting) that do not yet have the richness or complexity of those that people experience in their daily lives. The work thus far, though, leads to further research, both basic and applied. Within the constructivist tradition—its focus on mental representations, its use of a template methodology, and its accumulated body of knowledge—researchers have a paradigm for examining the cognitive structures and operations that emerge in more complex reading tasks.

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