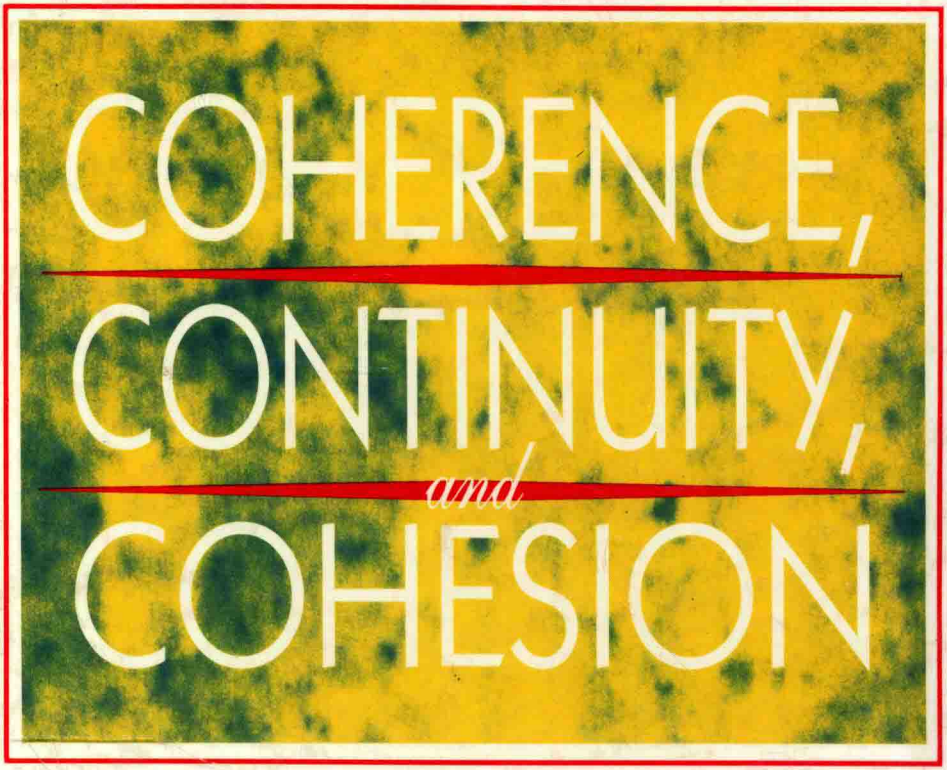

Theoretical Foundations
for Document Design

KIM SYDOW CAMPBELL

Coherence, Continuity, and Cohesion
Theoretical Foundations for Document Design

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CHAPTER 1

Introduction: A Research Agenda

> *'Sense' has two senses, one perceptual and the other linguistic. We have tried to take care of them both, for we feel the two are not as different as they are sometimes made out to be.*
>
> —Miller and Johnson-Laird (1976, p. vi)

The quote above from the preface of Miller and Johnson-Laird's landmark book, *Language and Perception*, led me to formulate the theoretical core of this book—that the cognitive principles which explain why humans 'sense' unity in a succession of sounds (which therefore constitute a whole musical piece) or in a configuration of visual shapes (which therefore constitute a whole object) are the basis of principles that explain why we 'sense' unity in a string of sentences or a series of computer screens (which therefore constitute a whole text or discourse). More specifically, I will argue that one aspect of discourse coherence, continuity, is analogous to visual and auditory unity, as studied by the Gestalt school of psychologists. In addition, I argue that Gestalt principles like proximity and similarity describe how cohesion is produced through the use of the full range of discourse elements (e.g., from white space and typography to beeps and pauses to parallel syntax to synonymous lexical items and deictic terms). Thus, I believe cohesion produces continuity, one type of coherence, in discourse. More generally, then, it is my premise in this book that humans extend the use of cognitive perceptual principles like that of proximity, originally used in response to interaction with visual and auditory phenomena, to the more complex, relatively late-developing cognitive task of discourse comprehension and production.

The notion that discourse unity might somehow be analogous to auditory and visual perceptions of unity appealed to me mainly because of my practical

experience as a technical communication teacher and a scientific editor. In particular, I regularly comment on the design of communication, including the auditory or visual qualities of an oral or written discourse along with its linguistic qualities. As one simple example, I often note that more attention to page layout or design would create a more clearly unified, coherent, and usable discourse (e.g., placing a diagram next to relevant prose in a technical manual). As I document later in this chapter, the practical importance of page design is well recognized by other technical communication professionals.

Although page design might appear to some to be of only trivial intellectual interest, I believe that its influence on a human being's sense of discourse unity must reflect the lawfulness of the human mind. Therefore, I conclude that, like a theory of language, a theory of discourse unity that could account for the unifying effects of visual and auditory as well as linguistic elements might be of great intellectual interest as a contribution to a theory of mind or cognition.

Unfortunately, my training as a linguist offered me no theoretical framework within which I could understand how the full range of elements (e.g., visual as well as linguistic components) are involved in creating unified texts or discourse. Not surprisingly, the unifying role of non-linguistic elements has not often been considered within linguistics and, in terms of linguistic elements, the unifying role of phonological and syntactic elements has been largely ignored in favor of semantic elements. Although I found that psycholinguistic research has indeed considered the effects of non-semantic and even non-linguistic elements, that research provided no general theory or explanation for why those elements enhanced the unity and coherence of discourse. As a consequence, I found no one theory that provided a satisfactory explanation of the relationship among these unifying linguistic and non-linguistic elements. Furthermore, no one theory provided a satisfactory explanation of the role of these elements in establishing coherence.

Therefore, my theoretical knowledge provided no way to account for my intuitive, practical experience until I read Miller and Johnson-Laird's (1976) work, which argues that a significant part of the semantic component of language is founded on perceptual concepts (e.g., the perceptual concepts of "motion" and "direction" are the semantic foundation of *ascend* [motion up], *pivot* [motion around], and *depart* [motion away]). These authors, however, concentrated on lexical or word meaning. It is my goal in this book to extend their general assumption about the relationship of perception and language to the level of discourse. The recognition of the relationship between perception and language inspired me to explore the utility of Gestalt theory (which provides perceptual principles describing how auditory and visual unity is achieved) as a theoretical foundation for understanding the role of and relationships among all discourse elements in achieving discourse unity and coherence.

The remainder of this chapter expands the preceding discussion in order to justify the need for basic research that establishes a new theory of coherence and

cohesion. This basic research, in turn, may provide a theoretical foundation for further applied research involving the design of communication. First, I demonstrate the importance of document design within fields outside linguistics and document the recognition for further research in this area. Second, I demonstrate that no linguistic or psycholinguistic research has been able to account for the unifying effects of both linguistic and non-linguistic discourse elements and for the role of these elements in establishing coherence. Third, I clarify the terminology used in the remainder of this book and outline the goals and design of the following chapters.

DOCUMENT DESIGN IN TECHNICAL AND SCIENTIFIC COMMUNICATION

Shriver (1989a) defined document design as "the theory and practice of creating comprehensible, usable, and persuasive texts" (p. 316). Within the field of technical and scientific communication, the importance of document design (also called "information design") has been increasingly recognized by teachers, professionals, and researchers since the 1980s. As Benson and Burnett (1992) noted:

> An increasing number of teachers of technical, business, and professional communication are integrating information about visual design into their classrooms. In addition to these pedagogical progressives, workplace practitioners have begun to recognize the need to apply research findings about effective designs of visible language. (p. 87)

Technical communication pedagogy reflects this emphasis in textbooks of the 1990s. For instance, the title of Mathes and Stevenson's (1991) textbook is *Designing Technical Reports*, and Houp and Pearsall's (1992) textbook has one of its five core parts headed, "Document Design in Technical Writing," which is comprised of three chapters and 154 pages. As Anderson (1987) wrote in his textbook chapter, "Designing Pages," "You build your written messages out of *visual* elements. These visual elements are dark marks printed on a lighter background: words and sentences and paragraphs; drawing, graphs and tables. They are *seen* by readers before they are read and understood" (p. 448). Advanced courses in technical communication are also teaching students the importance of document design. For example, Rude's (1991) textbook offers the following advice to technical editing students:

> An editor cares about format because format is functional. Format influences how well a reader uses and understands a document. The five main functions of format . . . [are] to meet reader expectations, to motivate readers, to provide access to

> selected parts of the document, to aid the readers in comprehension, and to facilitate its continued use. (p. 288)

Professional technical and scientific communication practice also reflects this emphasis on document design. For instance, Benson (1985), a research associate in the Design Center of the American Institutes for Research, advised professional communicators: "[t]o design a document well, you need to imagine what linguistic and visual organizers will help readers understand how the text is structured" (p. 36). In addition, the Society for Technical Communication's professional journal, *Technical Communication*, has published special issues on document design (e.g., *Document Design Moves into the Next Decade*, edited by Shriver, 1989c).

Professional communicators have also promoted the importance of research in the area of document design. As IBM's Brooks (1991) wrote:

> most [technical communicators] would probably agree that text set in all uppercase letters is harder to read than mixed-case text. That a well-designed serif type is easier to read than sans serif. But are you really sure why, or do you just *know* that? If you're challenged on a question like that, it helps to be able to back up your opinion with published research results or studies. (p. 183)

Shriver's (1989a) review of document design research in the 1980s includes the following questions as part of the agenda for the 1990s:

- What are the principles underlying the visual design of effective text? Do some visual information structures meet readers' needs better than others?
- What is the role of writers' knowledge in document design? Subject-matter knowledge? Linguistic knowledge? Perceptual knowledge? Strategic knowledge? Rhetorical knowledge?
- Which text-evaluation methods are best suited for judging text quality? . . . Can we develop more sensitive text-evaluation methods than are currently available? . . . (p. 325)

Thus, despite the obvious importance of document design within the field of technical and scientific communication, there is a perceived need for more research that illuminates the principles describing effective design and takes into account the various types of knowledge writers and readers bring to the task of communication production and comprehension. This research is important as a means of providing general principles that form a foundation for evaluating text quality in pedagogical and professional practice. General principles are crucial for providing novice communicators with the knowledge required to diagnose rather than simply detect problems with the texts they produce (Flower, Hayes, Carey, Schriver, & Stratman, 1986, p. 47).

RESEARCH ON COHERENCE AND COHESION

One logical place to look for systematic, general principles describing how unity or coherence is established in discourse is, of course, linguistic and psychological theories of coherence and cohesion. The importance of unity or connectedness as an aspect of coherence is universally recognized (e.g., as noted by Hatakeyama, Petöfi, and Sözer's, 1985, review of research on coherence in textlinguistics or by the title of Charolles and Ehrlich's, 1991, review of research on coherence, "Aspects of Textual Continuity"). To begin, I first define coherence and then take up the question of whether previous research can provide the general principles needed to answer the research questions mentioned earlier from document design.

Halliday and Hasan (1976) wrote, "[a] text is a passage of discourse which is coherent in these two regards: it is coherent with respect to the context of situation . . . ; and it is coherent with respect to itself, and therefore cohesive" (p. 23). Similarly, Hatakeyama et al. (1985) distinguished two types of textual unity or connectedness: co-textual and con-textual unity. **Coherence** (contextual unity) involves connections between the discourse and the context in which it occurs. For example, consider the following excerpt from a proposal written by a group of professional civil engineers:

Example 1.1.
Mr. Krishan Saigal, P.E., will serve as Lead Engineer. Mr. Saigal's primary tasks will include:

- Plan and provide direction for technical work elements.
- Coordinate technical direction of subcontractors.
- Assist in coordinating and disseminating project-related information to the Project Team . . . .

Mr. Saigal will also serve as Construction Manager for the Project Team, with the following primary responsibilities: (SCS Engineers, 1991, p. 2-2)

Note that, although it shows some signs of connectedness, it does not constitute a "whole" text. More specifically, although describing both of Mr. Saigal's duties consecutively (i.e., with no intervening, extraneous material) establishes some coherence, the excerpt lacks the quality of completeness: in other words, the completion of the last sentence, which should include a list of duties related to the role of Construction Manager. The reader expects completeness in a proposal like the one this excerpt comes from. Thus, coherence describes the relationship between the discourse and the context in which it occurs.

Cohesion (co-textual unity) involves connections within the discourse. As one example of cohesion, in Example 1.1, note that the word *technical* is repeated

in the each of the first two enumerated items and that two morphologically similar terms, *coordinate* and *coordinating*, are repeated in the last two enumerated items, thus creating a connection among the three items. As another example, note that bullets and parallel syntax are used; each of the three items begins with a bullet and a verb in the same tense/aspect, thus creating a connection among the three items.[1] In sum, cohesion describes connections among the elements within the discourse.

Coherence and cohesion theories that have received the most attention in applied research in writing and communication include Grice's (1975) theory of implicature, Mathesius' theory of functional sentence perspective (also known as the given-new contract or thematic progression; see Daneš, 1974), and Halliday and Hasan's (1976) theory of cohesion. First, for example, Cooper (1982) used the theory of implicature to explain how writers use their knowledge of the world to communicate with their readers, and Riley (1988a) used it to provide insight into recommended strategies for communicating negative messages in business. Second, Vande Kopple (1982) used functional sentence perspective (FSP) to show that writing can be made more comprehensible by following certain patterns of information arrangement; and Thompson (1985) used it to provide strategies for improving the communication of technical writing students. Third, much applied research in writing and communication has been based on the theory of cohesion developed by Halliday and Hasan (1976) in *Cohesion in English.* For example, Johns (1980) used their theory to investigate cohesion in business discourse; Witte and Faigley (1981) used it to investigate the relationship of cohesion, coherence, and writing quality in the written products of freshman English students; and Myers (1991) used the theory to investigate the relationship between cohesion and subject-matter knowledge of readers.

Unfortunately, however, this applied research has noted some problems with coherence and cohesion theory. First, the theory of cohesion "requires further change . . . [because] most of the Halliday and Hasan coding was done on British literature, especially *Alice in Wonderland*; . . . items which appear in Lewis Carroll's writing are not those typical of modern business writing" (Johns, 1980, p. 41). If we consider technical manuals, then the applicability of the cohesive devices in Carroll's writing become even less representative. For instance, Walter (1992) noted that technical orders (product manuals used by the United States Air Force) average 40% graphic content and 20% tables, with only the remaining 40% consisting of prose (pp. 13–17). However, Halliday and Hasan chose to limit their theory of discourse unity to only semantic elements. The authors noted that they were "excluding from consideration the effects of formal devices such as syntactic parallelism, metre and rhyme . . ." (Halliday & Hasan, 1976, p. 10). In addition, they omitted FSP from their categories of cohesion because it is structurally produced.

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[1]Because these connections do not involve semantic elements, these unifying elements are not included in Halliday and Hasan's theory. I explore the consequences of this later in this section.

As I wrote in Campbell (1991):

> While choosing to limit the scope of *Cohesion in English* to semantic cohesion is in itself fairly unremarkable, the fact that analysts of written texts have continued for fifteen years [seventeen at the time of this writing] to use Halliday and Hasan's theory of cohesion without substantial addition is remarkable. (p. 223)

I also noted that there are only a few studies that have expanded the original theory of cohesion. For instance, Stotsky (1983) argued for a modification of one of the original categories of semantic cohesion; Hartnett (1986) distinguished between two functions of semantic cohesion; and Markels (1983) investigated syntactic cohesion. However, only Markels introduced another category of elements and then only one of many possible categories. In response to this lack of expansion in cohesion theory, I attempted to establish the range of non-semantic cohesive elements by analyzing technical discourse: FSP, syntactic parallelism, and graphic devices (including typography, enumeration, and chart types; Campbell, 1991). However, that work did not provide a comprehensive, theoretical framework within which the unifying effects of both semantic and non-semantic discourse elements could be understood.

Research in psychology (defined broadly enough to include psycholinguistics, educational psychology, cognitive psychology, and reading comprehension) has in fact recognized the impact of non-semantic elements on discourse coherence (e.g., see collections edited by Tzeng & Singer, 1981; and Besner & Humphreys, 1991). As one example, in 1985 Kieras wrote:

> the cognitive psychology of comprehension has tended to ignore surface structure in favor of semantic content. However, it seems clear that surface structure is normally chosen by the writer in an attempt to convey a desired meaning most efficiently. . . . Hence an adequate theory of comprehension must explain not only how readers derive the semantic content of sentences and relate them to already known information, but also how the surface form of the input is used to guide or streamline this process. (p. 103)

No doubt this recognition stems from the fact that many researchers turned from studying narratives to technical and scientific discourse in the 1980s. Kieras (1985) also made a convincing case for the social importance of such studies, noting that this is the discourse of most textbooks and also of the overwhelming number of technical documents that accompany the products of modern technology (p. 90).

Unfortunately, however, the experimental research that has investigated the unifying effect of such elements has not provided a theoretical framework explaining the relationship between semantic and non-semantic cohesive elements, nor has it clearly established the role of these unifying elements in establishing coherence. For instance, Mayer (1985) provided "some suggestions

for how to increase the understandability of science text [which] are offered as 'good guesses' based on a general interpretation of our research, [and] should be subjected to additional testing" (p. 84). To illustrate, consider a few of Mayer's (1985) suggestions:

- Signal the major explanative ideas in the text such as using numbers. (For example, 'First, a pulse is sent out . . .'
- Use headings and indentations to indicate the major ideas. (For example, each idea is present on its own line.)
- Include repetition of important ideas in various wordings; build redundancy into the passage . . . (pp. 84–85)

Mayer argued that these suggestions provide writers with ways in which they can focus the reader's attention on the salient ideas in an explanatory text. Although I do not question the accuracy of Mayer's claim or the validity of his suggestions, I am not satisfied that such experimental results have explained **why** enumeration, headings, page arrangement, and semantic repetitions create more unified and coherent discourse.

A number of research studies that have applied Halliday and Hasan's theory of cohesion have provided conflicting or unclear results in terms of the relationship between semantic cohesive elements and coherence in a discourse. For instance, although McCulley (1985) found a correlation between some types of semantic cohesion and coherence, Witte and Faigley (1981) found no correlation between writing quality and semantic cohesion, and Tierney and Mosenthal (1983) found so many semantic cohesive elements that they judged cohesion analysis useless in determining coherence. In addition, some dissatisfaction with cohesion theory has involved the perceived lack of utility of quantitative analysis. For example, Hendricks (1988) wrote,

> It takes Halliday and Hasan about seven pages to explain their scheme for coding the types of cohesion. . . . And when one imagines the whole text of, say, *Alice in Wonderland* subjected to such an analysis, the result is bound to be a mass of data so overwhelming as to be practically useless. (p. 104)

In sum, I believe previous research in both linguistics and psychology suggests the need for a theory of coherence and cohesion that addresses the following questions:

A. How can we account for the unifying effect of the full range of discourse elements: semantic elements, other linguistic elements, and non-linguistic elements? What is the relationship between semantic elements and other cohesive elements?

B. What role do cohesive discourse elements play in establishing coherence? Can we predict when they will and will not enhance coherence?

The main point here is that the answers to such questions precede the possibility of using theories of coherence and cohesion to answer research questions in document design. To review, I noted a perceived need within the field of technical and scientific communication for research that provides general principles that would form a foundation for evaluating document quality in pedagogical and professional practice by answering the following questions based on Shriver (1989a):

1. What are the various types of knowledge writers and readers bring to the task of communication production and comprehension?
2. What principles describe effective document design?
3. How can we develop effective methods of evaluating text quality?

A theory of discourse coherence and cohesion that answered Questions A and B would provide a theoretical framework within which Questions 1, 2, and 3 could be approached.

THE GESTALT CONCEPT OF UNITY

In order to answer the research questions listed in the preceding section, this book explores the analogy between our sense of auditory or visual unity and our sense of discourse unity. Gestalt psychologists attempted to delineate the psychological principles that would explain why humans experience visual and auditory phenomena as wholes. As one of Gestalt psychology's founding fathers, Max Wertheimer (1938), explained:

> one sees a series of discontinuous dots upon a homogeneous ground not as a sum of dots, but as figures. Even though there may here be greater latitude of possible arrangements, the dots usually combine in some "spontaneous", "natural" articulation—and any other arrangement, even if it can be achieved, is artificial and difficult to maintain. (pp. 71–72)

He used Fig. 1.1 to illustrate. Note that the most natural way of perceiving this figure is as three groups of two dots. However, it is also theoretically possible to perceive this figure as two groups of three dots. As Wertheimer (1938) argued, "it is for most people impossible to see the whole series simultaneously in the latter grouping" (p. 72).

It was the premise of Gestalt psychologists that such perceptions of unity were predictable or rule-governed, and they developed a set of theoretical principles or rules that accurately describe human perceptual predispositions. In

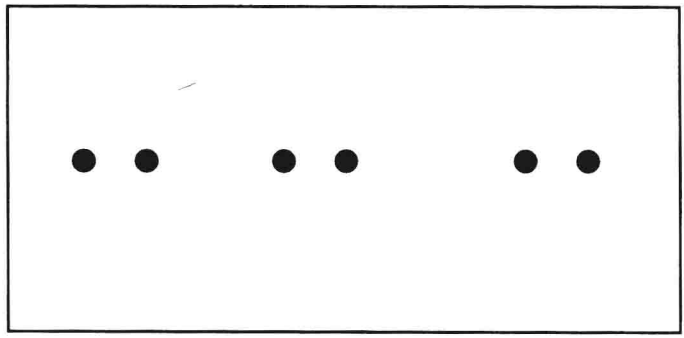

FIG. 1.1. A Gestalt figure demonstrating the principled nature of visual perception.

the case of Fig. 1.1, it is the principle of proximity that describes our preference for perceiving groups of two dots; in other words, because the sets of two dots are physically close to each other and physically more distant from any third dot, we perceive the sets of two dots as three unified wholes.

As I noted earlier, it is the premise of this book that humans extend the use of cognitive perceptual principles like that of proximity, originally used in response to interaction with visual and auditory phenomena, to the more complex, relatively late-developing cognitive task of discourse comprehension and production. As an illustrative, introductory example, consider Example 1.1 again. Note that, despite the excerpt's lack of completeness, I sense that the excerpt is comprised of two hierarchically equal segments: one related to a "Lead Engineer" and one related to a "Construction Manager." Note also that these two segments of the excerpt are physically separated by more white space than any other parts of the excerpt. Thus the principle of proximity provides **one** explanation for our perception of two unified segments within Example 1.1. (Of course, a number of other discourse elements and principles are also involved in this perception.)

Interestingly, one of the most gifted discourse analysts, Roman Jakobson, suggested the potential importance of psychological principles like those the Gestalt psychologists called the principles of proximity and similarity. As Jakobson explained:

> The perception of similarities and contiguities ... united by parallelism leads automatically to the need to find an answer to the unconscious questions: What links the two lines? Is it an association by similarity or by contrast? Or is it an association through contiguity, and, if so, is it a contiguity in time or space? (Jakobson & Pomorska, 1983, p. 103)

A few technical communication researchers have argued for the importance of Gestalt principles as a means of describing effective visual design. For instance,

Barton and Barton (1985) found "that the treatment of visuals often consists of an *ad hoc* series of guidelines whose rationale, or theoretical basis, remains obscure" (p. 129). Thus, they suggested that Gestalt principles might be used to provide such a theoretical basis. Bernhardt (1986) followed through on this suggestion by applying Gestalt principles to an analysis of the visual design of a technical text. Similarly, Moore and Fitz (1993) applied an even broader range of Gestalt principles to a range of technical texts. Fortunately, this line of research has provided a cogent theoretical basis for understanding the visual aspect of document design. However, no research has provided a theoretical basis for understanding the role of the complete range of elements involved in document design.

Based on such Gestalt principles as proximity and similarity, this book proposes a theory of coherence and cohesion comprised of a set of principles for describing the unifying effects of the full range of discourse elements: from visual to semantic. In addition, these Gestalt principles clarify the role of these unifying elements in establishing coherence. Based on this theory, the book also provides an approach to the research questions already noted above in the field of document design.

My aim in this book, then, is to develop a theory. But I want to make clear from the outset how I view the status of that theory. The quote that follows, taken from Lerdahl and Jackendoff (an insightful study of unity in tonal music based on Gestalt perceptual principles), clarifies my view. The authors noted that the principles they discuss are conceived of as:

> [an] empirically verifiable or falsifiable description of some aspect of musical organization, potentially to be tested against all available evidence from contrived examples, from the existing literature of tonal music, or from laboratory experiments. . . . We consider this book a progress report in an ongoing program of research, rather than a pristine whole. . . . We feel, however, that we have gone far enough to be able to present a coherent and convincing overall view. (Lerdahl & Jackendoff, 1983, p. xii)

My own view of the theory presented in this book is quite similar. In other words, I do not intend to provide the definitive and comprehensive set of coherence and cohesion principles in this book. And, although the utility of the principles are subject to some testing throughout the book as specific discourses are analyzed, I intend for this to be viewed as a springboard for more research in coherence, cohesion, and document design based on cognitive perceptual principles. In addition, my readers should know from the outset that, of the three aspects of research on discourse coherence—structure, world knowledge, and process (Britton & Black, 1985, p. 6)—I have limited the scope of the theory developed here in order to concentrate only on the first two aspects; thus, **the process** of comprehending discourse is largely ignored.