INFLUENCE OF COMPOSING STRATEGY ON THE COMPREHENSIBILITY OF TECHNICAL DOCUMENTS IN ENGLISH

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TABLE OF CONTENTS

Chapter Page

LIST OF TABLES

LIST OF FIGURES

Figure Page

CHAPTER I

FRAMING THE PROBLEM

Consider a possible 2006 workplace scenario. In the technical communication offices of a large North American medical supply firm, division manager Judi Greene is evaluating the capabilities of CommonText[1], a sophisticated new computer application for technical writers. Searching for a way to streamline the firm's document production, Greene has investigated CommonText because it provides a central electronic repository or *single source* for units of text, enabling all the firm's technical writers to retrieve and reuse any given unit repeatedly, without further editing, in the firm's manuals, reports, product inserts, web pages, and other technical materials.

In several ways, Greene finds CommonText impressive. She notes that the single-sourcing software would lessen the problem of outdated or inconsistent information across the firm's document suite, because it automatically applies writer-initiated corrections and revisions to units across the system, wherever those units appear. She likes the natural efficiency of reusing content; indeed, her firm, like many others, has been using standard product warnings, legal notices, and other boilerplate text for years. She understands how single sourcing amplifies the cut-and-paste or "conversion" features made possible by word processing (Hackos & Rockley, 1999, p. 3) into an ongoing process of creating, recombining, and distributing a centralized body of text for several audiences and purposes at the same time. She also sees that CommonText might provide the technological support her staff needs in order to develop a unified, "goal-oriented framework" (Carliner, 2000, p. 566) for both content and physical design of documents.

[1] CommonText is a fictional name, but the product reflects features that are available commercially.

Because the firm is asking her division to deliver information in greater volume, to more readers, and in more forms than ever before, she knows traditional document production will eventually be unable to meet the demand (Sander, 2002). She believes single sourcing could help the division to address this problem.

In addition, Greene understands that CommonText would help the firm to lower the costs of delivering documentation to its extensive global clientele. Although the firm markets abroad to educated professionals who generally expect to read technical material in English (Boiko, 2002; Kohl, 1999), the firm does provide translations in several languages and adjusts some content for local needs, a service that adds significantly to the publishing budget (K. Lourdon, personal communication, June 16, 2004). CommonText can differentiate between newly composed and previously translated text, and the system would enable writers to send only new text to the translators, thereby reducing costs and turn-around time.

Most importantly, Greene is interested in the ways CommonText might speed the composing process itself. Single-sourcing applications manipulate text in independent, stand-alone units, minimizing the need for transitions, contextual framing, and cohesive ties between units. CommonText would thus enable the writing staff to concentrate on product information, without devoting time to metalanguage. She can envision a divisional reorganization in which her writers, already somewhat specialized, would focus only on selected topics within the firm's documentation, leaving CommonText to assemble the discrete textual units into full-length documents under the direction of higher-level information architects.

In short, Judi Greene understands why CommonText and other single-sourcing applications have made dramatic advances in the technical communication workplace since the early 1990s (Clark, 2002). Still, even after viewing demonstrations, she hesitates. She is aware that CommonText and its competitors are "immature products" in a content management industry still emerging (Boiko, 2002, p. 79). Consequently, she is concerned that the features that enable CommonText to disseminate standardized text quickly could simultaneously degrade the high quality of the firm's documentation. As a former staff writer herself and teacher of English abroad, she questions some of the methodology's assumptions about document creation. Content reuse may produce consistent text, but can the software support variation when audience needs genuinely require it? Furthermore, how much cultural adaptation should the system be able to accommodate for the benefit of non-Western readers? And at the level of individual passages of text, would readers find the firm's documents as easy to understand if the writers omit conventional metalanguage?

In identifying these potential problems with CommonText, Greene joins many technical communicators who recognize single sourcing's potential for greater efficiency in a rapidly changing publishing environment but question whether single sourcing truly serves readers well. Because single sourcing is a fairly new methodology, relevant empirical data that could help Greene to make an informed decision are scarce. My objective in this project, therefore, is to contribute research-based findings to the discussion, using her concerns to frame the following key questions:

- How well can single-sourcing methods accommodate rhetorical variations that would improve reader comprehension?

- Is highly standardized text appropriate for cross-cultural audiences?
- Does removing metalanguage, particularly cohesive devices, from single-sourced texts significantly affect comprehension for specific groups of readers?

These questions are the foundation of this dissertation. In the next section of this chapter, I begin the discussion of these issues, continuing in Chapters II, III, and IV with reviews of relevant literature on each question, respectively. In this chapter I also introduce my rationale for using an empirical research design, explaining the details of my methodology more fully in Chapter V. In Chapter VI I report the results of my experimental study, and in Chapter VII I suggest ways in which these findings may apply to current single-sourcing practices.

Because the purpose of advanced single-sourcing programs is to reuse the same content in a variety of output forms, the term *single sourcing* in this dissertation is not genre-specific. I use the term to mean a computer-assisted method of organizing knowledge into discrete units of text and assembling some or all of those units, without further editing, into larger documents as needed. Chapter II reviews published definitions of *single sourcing* in greater detail.

Overview of Literature Surveyed

Judi Greene's questions about single sourcing reflect one aspect of a larger cultural debate about the interaction of technology and human behavior. At one extreme of this debate is the position Nardi and O'Day (1999) describe as *technophilia*, the uncritical acceptance of technology that focuses on novelty and gadgetry while ignoring "a sense of each technology's evolving social meaning and deep integration into social

life" (p. 21). In a business writing environment, the technophiliac might assume, for example, that readers regard professional texts solely as containers of data, to be interpreted at face value. According to this view, information speaks for itself and can be equally comprehensible in any number of arrangements, with little need for introduction, rhetorical framing, or context (Brown & Duguid, 2000). At the other extreme of the debate is *dystopia*, a position that condemns new technologies as threats to human activities and values (Nardi & O'Day, 1999). Instead of using technology selectively, the dystopic technical writer or organization might reject outright a method such as single sourcing, insisting on idiosyncratically composed texts, even if those documents communicate less effectively than texts produced with more technological assistance.

Nardi and O'Day point out, however, that neither perspective gives humans a meaningful role in shaping and using technology – in this discussion, a specific method of producing technical documents. Without additional research into human behavior, neither camp can say, for example, how readers respond to highly standardized texts, or the extent to which writers resist the new role of contributing to "information flow" instead of developing complete documents (B. Gu, personal communication, September 12, 2005). My purpose in this project is therefore not to argue the technophiliac or dystopic extremes but to examine the feasibility of a middle position. To gather evidence that bears on that position, I have attempted to ask what Nardi and O'Day call "know-why questions," the complement of the "know-how questions" (p. x) that currently dominate the single-sourcing discussion. From Nardi and O'Day I have also borrowed three common metaphors for information technology – *system*, *text*, and *tool* – to

"encapsulate" (p. 25) the manager's concerns about different aspects of single sourcing as a methodology.

- *Technology as system* suggests impersonal, large-scale activity with the potential for improvements in human life but for unintended consequences as well. When Judi Greene questions computer-assisted single sourcing's capacity to balance standardization with the textual variation her readers may need, she is envisioning the single-sourcing methodology as a system.
- *Technology as text* relates to the communicative role of technical phenomena. In considering her firm's culturally diverse audiences and their expectations for technical documents, Greene is assessing single sourcing as a "carrier of meaning" (p. 31) or text.
- *Technology as tool* implies the practical, everyday devices by which humans accomplish tasks. Greene's concern about the comprehensibility of documents containing only minimal cohesive ties reflects the metaphor of single sourcing as a tool writers use for specific purposes.

Individually, none of these metaphors presents a full picture of the single-sourcing methodology (or any technology) (Nardi and O'Day, 1999). However, they do help to illuminate selected aspects of single sourcing. Below, I use these metaphors to introduce literature reviews in the three areas relevant to the dissertation questions.

Single Sourcing as System: Accommodating Textual Variation

Before deciding for or against a single-sourcing program, Judi Greene must understand the parameters within which single-sourced text can be adjusted for specific

audiences, should readers' needs require it. She can make informed decisions about meeting those needs only when she knows more about relevant technical options and limitations. Chapter II therefore reviews general concepts of single sourcing, including structured writing and content management, two related developments in professional communication and data management.

Chapter II also presents critiques of single sourcing now emerging in the literature. When organizations implement technologies on a large scale, across entire enterprises, the new methods can literally and metaphorically become systems (Nardi & O'Day, 1999). That is, the cumulative effect of many small decisions made for the sake of efficiency may be "the dominance of technique" (p. 42), a situation in which technological change seems inevitable and people accept that technology is the only answer to problems. I recently observed this phenomenon firsthand in a European firm that develops software to support single sourcing. During my internship there, I learned that when the company's own documentation confused customers, the company's usual solution was not to revise or re-think the text but to add to it. Ironically, the firm's writers assumed that more was better; as a result, the documentation had mushroomed over time. In an environment that privileged systems and techniques, the writers had lost sight of how real readers used the documentation, and the types of information their readers considered truly valuable. Carliner (2000) offers a similar example, noting that systemic changes in desktop and other publishing techniques have modified common usage of the term *document design.* Instead of "problem-solving" for the user's benefit, as the term was once understood, document design now refers more often to "improving the appearance of pages and screens" (p. 562), a narrower, more mechanistic definition. As

both examples show, when technology becomes system, technique may influence practice disproportionately, and users may conclude that technological change is difficult to resist. In weighing the merits of single sourcing, Judi Greene must therefore consider how best to balance the technology's bias toward standardization with the audience's needs for customization. Chapter II suggests what is technologically feasible.

Single Sourcing as Text: Addressing Cross-Cultural Readers

Greene's next task is to define those audience needs more precisely. Because her firm disseminates technical information to global audiences, she must understand at a deep level the nature of communication across cultural boundaries, and the implications for reader comprehension if the division adopts the single-sourcing methodology. Chapter III therefore reviews current theories and practices in cross-cultural professional communication, including contrastive rhetorical studies of English and East Asian languages that are relevant to the research questions.

In contrast to single sourcing as system, the metaphor of single sourcing as text provides a greater sense of the humans in the communicative process. It also relates in a positive way to affective document design, which Carliner (2000) describes as a sense of comfort with a particular presentation of information, including the writer's attention to words, language, and cultural factors (p. 54). Too often, however, theory and practice in cross-cultural technical communication stress surface issues only. Attention to cross-cultural factors may go no further, for example, than translation options on a website, as I observed in the European software firm. Carliner cautions that true affective design "defies simplistic responses," though "[t]echnical communicators often seek formulaic

approaches . . . [such as] catalogs of rules like 'the five issues to avoid when writing for international audiences'" (p. 569). Genuine cross-cultural document design is challenging under any circumstances; in a single-sourcing environment, the task is even more difficult, given that adjusting text for global audiences "is a complex issue, often barely recognized" by current software (Boiko, 2002, p. 337). Judi Greene must therefore determine through research whether users' needs for cross-cultural variation justify the cost of "collecting the user information, tagging content, and maintaining rules" (Boiko, 2002, p. 571) as single-sourcing methodology would require. Chapter III reviews current scholarship in cross-cultural communication for insights on this question.

Single Sourcing as Tool: Providing Adequate Textual Cohesion

In defining reader needs, Greene must also consider metalanguage, particularly the cohesive devices writers usually omit between single-sourced text blocks. In this project, I generally follow the definition of *cohesion* proposed by Grabe and Kaplan (1996), which adds to Halliday and Hasan's (1976) classic formulation the structural elements introduced by Campbell (1991, 1995), such as headings, lists, and similar textual features. Although cohesion is not the only rhetorical issue associated with single sourcing, it does illustrate one of the most conspicuous differences between the new methodology and conventional composing practices. Chapter IV thus summarizes research on the effect of cohesion on reading comprehension, including comparative studies of native English readers and non-native English readers from East Asia.

The metaphor of single sourcing as tool raises interesting "questions and discussions about utility, usability, skill, and learning" (Nardi & O'Day, 1999, p. 30) in

two ways. On one level, single-sourcing methodology is a practical tool for composing, retrieving, and recombining units of text efficiently in particular situations. On another level, however, single sourcing radically limits the use of more traditional tools – cohesive ties – which are themselves practical composing devices writers use for specific rhetorical purposes. The effectiveness of the single-sourcing tool thus depends on the absence of other tools, so that units will be decontextualized. However, this rhetorical feature may prove problematic for readers. Without textual guides to deeper understanding, which Brown & Duguid (2000) describe as "all the fuzzy stuff that lies around the edges" of information (p. 2), readers may lose perspective, resulting in narrow, superficial interpretations of information. The technical communicator thus has a responsibility to determine the acceptable compromise, if any, between decontextualized information and reader comprehension. Carliner (2000) refers to this type of analysis as "cognitive design . . . [the process of] defining the intellectual capacities and needs of users and crafting an appropriate solution to meet those needs" (p. 564). Judi Greene must evaluate how well the single sourcing tool helps readers process information and the point at which the absence of cohesive ties becomes counterproductive for readers. Such analyses are rare in current technical communication literature, butChapter IV summarizes relevant psychological and linguistic studies in this area.

Overview of Research Design

For this project I have attempted to collect, analyze, and interpret data in a way that will reveal something of the relationships among single sourcing methods, cross-cultural communication, and textual cohesion. I have chosen an experimental research

design because I believe it to be a useful way of gaining insight into certain phenomena associated with computer-assisted single-sourcing methodology. As Barton (2000) puts it, some ideas have "minor interest and little force" by themselves, but when their patterns are verified empirically, they have "both significance and force in a discussion of the intricate relations between language and knowledge" (p. 408). In addition, the scope of some issues is difficult to determine solely through qualitative research methods such as ethnographic studies, think-aloud protocols, and other individualized reports. For such issues, experimental research can "provide stronger evidence of the prevalence of a problem and its trends than can individual testimony" (Charney, 1996, p. 572) and generalize more easily to larger populations (Carrell, 1989). I also see value in investigating single sourcing with methods familiar to those who make practical decisions about the technology. Technical communication scholars can seek answers to "know-why questions" (Nardi & O'Day, 1999, p. ix) in a form that will facilitate communication with practitioners and make the case for additional research without advocating a positivistic perspective.

Chapter V explains my methodology in detail. My overall strategy has been to test materials as authenticallyas possible, given the constraints of an experimental setting (Alderson, 2000). I have developed the data collection instruments from actual single-sourced texts, used by permission of the organizations thatorigin ally posted them online. Instead of objective questions, the instruments have asked participants to rate the texts on several measures and also to complete small tasks as a measure of comprehension (Lorch, 1989). Participants have been graduate students on two campuses, volunteers who might reasonably have retrieved the materials for actual reading. For purposes of linguistic

differentiation, I have limited the study to two broad groups: native English readers, and non-native readers from East Asian countries, a group of participants who have studied English and increasingly consult online technical material in English (St. Amant, 2006), but whose first languages and rhetorical conventions differ considerably from those of native English readers.

With the division manager's questions in mind, I have tested two research hypotheses: that (1) readers will respond differently to English single-sourced texts with and without cohesive devices, and (2) native and non-native English readers will also comprehend the texts differently.

Chapters VI and VII describe the experimental outcomes and potential applications of my findings, respectively.

CHAPTER II

REVIEWING SCHOLARSHIP IN SINGLE SOURCING

The form of single sourcing Judi Greene is considering – a computer-assisted method of organizing knowledge into discrete units of text and assembling some or all of those units, without further editing, into larger documents as needed – is a relatively new practice in technical communication. Much of the literature of single sourcing to date has focused on defining it, explaining its workings, offering guidance on implementing it, and examining its effect on organizations that adopt it. The few widely cited, book-length works on single sourcing directed to technical communicators (as opposed to programmers) address practitioners seeking to learn the methodology, including technical writers, publications managers, information architects, and other communications professionals. Ament (2003), currently the primary guide exclusively for single sourcing, focuses on the day-to-day aspects of writing and organizing content, while Boiko (2002), Hackos (2002), and Rockley (2003a) cover single sourcing as a specialized application within the broader field of content management systems (CMS). Less formally, single-sourcing writers gain information and advice from special-interest electronic mailing lists such as the Society for Technical Communication's Single-Sourcing Discussion List, trade shows, seminars, and proprietary newsletters sponsored by software companies such as AuthorIT, Epic, and Arbortext.

However, as Judi Greene has observed, the one perspective seldom discussed in any of these sources is that of the reader. Audiences may or may not encounter single-sourced documents as native readers of English. Further, they may or may not be

prepared for the relative lack of cohesion that characterizes most single-sourced documents, that is, the surface-level signaling that reveals relationships among the parts of a text and contributes to textual unity (Grabe & Kaplan, 1996). For that reason, the research questions of interest in this dissertation are how well readers comprehend English single-sourced texts: specifically, whether the presence or absence of cohesive devices affects reading comprehension, and whether the degree of cohesion results in different levels of comprehension between native English readers and those who read English as a second language. These questions reflect Greene's interest in single sourcing as a system: how best to balance the methodology's bias toward rhetorical standardization with her audiences' needs for variation.

Computer-assisted single sourcing has emerged from two earlier developments in technical communication: structured writing and content management. For background, therefore, I begin this chapter with an overview of these two developments. I then review definitions of single sourcing and briefly discuss some of its technical aspects to call attention to possible strategies for adding or modifying cohesive devices in single-sourced text. Finally, I summarize the assessments of single sourcing that have begun to appear in technical communication scholarship, including stated benefits, the writing process, and rhetorical issues.

Overview of Structured Writing

In the past few decades technical communication has been shifting gradually from linear composition to structured writing, a method of developing text in units according to predetermined patterns in order to address a reader's specific information needs. More

narrowly focused than traditional genres, structured writing treats information as "discrete pieces . . . that can be selected, manipulated, and presented to meet the needs of different audiences with different characteristics and different goals" (Houser, 2003, p. 13). One of the oldest forms of structured writing is Information Mapping®, a proprietary writing methodology developed in the 1960s by Robert E. Horn (1999) and still used today, particularly for instruction manuals. Horn theorizes that information sources are easier to navigate and process quickly when writers organize text in units other than the paragraph, a structure Horn finds "too poorly defined to be a basic unit of the analysis" (p. 23). He recommends that writers working on "relatively stable subject matters" subdivide their materials into as many as 40 types of "information blocks" according to rhetorical purpose, with blocks representing "precise functional descriptions" (p. 23), such as introductions, steps, definitions, cross-references, and the like. A writer or team then assembles the information blocks into a full-length document. In discussing writing for online displays such as Help functions, Horton (1994) sees a similar need for presenting information in "discrete chunks" (p. 99) or topics, although he is less prescriptive than Horn about the particular form a given topic should take. Horton defines topics as "semantic units representing a concept or thought rather than arbitrary units of presentation" (p. 100). He asserts that when writers organize online text by topics, they avoid two problems inherent in the linear, essay style of composition usually taught in schools: (1) They deliver content more efficiently to the "impatient readers of business and technical information" (p. 100) who commonly skim documents out of sequence in search of specific pieces of information, and (2) they work more effectively within the physical constraints imposed on text by small computer displays.

In addition to presenting information in a form presumably more helpful to the reader, structured writing offers the writer an efficient means of reusing, rather than rewriting, text for new purposes. Rockley (2003a) distinguishes between "opportunistic reuse," which depends on individual writers' knowledge of existing text, and "systematic reuse," which requires extensive planning at the organizational level (pp. 30-31). When authors systematically create text in blocks, each unit can potentially stand alone, without rhetorical links to other units, thus facilitating recombination in a variety of documents without revision. Authors in structured writing environments adhere to guidelines that "explicitly identify the content that needs to be included, the order in which it should be included, and the places where content is reused" (Rockley, 2003b, p. 350). The guidelines ensure design consistency across units, an essential quality in units intended for reuse (Hackos & Rockley, 1999, p. 7). This type of writing "requires efforts that depart from linearity, hierarchy, and sequentiality . . . [but it] ensures usability by allowing individual text fragments to be queried and reused as needed by different media, purposes, and audiences" (Sapienza, 2004, p. 401). The net result is that each writer develops reusable content blocks, likely as part of a team, instead of handcrafting unique documents as sole author.

Although structured writing requires traditional authors to learn radically different writing practices, proponents believe the method offers organizations several advantages. According to Houser (2003), organizations gain most from treating information as units when the information must be shared among organizations and is already highly modular, as procedures are, or when a server assembles units instantaneously online, as in the case of web pages constructed for specific user profiles. Further, structured writing minimizes

the adjustments necessary for displaying text automatically in several forms at once (Sapienza, 2004; Rockley, 2003b; Houser, 2003); it reduces the costs of translating text repeated verbatim in several documents (Rockley, 2003b); and it provides a type of quality control by unifying the content and style of documents that may be the work of several writers (Sapienza, 2004; Rockley, 2003b).

Structured writing is a method, not a technology (Ament, 2003), and authors can use the method on a modest scale to improve text readability or reusability (or both) without sophisticated computer support. However, writers in organizations that produce documents in volume are moving increasingly to an advanced form of structured writing, which involves assigning each unit of text a tag or short computer code, also known collectively as *metadata*, so that specialized computer applications can store, locate, and retrieve the unit as needed. Unlike the formatting codes of word-processing programs, which control a text's appearance, structured writing tags "richly describe the content [of each unit] in a semantic way, enabling functionality far beyond simple formatting" (Hackos, 2002, p. 68). Without such tagged subdivisions of text, a system retrieves full-length document files only (Hackos, 2002; Boiko, 2002), forcing writers to search manually within the files for specific reusable passages or to republish documents in their entirety. Indeed, while acknowledging that structured writing helps to ensure consistency, Rockley (2003b) contends that structure itself is the basis of effective computer-assisted single sourcing. Ament (2003) states flatly that modular or structured writing is "an all-or-nothing issue" for successful single sourcing projects, because only "stand-alone modules" can be reused without regard to format (p. 3), as single sourcing requires.

In turn, tagged structures and their potential for reuse have contributed to the evolution of the complex tracking and retrieval programs known broadly as content management systems, the second development contributing to the rise of single sourcing.

Overview of Content Management

An organization may implement a content management system without practicing single sourcing (Boiko, 2002; Hackos, 2002; Rockley, 2003a), but single sourcing on a large scale is unworkable without the support of a content management system, "a software layer controlling a database-management system . . . that stores either the content resources themselves or references to those in a file-management system" (Hackos, 2002, p. 77). Content management systems are proprietary products with a range of features and capabilities, but Hackos (2002) identifies four basic functions included in the most effective systems:

(1) The systems enable structured writers to create new, tagged units of information and also to import and manipulate documents developed previously as print or electronic forms, as documents in word-processing formats, or as unstructured files.

(2) The systems also store units in a central repository or database with a check-out mechanism for writers.

(3) They provide for assembling and linking units in larger documents, as needed.

(4) Finally, the systems separate content from style, postponing formatting until just before publishing the completed texts in a variety of media.

Rockley (2001a) characterizes a good content management system as one that controls access to the repository, searches and retrieves text, tracks versions and editing

changes, and provides for meaningful tagging of units; Ament (2003) recommends also that a system display relationships among units, and the important milestones in an organization's document production process.

Although systematic content management supports reuse on a scale never before possible, it does require detailed planning and collaboration among an organization's writers (Boiko, 2002; Hackos, 2002; Rockley, 2003a). Johnsen (2001) divides the process of managing document content into three general stages: analysis, design, and construction.

Content Analysis.

A writing team begins by analyzing the information components of real-world documents and the relationships and hierarchies among those components (Johnsen, 2001). During analysis, one critical decision concerns granularity, or the degree to which information in a given genre or model is to be divided and subdivided into units. Content management experts offer several perspectives on this question. Depending on publication needs, granularity may change throughout a model, ranging from the level of an entire document down to the level of paragraphs or even words (Hackos, 2002). According to Rockley (2003a), "granularity determines the smallest piece of information that is reusable" (p. 165). The finer the granularity, however, the more complex the task of coordination within the system (Hackos, 2002). Writing teams must therefore find an acceptable compromise between reuse potential and content manageability, given their organization's communication goals. In discussing the relationship between granularity and context, Rockley (2003a) notes that "surrounding information may need to be

included" in a unit, if the unit's meaning would otherwise change (p. 166). Darley (2003) recommends that authors identify as their smallest reusable units any information they may need to reformat, use for multiple functions, or exclude. Boiko (2002) approaches granularity somewhat differently, situating reusability in the writer's decision to develop content in greater or lesser detail so as to address the opposing needs of "strong communication" and reuse, a principle Boiko calls "balance of generality" (p. 497). However conceptualized, granularity reflects a team's decisions about segmenting content. It describes the arbitrary boundaries of the information units to be included or excluded from a document, depending on audiences and purposes.

Content Design.

The second general stage of document production involves using the team's analysis to design tagged content units, frameworks to contain them, and style sheets to alter the appearance of the content for different genres and media (Johnsen, 2001). In this stage the team (or designated individuals) develop metadata, the codes or "information about information" (Hackos, 2002, p. 73) that are attached as tags to content units. Metadata never appear in a published document, but within a content management system they "uniquely identify content so that authors can find it, reuse it, and move it" (Rockley, 2003a, p. 172). Usage of *metadata* as terminology is inconsistent in practice and in the literature of content management. According to Boiko (2002), many practitioners use the term in a narrow sense to refer only to the administrative data associated with tracking and retrieving content units, such as author, date of creation, review status, and so on. A broader view, however, is that metadata comprise all

identifying descriptors for a given content unit, including not only its production history but also data on itsinternal structure, formatting, variations, and relationships to other units. Boiko supports the broader view, contending that metadata are "what you need other than the data itself to understand and use that data . . . . [Metadata add] context and a wider interpretation to the data" (p. 456). Similarly, Rockley (2003a) states that metadata help writers "determine not only what the content is, but who uses it, how it will be used, how it will be delivered, and when" (p. 184). Hackos also argues that "metadata should chiefly be used to identify the subject matter of the content [rather than management processes] . . . making it easier to retrieve by authors or a publishing system" (p. 73). Because idiosyncratic tagging in any system has a negative effect on reusability and consistency, organizations seldom require individual authors to write their own metadata. More commonly, organizations designate one person or small group to create tags for the entire writing team or to customize, as needed, the standard tags built into some content management systems. The important principle is that, like granularity, a system's metadata represent a set of writing decisions made during planning. The extent to which an organization's metadata are detailed, descriptive, and semantically meaningful is one indicator of that organization's approach to communicating with its users through the content it develops.

Text Construction.

The final stage of document production in a content management system is to construct full-length documents by assembling the tagged units and applying style to content, as appropriate for the genre and medium (Johnsen, 2001). The instructions for

content assembly reside in separate computer files known variously as document type definitions (DTDs) or schemas, discussed in greater detail in the section that follows. A document's appearance online or on paper is formatted by a separate computerized style sheet.

The recent convergence, then, of structured writing and content management has laid the methodological and technical foundation for the practice of single sourcing. Structured writing creates text in discrete, internally cohesive units; content management systems provide a means of coding, retrieving, and publishing those units efficiently in different genres and media. As the practice of writing a unit of text one time – the "single source" – and reusing that unit in a variety of information types, single sourcing draws from both developments.

Single Sourcing: Definitions and Tools

Because not all writers use *single sourcing* in the same way, this section reviews published definitions and reiterates the definition for this dissertation. The section follows with summaries of concepts involved in the single-sourcing methodology.

Definitions.

Single sourcing is essentially a specialized type of content creation and reuse, and some published definitions of single sourcing apply equally to content management. Wiles (2003), for example, defines single sourcing as "storing text separate from the published documents and using technology to assemble documents from that text" (p. 380). Carter (2003) describes single sourcing similarly, as "producing documents

designed to be recombined and reused across projects and various media" (p. 317). Rockley (2001b) includes the practice of republishing intact documents in other media as an elementary form of single sourcing, as does Ament (2003; see "repurposing," p. 15). Sander (2002) proposes viewing single sourcing as a method of sharing information among authors, "a continuum of solutions" (p. 7) ranging from basic PDF files at one end to sophisticated content management systems at the other.

More often, however, published definitions address the advanced form of single sourcing that is the focus of this dissertation. Williams (2003) cites the definition of the Society for Technical Communication's special interest group on single sourcing: "using a single document source to generate multiple types of document outputs" (p. 321). The practitioner's need to publish documents easily in different media informs several definitions, as when Sapienza (2002) refers to single sourcing as "creating content once and using it many times" to create "device independent" documentation (p. 157). Butland (2001) also focuses on using "the same source document to produce multiple versions in any medium" (p. 23), while Darley (2003) describes the ability "to create and maintain one single set of information and yet produce a range of different outputs" (part 1, section 1). Ament (2003) uses the term "re-assembly" to describe "[r]e-organizing modules for different audiences and purposes," including reconfiguring them for new formats (p.15). In an early definition of single sourcing, Hackos and Rockley (1999) outline a specific process in which "writers break information down to the element level (e.g. section, paragraph, sentence), then write and compile all elements into a single source file" (p. 3) from which they draw elements, as required, for different information types. Hackos' later, more comprehensive definition of single sourcing is "to write once and use the

modules of information many times, revise once to update everywhere, and translate once" (2002, p. 295). Elsewhere, Rockley (2001b) identifies several levels of single sourcing, differentiating among identical content republished in multiple media (level 1), "static customized content . . . [which] cannot be changed without the intervention of the technical communicator" (level 2) and "dynamic customized content," the personalized online documents assembled almost instantaneously upon request, such as e-commerce web pages (levels 3 and 4) (p. 191).

Perhaps one useful way to distinguish between repurposing and advanced single sourcing is to consider differences in granularity and level of planning. At one extreme, an organization repurposes a document by lifting it from the medium of its original publication, possibly as an afterthought, and republishing it intact in a different medium. The so-called granule is the entire document. At the other extreme, an organization creates a single-sourced text by identifying all future publication needs, intentionally organizing and storing a body of knowledge in discrete components, and then assembling the appropriate components, without further editing, to address those needs, all with the aid of a sophisticated computer program. The second definition is the focus of this study.

Technology of Single Sourcing.

Organizations can choose from a wide variety of tools, capabilities, and configurations, depending on their specific single-sourcing needs. An analysis of proprietary technology is beyond the scope of this dissertation, as is a detailed discussion of programming and database management techniques. However, content management systems that support single-sourcing are of two general types: those that store units of

information as fields within a relational database, and those that store units as objects, using a markup language (Hackos, 2002; Sapienza, 2002; Darley, 2003). The two storage types (databases or repositories) are not mutually exclusive, and the most powerful and flexible systems may combine them (Boiko, 2002). Database administrators, not writers, are responsible for managing repositories (Hackos, 2002).

Relational Databases. A relational database system stores information in a series of tables, each of which represents a category of content that can be related to content in other tables. Each record or row in a given table is an "instance" of that category, and each column in that row is a field or "particular piece of uniquely named information that can be individually accessed" (Boiko, 2002, p. 846). The column and row labels provide the metadata for retrieving content units in the database, although the writer may be able to work with units "by checking boxes and making selections from lists" if the system has a graphical user interface (Darley, 2003, part 1, section 3). Sapienza (2002) notes that data-driven systems "offer searching and sorting of data as well as rapid access" (p. 159). However, the structure of relational databases is often rigid. Fields may be organized in a particular order and restricted to unmixed types of data, such as numeric or alpha characters only, which can impede data exchange between organizations (Sapienza, 2002). Moreover, the process of representing nested text, or content at differing levels of importance, can be unwieldy in a relational database. If, for example, a writing team decides that granularity at the sub-paragraph level is appropriate for certain topics, the task of re-creating that hierarchy in a row-and-column system may be "prohibitively complex" (Boiko, 2002, p. 852).

Object Databases. For greater ease in storing hierarchies of information, a content management system may employ an object database. This type of system borrows from a computer coding practice in which a programmer writes objects, or "small, reusable pieces of functionality that the programmer links together to achieve a larger result," in contrast to the long, comprehensive programs written in earlier periods that had to run from beginning to end (Boiko, 2002, p. 586). Just as object-oriented programmers connect chunks of code to generate a series of functions, so writers draw from object-oriented databases to join textual units or "data objects" (Houser, 2003, p. 13) into full-length documents. Rockley (2001b) points out that writers do not compose objects per se; "rather, they create information in context that can be extracted into objects that can be reused" (p. 191). Writers can customize the documents they assemble because of the programming principle of *polymorphism*, which refers to a system's ability to retrieve discrete units of tagged text and those units only, as instructed by the specific rules governing the construction of each document (Center for Information-Development Management, 2001; see also Applen, 2002, p. 309, on "omnimorphic" data structures). Such rules specify the content permitted for that genre or information type, the tags writers must use, and the sequence or hierarchy of those tags (Applen, 2002; Hackos, 2002), resulting in a "logical description" for each document (Hibbard, 1990, p. 14). Depending on the architecture of a particular content management system, the rules may be contained in document type definitions (DTDs) or schema, but their function of "specifying and enforcing a certain structure" on a document's content is the same (Boiko, 2002, p. 751). A DTD itself has no actual content, only the metadata that identify content units and the relationships among them (Applen, 2002).

eXtensible Markup Language (XML). In an object-oriented system, the metadata for content units come from markup language in the form of coded tags assigned to each unit. At present, the markup language most nearly resembling a "global standard" for content management systems and other applications (Boiko, 2002, p. 744) is eXtensible Markup Language (XML), a non-proprietary derivative of an older markup language, SGML. Although in superficial ways XML resembles (and is sometimes compared to) HTML, the language popularized in early Web applications, XML is much more complex and powerful.

XML, for example, supports content reuse because DTDs and schema require structured, decontextualized writing. HTML, by contrast, imposes almost no structure on content; so long as writers insert appropriate formatting codes such as line breaks and paragraph markers, they can handcraft HTML files just as they would any traditional document. In addition, XML easily supports publishing across print, online, and other platforms, because its publication parameters reside outside the content units in separate style sheets, which search the tags in each XML file to determine how to display the file in a given medium (Sapienza, 2002). HTML, however, displays only in Web browsers.

Perhaps most important, whereas HTML functions mainly as a formatting tool, XML is "self-describing" (Sapienza, 2002, p. 156). That is, an XML tag refers to "the actual information" within a content unit (Applen, 2002, p. 308), not the unit's physical appearance. Unlike SGML's or HTML's finite set of uniform tags, which have been standardized and approved by the World Wide Web Consortium, XML's semantic tags are infinitely original, devised by user groups to meet the content management needs of

their own organizations (Rockley, 2001a; Johnsen, 2001). If necessary, XML tags can contain several smaller descriptors to identify content even more precisely.

On the following pages, Figures 1-3 illustrate the functional differences between HTML and XML in a sample of text taken from the website of the Department of English at Oklahoma State University (n.d.).

Figure 1 is an excerpt from the page describing the doctoral program in Rhetoric and Professional Writing, as it currently appears online.

Figure 2 is the actual HTML code for that page, available for viewing through the Page Source function. In this excerpt, <h2> is the tag for "second-level heading," is "paragraph," is "unordered list," and <li> is "list item." A tag showing a forward slash (as in) signifies the close of that particular formatting operation. The HTML tags do not describe the actual content of the page, sometimes referred to as a document's "conceptual description"; instead, they link to a "formatting prescription" that governs the screen appearance of the text (Hibbard, 1990, pp. 14-15).

Figure 3 is the same text as it might be coded in XML. Here, the tags are semantic, describing the information itself. For example, the <PhD title> tag refers not to a heading style but to a set of words that can be incorporated into any document whose DTD calls for that tag. The <PhDitem> tags include additional descriptors to capture specific types within that category. Unlike the HTML tags, which users everywhere must apply in the same ways, XML tags can be customized as necessary. Separate style sheets would determine the appearance of this text in a brochure, a catalog, or a web page.

PhD in Rhetoric and Professional Writing

The PhD degree consists of 60 credit hours beyond the MA degree. Fifteen to 20 of these hours are devoted to the dissertation. In addition to these hours, students must

- Take a prequalifying exam in their second semester
- Demonstrate reading knowledge of two foreign languages or mastery of one language
- Pass the PhD qualifying examination in two areas
- Pass an oral defense of the dissertation

Students may also choose an interdisciplinary emphasis in a variety of areas: technical writing, composition and rhetoric, linguistics, teaching English as a second language, and all periods of British and American literature, Native American literature and language, creative writing, literary theory and criticism, and film. In consultation with their advisory committees, students devise an individualized curriculum that reflects their own intellectual interests and career goals.

Figure 1. Excerpt from the OSU Technical Writing Website (Department of English, n.d.)

```
<h2>PhD in Rhetoric and Professional Writing</h2>

<p>The PhD degree consists of 60 credit hours beyond the MA degree. Fifteen to 20 of these hours are devoted to the dissertation. In addition to these hours, students must</p>

<ul>
   <li>Take a prequalifying exam in their second semester</li>
   <li>Demonstrate reading knowledge of two foreign languages or mastery of one language</li>
   <li>Pass the PhD qualifying examination in two areas</li>
   <li>Pass an oral defense of the dissertation</li>
</ul>

<p>Students may also choose an interdisciplinary emphasis in a variety
of areas: technical writing, composition and rhetoric, linguistics, teaching English as a second language, and all periods of British and American literature, Native American literature and language, creative writing, literary theory and criticism, and film. In consultation with their advisory committees, students devise an individualized curriculum that reflects their own intellectual interests and career goals.</p>
```

Figure 2. Actual HTML Coding of Excerpt from the OSU Technical Writing Website (Department of English, n.d.)

<PhDdegree>

<PhDtitle>PhD in Rhetoric and Professional Writing</PhDtitle>

<PhDhours>The PhD degree consists of 60 credit hours beyond the MA degree. Fifteen to 20 of these hours are devoted to the dissertation.</PhDhours>

<PhDrequirements>In addition to these hours, students must

<PhDitem reference=”prequal”>Take a prequalifying exam in their second semester</PhDitem>
<PhDitem reference=”language”>Demonstrate reading knowledge of two foreign languages or mastery of one language</PhDitem>
<PhDitem reference=”qual”>Pass the PhD qualifying examination in two areas</PhDitem>
<PhDitem reference=”oral”>Pass an oral defense of the dissertation</PhDitem>

</PhDrequirements>

<PhDareas>Students may also choose an interdisciplinary emphasis in a variety of areas: technical writing, composition and rhetoric, linguistics, teaching English as a second language, and all periods of British and American literature, Native American literature and language, creative writing, literary theory and criticism, and film. In consultation with their advisory committees, students devise an individualized curriculum that reflects their own intellectual interests and career goals.</PhDareas>

</PhDdegree>

Figure 3. Sample XML Coding of the OSU Technical Writing Website.

Clearly XML offers great publishing power. The challenges for an organization are to coordinate programming and information development adequately and to write content that is simultaneously meaningful and reusable.

Conditional Text. Hackos (2002) explains the descriptive function of XML metadata as providing writers with “access to a categorizing framework” (p. 309), enabling them to select, at several levels, the content variants that best meet a specific information need. These options, sometimes referred to as *conditional text*, allow writers

to “mark text or graphics for conditional display, then switch the sections on or off, as needed” (Ament, 2003, p. 183). A writer might use conditional text, for example, to substitute a cross-reference in the print version of a document for a link in the online version (Butland, 2001). Other possible uses of conditional text include customizing for different audiences and user preferences (Brierly, 2002; Sapienza, 2004); changing product names (Hackos, 2002; Rockley, 2003a); incorporating variant spellings (Hackos, 2002); providing production notes or guidelines for translators (Kohl, 1999); and accommodating different document types and languages (Ament, 2003). Noting the potential for “multiple conditional markups, chopping sentences into short phrases or word blocks” within a given content unit, Kramer (2003) comments that “[c]onditional expressions can . . . be one of the single most complex features a writer will work with,” forcing the writer to imagine how a given content unit might fit into any of several different formats (p. 331). Similarly, Ament (2003) advises writers to use a content management system if they find themselves working with ten or more conditional tags (p. 185). Despite the complexity of conditional text, however, Rockley (2003a) prefers it – that is, using “metadata to define variables that are inserted as required” whenever “word variations are required to make content reusable” – to the routine use of word-level granularity, an approach she considers “extremely difficult to model and maintain” (p. 166). To date, technical communication scholarship has yet to address the possible use of conditional text for rhetorical purposes. However, clearly the mechanism exists for customizing information in a variety of situations. With study, conditional text adding cohesive or transitional devices could prove to be one means of adjusting single-sourced

text for specific audiences, thereby increasing readability and audience comprehension, as Judi Greene hopes to do.

Critical Views of Single Sourcing

Much of the single-sourcing literature relates directly to practice; authors commonly focus on the methodology's benefits to organizations, or share experiences and tips on implementing it. In the following section, I summarize the arguments in favor of single sourcing. However, a few authors have begun to examine the radical rethinking of organizational structure and writers' roles that single sourcing entails, and I review those critiques as well. Finally, I examine the literature on rhetoric and single sourcing, summarizing theoretical perspectives that have been proposed for improving the readability of these texts.

Stated Benefits of Single Sourcing.

Organizations that invest in single sourcing generally do so to reduce the time, effort, and other costs of document production (Butland, 2001; Darley, 2003; Carter, 2003). A high-end content management system that supports single sourcing can cost more than $250,000 and require up to two years to implement (Sander, 2002), and Butland (2001) finds that single sourcing is usually feasible only when at least 50 percent of a given body of text is shared across documents. Still, according to proponents, single sourcing provides "faster responsiveness to a constantly changing marketplace" and enables technical communication departments to do more with fewer resources during budget cutbacks (Clark, 2002, p. 317). Consultants Hackos and Rockley (1999), for

example, estimate that single sourcing decreases costs for their clients by 25 to 60 percent (p. 5), especially when documents must be translated.

In addition, single sourcing can improve the quality of document families by increasing the consistency of information and decreasing duplication. Writers from any department within an organization may add, update, or review text once, in the source content unit, and thereby make those changes automatically wherever that unit is used (Sapienza, 2002; Darley, 2003), a feature that also decreases clerical tasks for authors (Hackos & Rockley, 1999). Because single sourcing separates content from formatting and design, authors can write documentation that is "device-independent," suitable for print, HTML, PDF, or other types of output without the need to revise content for each version (Sapienza, 2002, p. 157). Weiss (2002), who refers to the new model of authorship as "egoless writing" (p. 3), compares the traditional technical writer to the pre-1970 computer programmer, both of whom often worked alone in a process that privileged an individual's "artistic impulse" (p. 6). In the absence of outside scrutiny by a development team, Weiss maintains, crafted products were commonly "filled with technical errors, delivered too late for thorough editing, and inherently unmaintainable by anyone other than the solo author" (p. 6). Instead of the craft process, Weiss values an engineering model that integrates teamwork, analysis, planning, and testing with modular, reusable writing. In Weiss' view, the engineered text, written to specifications, actually protects readers by guiding them through the material, in contrast to a more individualistic text that expects "the readers to find things and apply them correctly" on their own (p. 7). Acknowledging that the transition from artist to modular writer can be difficult, Hackos and Rockley (1999) frame the writers' new role as a necessary tradeoff

between the added responsibilities of understanding readers' needs for multiple outputs and freedom from formatting tasks, along with the opportunity to gain "proficiency with many types of information" (p. 10). They foresee specialized single-sourcing teams that could consist of writers developing blocks of information, designers building information models and document templates, editors checking for standards and consistency, and tools experts designing and maintaining the content management system.

Changes in the Writing Process.

Not surprisingly, arguments that single sourcing brings new efficiency and benefits to technical publishing are countered by arguments that single sourcing complicates it. In an environment of rapid production cycles, global markets, and multiple media, single sourcing requires that authors simultaneously decontextualize their writing and work more collaboratively than ever before. At the organizational level, Carter (2003) relates current changes to the beginning of the personal computer era, when organizations eliminated typing pools and reassigned text production to a few writers equipped with computer software and printers. Carter (2003) asserts that "[a]s a practice, single sourcing puts pressure on the seemingly stable constructs of the writer and the document in ways that many previous innovations have not" (p. 318), including earlier forms of team writing. According to Carter, the present paradigm shift may affect the traditional "unified writer" (p. 319) in one of two ways: Either (1) the organization will offer the writer an expanded role involving new managerial and technical skills, or (2) the organization will redirect the writer into specialized content development, reassigning

tasks of design and coordination to other workers, as Hackos and Rockley (1999) have outlined.

Scholars view this boundary between generalist and specialist in different ways. While agreeing that writers in single-sourcing organizations will need to adapt to "a more management-technologist role" (p. 329), Kramer (2003) foresees a blurring of roles, rather than a sharp division. In contrast to the compartmentalization Hackos and Rockley envision, Kramer situates single sourcing's complexity in "the lack of separation between writing and the roles of editor, content developer, and technical expert" (p. 329). On the one hand, instead of developing text structures and document styles on their own, writers must accept "what the tools at hand produce within already defined styles" (p. 329) and refocus their design, organizational, and technical skills on managing the new toolset and on problem-solving at a broader level. At the same time, Kramer argues, writers must maintain their specialized product knowledge, without which "[t]he document development process is complex and difficult to visualize" (p. 331). Quite apart from the arcana of markup language, Kramer believes the need for writers to be both generalists and specialists is the biggest challenge posed by single sourcing.

Clark (2002) allows that generalists may gain prestige from working more closely with information technologists and sharing "their new expertise . . . in enterprise-wide content management initiatives" (p. 21). However, Clark also warns that single sourcing may simultaneously devalue specialists who relinquish traditional interdisciplinary skills to focus solely on writing. Clark reports qualitative findings gathered in three (US) software documentation firms whose practices correspond to Rockley's (2001b) first three levels of single sourcing. In the firms at levels 1 and 2, the technical writers did

spend more time on composing, once templates and output files were in place. In the level 3 firm, however, the writers developed training manuals mainly by adding XML tags to content provided by the client, a potentially mechanistic process that could conceivably be reassigned to less skilled workers. Clark contends that separating content and form could "add to the limited perceptions of expertise many in organizations have about technical communicators" (p. 23) and believes that writers must oppose this devaluation. Similarly, Williams (2003) advises writers to "avoid being saddled with processes and initiatives they don't influence with their skills and expertise" (p. 324), urging them to be actively involved in determining the role information technology will play.

A second finding from Clark's qualitative study (2002) suggests that single sourcing can "privilege organizational needs over enduser needs" (p. 21), an objection not unrelated to collaborative, structured writing. In single sourcing, an author creates and edits only chunks of information, or possibly a cross-section of information in a suite of documents (Rockley 2003b). The collaborative model shifts "ownership of . . . output" (Hackos & Rockley, 1999, p. 9) from sole author to writing team, to "ensure that the content meets all the requirements for reuse" (Rockley, 2003b, p. 352). But when teams view content reusability as paramount and "content differentiation" as costly (Rockley, 2003b, p. 352), users' unique information needs can receive lower priority. In Clark's study (2002), the level 1 organization published content without change in print, PDF, and online forms, an efficient approach but one that "added nothing to the benefit of users and in fact made user-based adjustments less frequent than they had been when the writers had to hand-create and assess" each document individually (p. 22). The level 2

organization adapted content for users by "adding or subtracting tagged chunks of content from online vs print versions" (p. 22), yet the team lacked resources to test the effect of such adaptations on document usability. Clark cautions that system goals for "*kairos*-neutral" efficiency should not have precedence over the user's need for "a nuanced, carefully crafted individual presentation" provided in proper context (p. 22), even though consistency across a document suite can be valuable to readers.

However, consistency itself can be problematic in a single sourcing environment. As Albers (2003b) points out, traditionally crafted documents are naturally inconsistent because no two writers apply corporate style guides in exactly the same way. So long as the user reads only one text at a time, inconsistency across documents may not be obvious. But when writers approach single sourcing with a traditional mindset, the completed document may juxtapose idiosyncratically crafted units. The result: "discontinuities across the whole" (p. 338), which may be jarring to readers at a subconscious level. To keep the focus on "a user's real-world information needs" (p. 338), Albers believes technical communicators will need to "shed the craftsman model" (p. 338) and prepare themselves at a senior level to share in the technical decisions on how best to design and deliver information from the user's point of view.

Rhetorical Issues in Single Sourcing.

Single sourcing emerged in response to publishing needs in business, particularly in online genres. Its roots lie in programming and information management, not communication. As a result, scholars have only begun to examine its rhetorical

assumptions and to propose "evaluative techniques" (Sapienza, 2004, p. 399) appropriate for a writing methodology that is tangential to traditional notions of linearity and context.

Because of its database origins, single sourcing's functionality depends heavily on classification and patterning. Writers must categorize information correctly and store it hierarchically if a content management system is to respond properly to queries. Research in single sourcing has therefore focused more on the techniques of ensuring good matches between users and content units than on rhetorical factors. In recommending areas for audience research, for example, Boiko (2002) emphasizes pragmatic issues such as collecting demographic and statistical data on each audience, identifying audience attitudes, studying competitors' publications, and analyzing how audiences are likely to use such publications (p. 506). Excluded from his summary are any theoretical considerations of cognition or rhetoric that might bear on the arrangement of content units. Rockley (2001a) offers a similar list of necessary analyses, such as audience types and their information goals, information types, level of granularity, and metadata needed for content units, but (with one intriguing exception) says little about why or how these analyses contribute to readability. Referring to an earlier debate over whether single-sourced documents should display linearity and organization, Rockley does comment that "research and experience have shown that the people who stressed effective organizational patterns and information context [in the 1980s] were right" (p. 30). However, she does not elaborate. Ament's (2003) guide for practitioners is just as task-oriented, explaining that single sourcing is a process of "build[ing] cross-references (for example, tables of contents, section contents, inline cross-references, indexes) that link modules logically for a given document. These cognitive bridges connect stand-alone

modules, transforming them into coherent documents" (p. 11). In outlining generally what is to be done and how, Ament omits any discussion of why the process works, why a reader would regard a given link as "logical," or why a document should be "coherent." In these widely cited works, the absence of theoretical constructs that relate to communicativity is conspicuous.

However, a few researchers have begun to move beyond hands-on matters of implementation to ask whether single sourcing's rhetorical foundation is adequate for its communicative tasks. Does a system genuinely meet readers' needs, for example, simply by classifying, sorting, and matching tagged units of text, even if the system does so efficiently? Albers (2003b) and Clark (2002) find the relationship between dynamic content assembly and reader needs rhetorically problematic, but for different reasons. Albers expresses concern that organizations will inadvertently allow the craft model of writing to persist, particularly if design decisions are left to XML experts and systems analysts, who may understand technology but not principles of presenting information. In Albers' view, the resulting deliverables could "end up providing a high-level collection of text blocks with minimal content stuck into a template that fails to adequately meet the context of the user's situation" (p. 338). To keep the organization's focus on content rather than technology, he urges technical communicators to advocate for systems that are user-aware as well as organization-friendly. From a different perspective, Clark suggests that organizations may marginalize rhetorical concerns in single-sourcing environments because, in practice, much of single sourcing still depends on guesswork. In his qualitative study of single sourcing in three software documentation firms, Clark reports that in the level 2 organization, granularity, not structure or design, was the

pivotal issue in adapting text for an audience. Moreover, the writers usually settled on paragraph-level granularity "on the assumption (and without the benefit of much data about their user populations) that an online- or hardcopy-specific paragraph here and there would be sufficient to adjust to reader needs" (p. 22). Clark argues that in "privileging chunking over editing" for a particular audience, purpose, and situation (p. 22), single sourcing elevates the organizational need for efficiency over the user's need for context.

A broader issue raised by some researchers concerns single sourcing's position in rhetoric. What perspectives might offer the greatest explanatory power for single sourcing, and how might technical communicators use those perspectives to inform best practices? Clark (2002) contends that the pragmatism so common in single-sourcing literature reflects the disproportionate influence of marketing, management, and information technology theories in the new writing environment. Technical communicators, he believes, have been slow to critique those theories and to think through the relationship between the new methodology and established writing processes. Attempts to superimpose one upon the other may be unwise. A better course, he believes, is to redevelop single-sourcing methodology with "sophisticated rhetorical grounding" so that writers can reach authentic "context-driven communicative goals," rather than only "approximate" them by skillful patterning (p. 20). Clark does not specify how to accomplish this task, but Price (2003) proposes neo-Aristotelian criticism as a starting point. Price outlines "a rhetoric of objects" (p. 147) that applies to discrete chunks of information all the classic elements of invention, arrangement, style, delivery, and memory, adapting them as necessary for today's multiple outputs and information types.

For example, if a writing team adjusted a standard template to document as accurately as possible the objects or steps in a particular procedure, the team would be applying the principle of arrangement for the user's benefit. Price broadens the concept of rhetorical purpose from simple persuasion to include "almost any communicative act" (p. 147). He also notes that, unlike Aristotle's "unified audience" (p. 148), today's multiple audiences vary widely in their information goals and participate actively in shaping objects and object relationships through electronic discussions, online choices, and other forms of feedback. This very interactivity, however, has the power to transform object-oriented methods from pattern-matching into near-dialogic exchanges. The critical factor is the writers' commitment to a rhetorical, rather than technological, perspective.

Although Price confines his discussion to verbal information objects, visual design is also important to user-centered communication, and to this end Johnsen (2001) offers another way of combining object orientation with rhetorical theory. Johnsen focuses on how visual language theory might compensate for the limitations of object orientation in ensuring that a document's final design is truly appropriate, perceptually and rhetorically, for a given purpose and context. Borrowing from Horn (1998), Johnsen argues that four components – morphology, syntax, semantics, and pragmatics – provide insights into "the interaction of verbal and visual elements" (p. 61) that object orientation alone cannot. A content management system selects and manipulates objects, but style sheets determine their configuration on the page or screen, and style sheets reflect only what their human designers choose to include "about documents, their structure and content, and the way users interact with them" (p. 65). Johnsen encourages writers and designers to encode their knowledge of visual principles such as repetition, patterning,

separation, and others into the instructions that render content units as finished documents. In so doing, Johnsen believes, writers and designers will create "a powerful tool for capturing part of that knowledge in a theoretically sound way" (p. 65) so that the knowledge will still be operative in the future when publishing is even more automated than it is now. The integration of object orientation and visual language theory is an excellent example of what Applen (2002) refers to as "data with context" (p. 308), that is, organizational (or perhaps individual) knowledge that has been carefully examined, separated into components, and encoded into a markup language, but which retains at least some of the situatedness that made it meaningful to its users in the first place. In Chapter IV, I explore further the ways in which visual, structural features complement verbal elements to strengthen a document's overall rhetorical grounding.

Research Needs in Single Sourcing

Among academic technical communicators and researchers, single sourcing is only beginning to attract attention. Although practitioners regularly exchange information on single sourcing through such venues as *Intercom* magazine and conferences associated with professional groups such as the Society for Technical Communication and others, theorists have lagged behind. A recent call for papers on content management for *Technical Communication Quarterly* points out that "academics [in technical communication] have yet to discuss CMS in writing," despite high interest in this topic in the information management industry (B.Gu, personal communication, September 12, 2005). For conference sessions from 2000 through 2005, the website of the Association of Teachers of Technical Writing lists only five titles directly related to content

management (ATTW, 2005), although a posting on the ATTW listserv does list "[t]he rhetoric of content management" as one of technical communication's most promising areas of research (K. Schriver, personal communication, October 1, 2005). A few theorists have cited the need for empirical work in XML technology, usability, and content analysis (Clark, 2002; Albers, 2003a).

The present project, therefore, is unique in that it is an experimental, rather than theoretical or practical, study. In addition, by attempting to isolate one of the features of single-sourced writing that may reduce comprehensibility, this study places a new focus on the audience. Instead of production, it addresses problems of reception.

In the following chapters, I examine two issues related to audience reception that also apply to single-sourcing practices. In Chapter III, I examine scholarship in technical communication across cultures, including contrastive studies of texts in English and in East Asian languages. In Chapter IV, I review the literature on textual cohesion, a linguistic feature conspicuously absent from many single-sourced texts, and consider cohesion's effect on the comprehensibility of these documents.

CHAPTER III

REVIEWING SCHOLARSHIP IN CROSS-CULTURAL COMMUNICATION

Because her firm disseminates information to global audiences, including growing numbers of East Asian readers, Judi Greene knows that she must consider single sourcing not only as a system but also as a text, a medium within which writers and readers interpret technical phenomena. In any setting, the communicative power of single-sourced documents depends on how well writers "read" a prospective audience and, in turn, how well that audience "reads" the products of the technology. In a cross-cultural environment, sensitivity to cultural issues is particularly critical, given that neither writers nor readers can assume shared backgrounds or interpretive strategies. Consequently, Greene believes that she must do more than accumulate demographic facts about her diverse audiences. Instead, she must become more aware of culturally based ways of conceptualizing technical topics, the specific cultures with which her firm interacts, and the communication styles most effective in those cultures (Hofstede, 1991; Warren, 2002). In thinking of single sourcing metaphorically as a text, she must understand the implications for reader comprehension if her division adopts the methodology.

As an experienced writer and manager, Greene knows that some scholars and practitioners argue for universal technical communication principles, rather than cultural accommodation. According to this more traditional, product-oriented view, the North American style of technical writing already embodies principles of simplicity and clarity that are "effective and appropriate . . . [in] nearly every culture" (Weiss, 1998, p. 266). When writers purposely introduce textual conventions such as ambiguity or indirection in

order to accommodate local rhetorical traditions, they are adopting an approach that is not "culture-free" but "culture-fair," according to Weiss (pp. 255-56). Traditional scholars and writers find such cultural accommodation not only rhetorically ineffective but also condescending to cross-cultural readers and possibly "meretricious" (p. 262), depending on whether the writers' sole motivation for adjusting the text is to increase employer profits.

However, Greene shares the perspective of scholars who give greater weight to audience reception, arguing (as does this dissertation) that writers should adjust Western-style theory and practice to incorporate other cultural norms when doing so improves comprehensibility. Increasingly, these communicators are turning to interdisciplinary scholarship for a more balanced understanding of non-Western readers and their information needs. This shift accompanies "a movement away from the old emphasis on technical writing as primarily 'thingish' or oriented toward a description of a physical world and a movement toward an emphasis on technical writing as an effort to accommodate technology to the needs of human action" (Killingsworth & Gilbertson, 1992, p.129). Unfortunately, some communicators have applied cross-cultural scholarship somewhat shallowly. Instead of considering principles of language and content structure, they have focused on formatting, symbols, page layout, and similar surface issues (Carliner, 2000; Warren, 2005). Moreover, many communicators have tended to accept received cultural categories somewhat uncritically, supported by relatively little empirical research. Few researchers to date have investigated experimentally the relationships among culture, rhetorical conventions, and reader comprehension in technical communication, which are the issues Judi Greene has raised.

Therefore, to add to the knowledge base of cross-cultural technical communication, this dissertation compares responses from native and non-native English readers to investigate whether and how specific cultural differences might affect readers' responses to English single-sourced texts, and how any differences might be demonstrated. As I explain more fully in Chapter V (Research Design), all readers in this study are graduate students. Further, I have chosen non-native readers from the population of East Asian students in order to obtain data from readers who seldom use English in daily life in their own cultures but who have studied English and represent an authentic (and growing) audience for online technical material in English.[2] Although I have tried to avoid stereotyping people or languages (Thatcher, 2001; Weiss, 1998; Spack, 1997, Zamel, 1997), I also believe East Asian languages more likely to produce significant differences in test results, in that these languages are less similar to English than other languages represented in sizeable numbers on campus. The cross-cultural scholarship included in this chapter therefore focuses on these language groups.

In this chapter, I review definitions of *culture* in the scholarship of technical communication, anthropology, and sociology. I then look more closely at two competing positions in cross-cultural studies – the functionalist and interpretive approaches (Sypher, Applegate, & Sypher, 1985) – and how they have influenced cross-cultural writing strategies. I also discuss scholarship in contrastive rhetoric, an area of linguistics research particularly relevant to single sourcing. Finally, I look at research needs applicable to single sourcing in a cross-cultural environment.

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[2] Internet connections in China alone now number 100 million (St. Amant, 2006).

Definitions of Culture

Current literature in technical communication generally uses *culture* to refer to a set of beliefs, customs, and attitudes shared by members of groups and manifested in their behavior, often unconsciously. A culture may be characterized by the schemata, patterns, or frameworks its members use to interpret natural and social events (Goffman, 1974; Ting-Toomey, 1985). These patterns may occur in easily observable practices, in less obvious norms and values, and in deeply held assumptions about existence (Trompenaars, 1994). Unlike instinct or human nature, culture is learned, not inherited; unlike personality, which is specific to an individual, culture is specific to a group. The link between culture and personality is an individual's affiliation with a group on the basis of language, locale, ethnic background, or other factors (Boiko, 2002). Group identification works well when change is gradual; when change is rapid, however, identification can seriously impede cross-cultural understanding (Hall, 1989). Misunderstanding can also occur when individuals are equated with their cultures, a phenomenon social scientists call "the ecological fallacy" (Hofstede, 1991, p. 112). Most individuals function within several cultures simultaneously, whose figurative boundaries may or may not coincide with those of geographic units such as nations (Hofstede, 1991; Geertz, 2000; Woolever, 2001; Boiko, 2002; Warren, 2005). Individuals usually take for granted the cultures to which they belong and may exhibit a wide range of behaviors and norms within a given culture.

Theorists differ in the degree of causal power they ascribe to culture. *Functionalist* views of culture tend to assume that individuals are fairly passive, acted

upon by culture (Sypher, Applegate, & Sypher, 1985). In the age of information science, some functionalist theorists have applied electronic metaphors to culture, comparing it to "a giant, extraordinarily complex, subtle computer" whose operations "guide the actions and responses of human beings in every walk of life" (Hall & Hall, 1990, pp. 3-4). Similarly, culture has been described as "software of the mind . . . the collective programming of the mind which distinguishes the members of one group or category of people from another" (Hofstede, 1991, p. 5). In this view, cultures act as highly selective filters or pattern systems that screen and direct an individual's attention, thereby constituting "one of the ways in which reality is structured" (Hall, 1989, p. 87; see also Ting-Toomey, 1985). In some ways the functionalist or received view of culture (Atkinson, 1999) is analogous to instrumentalism, which sees human activity as something to be guided and controlled rather than explored or empowered in its own right (Killingsworth & Gilbertson, 1992).

Interpretive views of culture are less deterministic. They see culture not as the cause of social or psychological patterns, or a behavioral superstructure with the power to shape human activity, but as a context within which "events, behaviors, institutions, or processes . . . can be intelligibly –that is, thickly – described" (Geertz, 2000, p. 14). Instead of viewing culture as a motivating force, the interpretive approach regards culture as a medium in which "questions of interpretation and description take precedence over questions of function and causal explanations" (Sypher, Applegate, & Sypher, 1985, p. 17). From this perspective, the task of anthropologists and other observers is to delineate these contexts by sorting through the sign systems and complex structures that characterize them. Elements that particularly influence communication include a culture's

view of history and the world; forms of organizing relationships within the culture; the use of language and discourse; and ways in which the culture's members are socialized (Scollon & Scollon, 2001). An extreme interpretive view is the perspective, influenced by postmodernism, "that cultures are anything but homogeneous, all-encompassing entities" Atkinson, 1999, p. 627) and that *culture* as a stable concept is no longer useful. However, a middle-ground interpretive approach (the position taken in this dissertation) is that cultures do exist insofar as individuals share certain knowledge, experiences, and social practices, but that "[s]ocial group membership and identity are multiple, contradictory, and dynamic" (p. 643). In emphasizing individual initiative and autonomy, the interpretive view is more compatible with communicative, rather than instrumental, action (Killingsworth & Gilbertson, 1992).

In the following sections, I examine the functionalist and interpretive approaches in greater detail, including their roles in literature for technical communication practitioners.

Functionalist Approaches to Culture

Until recently, much of the scholarship in cross-cultural technical communication has rested on a relatively small base of functionalist models from sociology and anthropology. These models have provided a ready set of comparative measures that have been widely cited, despite (or perhaps because of) their essentialist qualities. The spread of cyber-communication appears to be reducing the effects of some cultural stereotypes as the result of electronic "cultural 'levelers' that have created in the younger generation around the world a similar set of expectations and behaviors" (Woolever, 2001, p. 50). In addition, global corporate cultures are now generating their own rhetorical conventions

across linguistic lines (Woolever, 2001). Functionalist models are too general for small-scale research, and I have not followed them in this project. However, functionalist models have influenced cross-cultural communication scholarship (for example, see discussions in Hoft, 1995; Tebeaux & Driskill, 1999; Thatcher, 2001), and for that reason I review three of them here: the contextual, programming, and problem-solving models.

The Contextual Model.

The contextual model of culture uses relative sensitivity to situation as the primary cultural descriptor (Hall, 1989; Hall & Hall, 1990). Here, *context* refers to "information that surrounds an event" and combines with that event "in different proportions depending on the culture" to produce meaning (Hall & Hall, 1990, p. 6). According to the contextual model, a society that compartmentalizes daily life and emphasizes details, goals, and interpersonal distance is a *low-context culture* (Hall, 1989, p. 91). Members of low-context cultures such as North America and Western Europe tend to communicate through selected channels in oral or written codes that spell out information explicitly. They are less likely to rely on nonverbal cues from other individuals or the environment, and they often collect considerable information before making decisions. By contrast, members of *high-context cultures* tend to convey information either "in the physical context or internalized in the person" (Hall, 1989, p. 91), with greater involvement, intimacy, and networking among individuals, as in some Latin American countries. Persons in high-context cultures are less likely to rely on a formal code or symbol system for exchanging information. Because messages in high-context cultures change more slowly than those in low-context cultures, they tend to be more stable and culturally unifying (Hall, 1989).

The contextual model focuses primarily on information flow in daily life. For example, context is a factor in the relative speed at which individuals can receive and interpret messages comfortably, and the speed and volume at which information travels through organizational and personal channels (Hall & Hall, 1990). The model has also been applied to conflict analysis and resolution (Ting-Toomey, 1985). In this reading, a low-context culture – with its tendency to value "individual orientation, overt communication codes . . . and . . . heterogeneous normative structure" (p. 76) – is more likely to regard conflict as nonthreatening, even necessary, to overall cultural productivity, whereas a high-context culture is more likely to regard conflict as destabilizing to the group and therefore dysfunctional (Ting-Toomey, 1985).

As do other functionalist approaches, the contextual model contains the potential for stereotyping and may sometimes fail to describe a communicative situation fully. For example, Chinese culture is often described as high-context, with less need for communicative explicitness between individuals. Nevertheless, Wiles (2003) points out that speakers of different Chinese dialects do not necessarily comprehend each other's speech, despite their shared ethnic background and writing system. This phenomenon suggests that Chinese culture (among other cultures) is too varied to be labeled broadly as high- or low-context without qualification. Consequently, though the contextual model is often cited in technical communication literature, I have not used it in my research design.

The Programming Model.

The metaphor of culture as mental software emerged from the results of a values survey administered to several thousand IBM employees worldwide during the late 1960s

(Hofstede, 1991). The programming model assumes that individuals consistently derive certain values from their cultures and that the aggregate of individual survey responses from a given culture is therefore a reliable guide to attitudes within that culture as a whole. The model consists of numerical ratings, developed from the survey responses on several measures, for about 50 countries (here, *country* is synonymous with *culture*). By combining a culture's ratings on several dimensions, the researcher can plot the culture on a grid.

Although some of the measures in the programming and contextual models are similar, the programming model emphasizes personal values more than information flow and delineates them more precisely. The programming model measures characteristics from both workplace and familial situations. For example, the programming model approximates the degree of *power distance* in a given culture, or "the extent to which the less powerful members of institutions and organizations within a country expect and accept that power is distributed unequally" (Hofstede, 1991, p. 28). The model also measures the degrees to which a culture tends toward individualism or collectivism, distinct or overlapping gender roles, and toleration or anxiety over uncertainty. Chinese social scientists have added to the original programming model a non-Western dimension that rates a culture's tendency to adopt a long- or short-term orientation toward such factors as relationships, tradition, and economic activity (Hofstede, 1991).

The Problem-Solving Model.

The concept of culture as a matrix within which a group addresses universal human problems (Trompenaars, 1994) is a third model often cited in technical communication literature. As a group solves problems, the group's solutions, regularly

applied, may evolve into unspoken assumptions, the "shared system of meanings" (Trompenaars, 1994, p. 14) underlying the group's practices and values. In describing solutions as *extensions* and *extension systems*, Hall (1989) notes that group members sometimes confuse an established solution with the situation that brought it into being, a concept known as *extension transference* (p. 29). When extension transference occurs, group members are ascribing to the original solution "properties it does not possess" (p. 29), which helps to explain why cultural patterns can be so resistant to change.

The problem-solving model organizes internal and external challenges into three broad categories: problems associated with the environment (Hall, 1989; Trompenaars, 1994), problems of time (Trompenaars, 1994), and problems of relationships (Trompenaars, 1994; see also Parsons, 1951, for the original formulation of these concepts). Problems of relationships lead to "pattern-variables of role-definition" (Parsons, 1951, p. 66), or differing perspectives of the self in society on several paired measures. A *universalist* culture, for example, may believe that societal codes are valid in all times and places, while a *particularist* culture holds that friendship and unique circumstances determine one's obligations to others. Persons in an *individualistic* society focus primarily on their own needs; in a *collectivist* society, the group's needs are paramount. A society values *neutrality* if people generally believe that human interactions should be objective and detached; a society values *emotion* if personal expression is acceptable. If relationships are circumscribed, as in business, the society values *specificity*; if relationships involve the whole person, the society values *diffuseness*. In an *achievement*-oriented society; persons gain status for the quality of

their performances; in an *ascription*-oriented society, they gain status for inherent attributes such as kinship, gender, or age.

The contextual, programming, and problem-solving models have been useful in technical communication insofar as they have raised awareness, prompted comparisons, and stimulated thinking about phenomena that writers might otherwise take for granted. These models exemplify the *etic* or "experience-distant" form of analysis that favors researchers' third-person descriptions and abstractions based on observed behavior (Geertz, 1983, p. 57; Hymes, 1974). However, in relying on classification and dichotomy, the functionalist models produce a somewhat monolithic understanding of culture, another reason I have tried to avoid them in this project. They tend to objectify culture and render it distinct from individuals and institutions. When used as support for technical writing practices, they can also lead to prescriptiveness, as illustrated later in this chapter. For this dissertation project, interpretive cultural models have been more useful, and I review several examples in the following section.

Interpretive Approaches to Culture

In contrast to functionalist models, which tend to assume a static view of culture as an external entity, the interpretive approach sees culture as dynamic, the product of recurring human interactions (Sypher, Applegate, & Sypher, 1985). When researchers follow an interpretive approach, they attempt to read cultural phenomena "as an acted text" by analyzing discourse hermeneutically (p. 19). They may also examine the rules and conventions of language as a prerequisite for understanding culture.

In ethnography, the interpretive counterpart of experience-distant analysis is *emic* analysis, an "experience-near" approach that develops cognitive theories from researchers' first-person accounts (Geertz, 1983, p. 57; Hymes, 1974). Instead of labeling a culture from the outside, the emic researcher tries to understand the culture from the inside, as its members do. While valid as methodology, however, emic analyses can also interfere with the researcher's ability to maintain perspective on the phenomena being observed. The challenge therefore is to balance the immediacy of experience-near concepts with the objectivity of experience-distant concepts so as to record but simultaneously reflect upon "the general features of social life" (Geertz, 1983, p. 58). At least one technical communication researcher has argued that, by themselves, emic analyses are ineffective in cross-cultural communication scholarship, because they define differences as the observer would (Thatcher, 2001), leading to analyses of the second culture using constructs of the first. For more valid cross-cultural comparisons, Thatcher argues that researchers should first establish an etic framework or continuum of cultural similarities (for the importance of establishing commonality, see also Maylath & Thrush, 2000). Ideally, the framework would be a collaborative effort between researchers from each culture. The continuum would then serve as a background of "larger cultural-historical contexts" (Thatcher, 2001, p. 466) against which writers could see variances more clearly. In this way researchers could ensure greater balance between difference and sameness without resorting to either extreme of essentialism or total subjectivity.

A prototypical cross-cultural framework of the kind Thatcher (2001) suggests is beyond the scope of this dissertation. However, several concepts from sociology, anthropology, and linguistics have been useful for developing an interpretive approach

for this study. These concepts are also accessible to Judi Greene and other practitioners as analytical tools.

One such concept is *frame analysis* (Goffman, 1974), a method of making sense of the cultural elements that define events and situations. Framing is useful when writers are learning a new culture, although they must become familiar with appropriate language beforehand if they are to report accurately what is occurring (Hall, 1989). Communicators may analyze frames by focusing on audience characteristics, such as differentiating between local communities defined by demographics and global communities defined by patterns of action and discourse (Killingsworth & Gilbertson, 1992). Communicators may also apply frame analysis to their own messages, asking specifically whether and how audiences are making sense of those messages. In frame analysis, writers must understand the cultural *keys* or conventions used by the audience to interpret texts (Goffman, 1974). For example, before including scenarios or case studies in cross-cultural training material, a writer may need to determine whether readers have the appropriate conventions to interpret simulated acts as the writer intends them. For this study, the frame has been an experimental testing situation within academic culture, a setting within which study participants are familiar with technical reading material and understand the conventions of graduate-level research procedures.

Another useful analytical approach to describing speech events, including written communication, is the *SPEAKING* heuristic[3] (Hymes, 1974). This sociolinguistic model offers communicators an etic structure that can be used for systematic cross-cultural analyses while avoiding functionalist stereotyping. Although the heuristic includes

[3] Mnemonic code for the following components of speech acts: Situation (or frame), Participants, Ends, Act sequence, Key, Instrumentalities, Norms, and Genres (Hymes, 1974, p. 53 ff).

language (under Instrumentalities), it does not equate language with culture. Rather, it focuses on "persons and their ways of speaking" (p. 123), including their attitudes and the social meanings they attach to language, their contextual and interpretive skills, and their understanding of the rules of speech. Also included under Instrumentalities are linguistic registers, whose characteristics are "usually defined by the context in which that language is used" (Ulijn & Strother, 1995, p. 113). Registers frequently used in technical communication include the business and scientific/technical registers, which may or may not be monolingual. In this study, for example, the online technical texts in English I used with native and non-native readers have addressed several aspects of instrumentality for this communication event.

In linguistics, one research area that typically employs an interpretive approach to culture is *contrastive rhetoric*, which emerged within second language acquisition studies in the 1960s as a method of examining rhetorical similarities and differences among cultures (Woolever, 2001). Contrastive rhetoric is based on empirical findings that **"**there are situationally, generically, or stylistically preferred compositional forms and that these are not the same from language to language or from culturally defined situation to culturally defined situation" (Scollon, 1997, p. 353). Numerous empirical studies suggest that, while cultures are more fluid and heterogeneous than was once believed, culture-based differences among readers do exist. Therefore, an important first step to improving single-sourced content for those readers is to define their reading needs thoughtfully and accurately, heeding Carliner's warning about simplistic and "formulaic approaches . . . [such as] 'the five issues to avoid when writing for international audiences'" (2000, p. 569). Genuine cross-cultural document design is challenging under any circumstances; in

a single-sourcing environment, the task is even more difficult, given that adjusting text for global audiences "is a complex issue, often barely recognized" by current software (Boiko, 2002, p. 337). Hence, cross-cultural writers must ground their content management in research, drawing from the knowledge base for cross-cultural reception to strengthen comprehension for a variety of end-users. Contrastive studies have contributed significantly to that knowledge base.

Because contrastive rhetoric has been the theoretical basis for asking whether native and non-native readers might respond differently to single-sourced texts, I discuss it at some length below, noting contrastive studies especially relevant to the native English and East Asian readers in this project. Although not all of the studies are recent, few (if any) of their findings have been applied to cross-cultural single-sourcing practices. The studies do not offer easy prescriptions, for responses of readers and writers can be difficult to measure, and studies sometimes yield contradictory results. However, existing studies help to place the present project in context. In Chapter IV, which focuses specifically on cohesion and reading comprehension, I include additional contrastive studies on those topics.

Contrastive Rhetoric

Contrastive rhetoric is based on empirical findings that **"**there are situationally, generically, or stylistically preferred compositional forms and that these are not the same from language to language or from culturally defined situation to culturally defined situation" (Scollon, 1997, p. 353). Contrastive rhetoric rejects a positivistic view of language as a static, "independent . . . system composed of unique and invariant structural

and semantic rules" that can be described unproblematically (Grabe & Kaplan, 1996, p. 176). Instead, contrastive rhetoric regards language as "a human product and a social tool" that varies with culture and time (p. 177). Texts are part of those same dynamic cultural contexts (Connor, 2002; Grabe & Kaplan, 1996), and because they are culturally defined, they can be described "through culturally agreed conventions" (Soter, 1988, p. 179). A common premise in contrastive studies is that "a culture's rhetoric constitutes an interface where the prescriptions of the language meet the practices of the culture" (Matalene, 1985, p. 788). Because contrastive rhetoric assumes a cultural origin for the logic underlying different speaking and writing patterns, the rhetoric evolving from that logic is culturally based as well and will vary not only among cultures but even within a single culture or subculture at different times (Kaplan, 1966; Taylor & Chen, 1991). Some researchers have emphasized the importance of differentiating between discourse specific to a culture, and discourse specific to a language (Taylor & Chen, 1991; Spack, 1997). An interdisciplinary approach is often appropriate for contrastive studies, many of which combine anthropological observations with psychological methods of quantitative analysis (Purves, 1988).

Contrastive rhetoric originated in a seminal study of 600 English compositions by university students from Arabic/Semitic, Asian, Romance, and Russian language backgrounds (Kaplan, 1966). The study attempted to determine whether students transferred certain rhetorical moves from their first languages into their compositions in ways that interfered with standard English paragraph development (Kaplan, 1966; Connor, 2002). Although the study was "the first serious attempt by applied linguists in the U.S. to explain second language writing" (Connor, 1996, p. 5), it assumed that

second-language writing accurately reflected first-language rhetorical strategies. Further, it implied the functionalist cultural models discussed earlier in this chapter and was therefore criticized for appearing to privilege English norms, treat cultures as discrete and predictable, and equate simplistic diagrams of rhetorical patterns with cultural thought patterns (Connor, 2002; Panetta, 2001; Scollon, 1997; Pery-Woodley, 1990). In the past four decades, however, contrastive rhetoric has matured as a research field, supported by more recent views of culture as heterogeneous, fluid, and fragmented (Connor, 2002). In its claim that different languages affect perception and thought in different ways, contrastive rhetoric "derives some, but not all, of its orientation from the weak version of the Whorf-Sapir Hypothesis" (Grabe & Kaplan, 1996, p. 179), a position receiving new scholarly attention (Connor, 2002).

Perhaps because of its origins in composition studies, contrastive research in linguistics has tended to emphasize writing rather than reading. Writing produces a tangible artifact and involves textual features such as cohesive devices that are easy to identify, whereas reading comprehension involves "psycholinguistic processes" and is therefore more difficult to study (Connor, 1990, p. 172). However, contrastive composition studies and psychological studies of reading comprehension (such as those reviewed in Chapter IV) do involve some of the same principles. According to Carrell (1987), reading involves both top-down recognition of a text's structure and bottom-up processing of linguistic signals such as cohesive devices; that is, "readers must take in the linguistic cues of the text and integrate them into their ongoing hypotheses about the content and form of the text" (p. 49). While signaling may be less important to comprehension for very good or very poor readers, as measured by reading recall,

average ESL readers do seem to respond to signaling or lack thereof. In this sense, reading and writing appear to be "complementary processes" (p. 55) for at least some ESL readers. I have therefore included relevant contrastive studies of both processes in this chapter.

Contrastive studies of the past two decades have addressed questions of text linguistics, cultural approaches to different discourse types, and differences in writer/reader roles. I discuss these areas in the sections below.

Contrastive Studies of Text Linguistics.

Text-based contrastive research includes comparative studies of texts in two different languages, studies of larger textual units, and studies of syntactic and textual features that define discourse forms (Grabe & Kaplan, 1996). At the micro level, text-linguistic research has focused on specific linguistic features, such as "the relative frequency of certain cohesive ties, in the patterns of subordination and coordination, and in the placement of modifiers" (Purves, 1998, p. 18). Examples of this analytical approach are Enkvist's (1984) sentence-based models of text linguistics, which show how lexical and syntactic elements help to situate sentences within a text. Among empirical sentence-based studies, Reid (1992) reported that writers' use of cohesive linguistic features appears to vary significantly with language and topic type. This study analyzed 768 English essays by native Arabic, Chinese, Spanish, and English writers, focusing on the percentages of pronouns (as a form of referential tie), coordinate conjunctions, subordinate conjunction openers, and prepositions in the essays. Each participant wrote on two topics for each of two topic types, the comparison/contrast essay and the

discussion of graphs. Across all language groups, use of cohesive devices varied consistently across topic types, suggesting that some types invite the use of certain features. For example, writers used more pronouns and coordinate conjunctions in their comparison essays, and more prepositional phrases in discussing graphs. Overall, however, native speakers used "far fewer pronouns and coordinate conjunctions, and far more prepositions than the Arabic, Chinese, and Spanish speakers" (pp. 96-97). Because the writers produced the essays under the testing conditions of several international TOEFL centers, the study suggests that appropriate use of linguistic features within sentences may be linked to a writer's understanding of the communicative situation: here, the (English) rhetorical expectations of academic readers. Differing instructional methods and writers' familiarity with cultural expectations also appear to be significant factors in a study of narratives written by American students in English, Thai students in English, and Thai students in Thai (Indrasuta, 1988). However, in this study, the groups differed less in their use of cohesive ties, and more in their handling of narrative components such as plot and setting. The two Thai groups were more similar to each other than to the American group. Such findings indicate that cultural differences do affect rhetorical strategies, although responses at the micro level may be inconsistent.

At the macro level, text linguistics examines "larger patterns of organization . . . [such as] the movement of the text from paragraph to paragraph" (Purves, 1988, p. 17), beyond the level of the sentence (Enkvist, 1984; Pery-Woodley, 1990; Woolever, 2001; Grabe & Kaplan, 1996). Such research has provided insights into ways writers signal topics, reveal textual structure and discursive functions, and fit sentences and paragraphs into the overall flow of information (Enkvist, 1984; Grabe & Kaplan, 1996), thereby

helping to achieve textual coherence. For example, researchers have found that writers from different cultures may use different strategies to introduce scientific and expository texts. In an analysis of student essays written in English, Scarcella (1984) found that highly proficient native English writers tended to write the shortest orientations. To gain readers' attention, these writers used devices such as structural repetition, direct assertions, rhetorical questions, cataphoric reference, dramatic statements and syntax, and historical context (pp. 676-677). They also established themes with explicit statements and pre-sequences, repetition, paraphrase, and explanation. By contrast, Japanese, Korean, Romance, and Taiwanese students writing in English introduced texts with direct assertions and historical context. The non-native writers also used significantly more repetitions, paraphrases, and explanations, though not in explicit ways, and also tended to "overspecify the theme" (p. 683). The study concludes that, rather than first-language transfer, these non-native writing patterns indicate the writers' lack of familiarity with English expository norms. In their attempts to apply the second-language cohesive devices they have studied, non-native English writers may employ repetition, paraphrase, and other devices awkwardly in their introductions. To native readers, the result is that such features appear too numerous or too obvious and thus themes seem overspecified.

Cultural differences also appear in a study of introductions to scientific papers by Chinese- and native English-speaking physical scientists and engineers (Taylor & Chen, 1991). Papers in the study were written variously by native writers in English-speaking cultures, Chinese professionals writing English as a foreign language, and Chinese professionals writing in Chinese. The study found "no 'Chinese way' of writing science that is attributable to features of the Chinese language system itself" (p. 330), suggesting

that scientific discourse is somewhat internationalized across cultures. However, the introductory conventions did vary somewhat by professional discipline; in addition, Chinese writers tended to write shorter introductions, use fewer unconventional or expanded rhetorical moves, and cite fewer references than English writers. According to the study's authors, the regional contrasts may indicate that Chinese scientists are less dialogic and disputatious within their fields than English-speaking scientists, and perhaps less inclined to point publicly to flaws in the work of others; at a practical level, the differences could also reflect limited access in China to bibliographic resources.

Because comparability of texts becomes problematic in broadly defined cross-cultural studies, Pery-Woodley (1990) suggests that contrastive research may be more fruitful at the micro level, as in studies of "the textual devices spontaneously employed by groups of subjects belonging to two different linguistic/cultural communities when faced with the same task" (149). Such research may contribute more than generalized studies to scholars' understanding of textual coherence, specific signaling devices used by different linguistic and cultural groups, and practical ways to help language learners (Pery-Woodley, 1990).

Contrastive Studies of Discourse Type.

These studies ask whether discourse types vary significantly across cultures, and how variance may affect cross-cultural reading comprehension. One issue receiving considerable scholarly attention concerns methods of introducing and developing main ideas, an area relevant to document type definitions in managed content intended for cross-cultural dissemination. Kaplan's original contrastive study (1966) hypothesizes an

opposition between Western rhetorical directness and Asian indirection, sometimes described as the difference between deductive and inductive organization, respectively. A common empirical approach to this question is to measure what participants recall after reading a text, on the assumption that "people will integrate information into memory more easily when that information is presented according to a native organizing schema rather than an alien organizing schema" (Hinds, 1984, p. 46). For example, cultural preferences are evident in a study testing the ability of native Japanese and English speakers to recall a newspaper article composed in the *ki-sho-ten-ketsu* organizing pattern, a Japanese prose form in which readers must use unstated information to interpret the text coherently (Hinds, 1984). When participants were tested immediately for recall of clauses, no differences in the two groups were apparent, but when the groups were retested one week later, the Japanese readers recalled more of the text, particularly the *ten* section, a rhetorical pattern not found in English. By contrast, English readers tended to emphasize and therefore recall the conclusions.

The influence of cultural norms on text organization and document structure is apparent in other studies as well, a factor writers should be aware of when localizing technical content for specific audiences. Significant differences emerged for Asian readers in a study of comparison, causation, problem-solving, and collection types of English expository text (Carrell, 1984), which could indicate preferences for native rhetorical patterns. In general, for the Spanish, Arabic, Korean/Chinese, and other participants in this study, recall tended to be greater for the more organized discourse types to the extent that readers recalled top-level organization of text. In a similar study (Kobayashi, 2002), English-proficient Japanese students wrote better summaries (a

measure of overall comprehension) when they read clearly structured English texts than when they read unstructured texts. The level of structure tended to make little difference to less proficient students. In two other studies, perceptions of authorial purpose appeared to affect Japanese preferences for organization in Japanese expository texts (Fukuoka & Spyridakis, 1999, 2000). When readers believed authors to be presenting views as theses or conclusions, rather than reporting facts, comprehension as measured by recall was higher for inductively, rather than deductively, organized text. Following tests of Korean adult learners of English in the U.S., Eggington (1987) concludes that over time, "information is retained far better when it is presented in a manner compatible with the reader's expectations" (p. 166). In this case, one Korean group read an English academic text written in English linear style, while the other group read an English passage in traditional Korean style, which resembles classical Chinese with a beginning theme, development, change to subtheme, and conclusion. An immediate recall test showed no difference between the groups, but a retest one week later showed a significant difference between the traditional and English-influenced texts. In working with single-sourced text, writers should consider reader preferences within specific discourse types.

In attending to cultural preferences, however, communicators must continually reevaluate existing binaries to develop authentic, rather than stereotypical, perspectives on how texts function dynamically in cultures (Connor, 2002) and how readers in a given culture respond to different writing strategies. With the growth of online communication, global publishing, and opportunities for education abroad, readers in many cultures have greater exposure now to non-native rhetorical patterns and may adjust their responses accordingly. Kobayashi (1984) found that Japanese students composing in English in the

U.S. tended to favor rhetorical patterns and topic statement types different from those of Japanese students writing in English in Japan. Although the results indicate some cultural preferences for first-language rhetorical patterns and statement types, the second-culture context may have produced some hybrid writing practices. For example, the Japanese students in the U.S. often chose an organizing pattern midway between the general-to-specific pattern of native English writers in the U.S. and the specific-to-general pattern of Japanese writers in Japan. Similarly, culture-specific patterns were insignificant factors in recall results for a study involving an English expository text (Connor & McCagg, 1983, 1987). When native English, Japanese, and Spanish students at an American university were asked to paraphrase the text of an English newspaper article and answer comprehension questions on main ideas, the non-native writers were more likely than the native English writers to reproduce the original structure of the propositions. These results suggest that the English rhetorical structure may have constrained the writers or functioned as a counterbalance to their first-language patterns. When native English writers develop managed content for cross-cultural readers, they will need information about the audience's exposure to Western writing conventions to determine whether the document structure should incorporate organizing patterns from the readers' first languages.

Contrastive Studies of Writer/Reader Roles.

Beyond textual and experimental studies, contrastive researchers have examined ways in which social and cultural factors may shape rhetorical practices and normative roles for readers and writers. For example, Matalene (1985) links Chinese rhetorical

patterns to cultural attitudes toward tradition, the need to memorize thousands of written characters, and an expectation "consistent with the nature of the language" that readers will "infer meanings rather than . . . have them spelled out" (p. 801). According to this view, the eight-legged essay, a stylized form of textual organization used for several centuries in the civil service bureaucracy, continues to influence Chinese writing practices. Other researchers contend that contrasts in Chinese and English expository prose have been exaggerated, and that the eight-legged essay is not currently a central form (Mohan & Lo, 1985). Evidence from comparative studies in British Columbia and Hong Kong suggest that apparent differences in rhetorical preferences may have more to do with instructional practices and developmental issues than with "a preference for 'indirectness' in the language and culture of Chinese" (p. 522). That is, positive response to linear rhetorical patterns may be a function of exposure to English composition above the sentence level.

In a widely cited study (1987), Hinds proposes a new "language typology" to distinguish between such "reader-responsible" and "writer-responsible" cultures, respectively (p. 141). In contrast to the Japanese perspective that it is up to readers to "determine the relationship between any one part of any essay and the essay as a whole" (p. 151; see also Connor, 2002; Kaplan, 1988), English expository writing acknowledges that "readers expect, and require, landmarks along the way" (p. 146). Writers in English therefore include linguistic markers such as obvious transitional devices that would be more subtle or missing altogether in Japanese writing. A subsequent analysis (Kubota, 1997) challenges Hinds' hypothesis, arguing that the reader-/writer-responsible dichotomy overgeneralizes with regard to Japanese and fails to account for changes in

Japanese punctuation, linguistic features, and rhetorical patterns resulting from the flow of Western materials into the country since the mid-1800s. However, Carson (1992) supports Hinds on this point, agreeing that Japanese speakers do expect listeners and readers to understand and interpret messages correctly, though Chinese speakers tend to assume (as do English speakers) that "the responsibility for clear communication [rests] on the speaker/writer" (p. 54). According to Carson, the source of varying discourse patterns lies not in the Chinese or Japanese languages themselves but in differing cultural expectations.

Relating the issue of rhetorical indirection to communicative roles, Hinds (1990) has used organizational patterns in expository texts from Japanese, Korean, Chinese, and Thai to argue that texts that delay introducing main ideas are not necessarily inductive. Rather, they are intended for readers with a common set of cultural norms, and "the author *does* expect that the minds of readers work in a very similar way to his or her own" (p. 98). Hinds contends that readers in those cultures "expect that the purpose of an article is to introduce a set of observations related loosely to a general topic" and that their roles as readers is "to sort and evaluate these observations" and come to their own conclusions, an approach Hinds characterizes as "quasi-inductive" (p. 99). Noting that inductive and deductive organizing patterns have long been common in both Asian and Western discourse of different types, Scollon and Scollon (2001) hold that apparent cultural preferences for these patterns have more to do with cultural roles than with rhetorical conventions *per se*. That is, specific usages relate to different expectations for "the cultural structuring of situations and participant roles" (p. 95) rather than to linguistic factors alone.

In summary, for writers seeking a research-based strategy of managing English content for cross-cultural readers, current findings suggest that the nature of the material may determine the organizing pattern most appropriate. Further, when audiences have had exposure to Western educational methods and texts, they may combine first- and second-language conventions in their communicative practices, and they will likely comprehend texts that are linearly organized. When writing in English themselves, they may include rhetorical strategies such as cohesive devices, although their usage may be different from that of native speakers, depending on their understanding of topic type and English norms. By contrast, when an audience's cross-cultural exposure is limited, such readers will be more responsive to document structures that incorporate familiar, first-language organizing patterns. They may be more likely to seek coherence in context or social roles than in explicit textual cohesiveness.

Functionalist and Interpretive Approaches to Single Sourcing

Although instrumental discourse is often regarded as inherently controlling, it can be used for communicative purposes if it supports individual initiative (Killingsworth & Gilbertson, 1992). Similarly, commonly stated goals of cross-cultural communication – such as bridging cultural differences, seeking diversity, developing multilingual and multicultural awareness, and addressing readers selectively, usually with the practical objective of balancing business interests with user needs (Hoft, 1995) – may be functionalist or interpretive, depending on the writing strategies an organization adopts. The literature commonly advises English-languagepractitioners to make two determinations: first, the level at which the organization plans to accommodate a

particular culture's rhetorical and design conventions, and then the specific adaptations necessary at that level. If writers define the conventions on the basis of sterotypical linguistic and regional boundaries, the resulting discourse is likely to be functionalist; but if writers conduct more complex analyses to determine the readers' unique content needs (Boiko, 2002), the organization's approach will be more interpretive. Both perspectives are represented in technical communication literature.

Although the literature is somewhat inconsistent in categorizing the levels of accommodation, I describe them below as they commonly appear. Within a given organization, the levels are not mutually exclusive. A firm's writers may use elements of several strategies within a single document suite.

Functionalist Approaches to Single Sourcing.

In the strategies described below, adjustments in rhetoric, content, and structure tend toward the generic, rather than the customized. When these strategies do accommodate readers, the primary adaptation is linguistic.

Publishing in English. For North American organizations, the writing strategy requiring the fewest cultural adaptations is to disseminate documents as originally composed in English. As I learned during my European internship, organizations outside the U.S. may also follow this policy when English is the one language their global clients have in common (K. Lourdon, personal communication, June 16, 2004). These readers are educated professionals who expect to read technical or scientific material in English (Boiko, 2002; Kohl, 1999), and they accept English as a compromise across cultures (Boiarsky, 1995). They may even use English officially, as do aviation professionals, for

example, possibly in a restricted-vocabulary variant such as Plain English (Thrush, 2001) or International English, which tries to avoid "expressions or styles that are idiomatic to a particular region where English is spoken" (Boiko, 2002, p. 493). To the extent that global business communication in English has produced "a less dogmatic, more flexible approach to standards of English grammar and usage, and a greater sensitivity to differing conventions" (Boiarsky, 1995, p. 254), this strategy displays the interpretive approach. However, when publishing in English accommodates contextual or rhetorical differences only minimally, if at all, the organization may reveal a functionalist view of communication that values efficiency over reader comprehension.

Translating Texts. The next level of accommodation is to translate English documents into the readers' own languages, a policy that generally makes no allowances for rhetorical adjustments needed in the original text. While many organizations in recent years have debated the need for translation, particularly for English-language websites, others are concluding that translation is the minimum level of accommodation needed for technical documents that originate in North America (Nagy, 2003; Bailie & Ryckhorst, 2002). In some circumstances, translation without additional adjustments is now considered inadequate (Bailie & Ryckhorst, 2002). International marketing consultants believe that Internet users who are not native English speakers have outnumbered English-speaking users for several years (Yunker, 2000). Consequently, websites translated from English, with local linguistic variations, may have become a competitive necessity for some organizations (Nagy, 2003). In an era of budget constraints, many organizations are translating fewer documents than previously; others have shifted resources away from Romance-language translations to meet the rising demand for

translations into East Asian languages (Butland, 2004). As with publishing in English, a translation policy tends to align with the functionalist position in that one pattern of text organization and rhetorical structure suffices for all, regardless of language.

Globalizing Texts. An organization globalizes documents by developing text that is "universally intuitive" and able to communicate "in many cultural contexts without modification" (Hoft, 1995, p. 24). The globalized text may be written in International English or translated into local languages, possibly by machine, but in its idealized form it is "the most generic single-language document possible," capable of serving "geographically and culturally diverse users" (Bailie & Ryckhorst, 2002, p. 18). True globalization requires that writers conduct multinational usability studies and work in international teams to develop content, organization, sequence, style, and format in ways that are comprehensible and acceptable to all the organization's audiences. However, audiences may also view the globalizing strategy as "a power play where a dominant culture imposes its mores and expectations on the less powerful cultures" (Woolever, 2001, p. 51). In its reduction of content and rhetoric to highly standardized textual elements, globalization assumes a functionalist, static view of cultures.

Interpretive Approaches to Single Sourcing.

Interpretive approaches to cross-cultural technical communication require more research and hence are more expensive than functionalist approaches. At the same time, technology is enabling communicators to adjust texts more efficiently than ever before.

Localizing Texts. An organization localizes documents not only by translating text but also by adjusting rhetorical elements for specific conditions, idioms, and preferences, thereby emphasizing cultural differences (Bailie & Ryckhorst, 2002; Woolever, 2001; Boiko, 2002; Hoft, 1995). Until recent years, technology significantly limited an organization's ability to customize content for multiple media and audiences, for publishing applications had no efficient way to code information for inclusion or exclusion according to readers' needs (Rockley, 2001b). Today, however, systems can support general localization strategies that address surface issues such as currency, date and time formats, measurements, paper size, colors, visuals, and humor. At a deeper level, they can also support radical localization that considers the values, discourse structures, writing strategies, text organization, and culturally appropriate examples that affect reader attitudes and actions (Hoft, 1995; Ulijn, 1996; Artemeva, 1998; Yunker, 2000; Woolever, 2001; Panetta, 2001; Boiko, 2002). An organization may localize material fully or partially, for all potential audiences or selected audiences only (Boiko, 2002). For example, because employees in East Asian cultures often share workplace computer terminals and have limited Internet access, North American organizations localizing their websites for those readers might develop "shallow sites with long, easily printed pages . . . [instead of] graphic-intensive sites with multiple one-page layers" (Yunker, 2000, p. 18). Although content management systems can mechanically aid the movement of text within a publishing operation, ultimately localization is part of authoring, "a human process of knowing what 'works' in one locality or the other" (Boiko, 2002, p. 492). Localization is interpretive in that its objective is to accommodate technology to humans, instead of the reverse.

Many Western organizations overlook localization as a writing strategy because they underestimate its importance in user-friendly documents, or because they believe that varying language and content structure for local needs is unacceptably complex (Boiko, 2002). Localization does involve extensive audience research, which can be expensive, time-consuming, and logistically difficult (Woolever, 2001). It also lengthens the product development cycle and introduces liability issues (Hoft, 1995). However, it is the approach most sensitive to user needs (Bailie & Ryckhorst, 2002), and it may help an organization to improve sales, enter niche markets, and overcome cultural differences, particularly if the organization or its market is small (Hoft, 1995). Localization cannot occur as an afterthought (Boiko, 2002), and organizations may find it best to plan and budget for a full commitment from the start rather than localizing gradually (Yunker, 2000; Bailie & Ryckhorst, 2002).

On localization projects, collaboration among multicultural teams may be the best way to resolve cultural differences while respecting "the complex nuances of contrasting rhetorics" (Woolever, 2001, p. 52). Commenting on evolving technical communication practices in China, Wiles (2003) observes that the cultural principle of *guanxi* – "act[ing] and communicat[ing] in the best interest of the relationship" (p. 376) – is likely to prepare Chinese writers well for the intensive teamwork of a single-sourcing environment.

Internationalizing Texts. Internationalization combines the generic aspects of globalization with the user-specific features of localization. In an internationalized document, core information is stored separately from variables so that the writing team can adapt the document for local audiences more easily. This strategy removes cultural specifics from the core so that the text can be reused without change; the writers then

customize the variables for local conditions (Hoft, 1995). A strategy of concurrence applies the same process at the corporate level, so that all communication projects draw as much as possible from the same core information and the same variables (Hoft, 1995). Internationalization and concurrence thus employ single sourcing at the enterprise level.

Research Needs in Cross-Cultural Communication

Although technical communicators have been working on cross-cultural issues for several decades, new questions have appeared as technologies and concepts of culture have changed. One issue is the need to develop authentic, rather than stereotypical, perspectives on how texts function dynamically in cultures (Connor, 2002) and how readers in a given culture respond to different genres or writing strategies. For example, recent observations (Wiles, 2003) suggest that Chinese readers may be less inclined than Western readers to value user-centered technical documentation. To the extent that Chinese audiences elevate community needs over individual needs and rely heavily on contextual cues for meaning, they may see less need for explicit discussions of technical content. This situation may change, however, as the Chinese readership for technical texts grows and becomes more involved with Western markets (Wiles, 2003). In such fluid settings, technical communication scholars must reevaluate existing cultural binaries, using diachronic research to trace changing norms (Connor, 2002). Researchers must frame and answer questions authentically.

In addition, to learn more about the significance of "connections between particular language patterns and mental life" (Lucy, 1996, p. 37), scholars must expand the volume and quality of cross-cultural experimental research. The profession needs

additional empirical work on this topic (Thatcher, 2001) to complement descriptive and theoretical studies. Western researchers also need to improve the validity and ethics of their empirical practices by "balancing the fact of difference with the need for generalization" (Thatcher, 2001, p. 459), without oversimplifying cultural issues; by considering the relationships among communication media, cultural patterns, and information flow; and by respecting patterns of interaction common in the cultures of interest. Well-designed empirical research will also focus on a central linguistic concept, rather than a limited group of vocabulary items, and examine authentic behavior in real-world, multilingual settings (Lucy, 1996). For contexts in which English is a given, the profession needs "much more information on how readers from different cultures and language backgrounds interact with texts, and how specific features of English technical writing facilitate or interfere with comprehension" (Thrush, 2001, p. 292). With regard to single sourcing in particular, empirical research is needed in almost every area.

The present project therefore attempts to address some of the stated research needs as an empirical, rather than theoretical or practical, study of cross-cultural reader comprehension. In the following chapter, I review the literature on textual cohesion, a rhetorical feature conspicuously absent from many single-sourced texts, and consider cohesion's effect on the comprehensibility of these documents.

CHAPTER IV

REVIEWING SCHOLARSHIP IN COHESION

In the medical supply firm, Judi Greene understands that single sourcing requires writers to develop text in nonsequential, nonreferential modules they can reuse in a variety of contexts or output formats without further editing (Ament, 2003; Sapienza, 2004). Greene knows that, to avoid signaling relationships among modules that may or may not appear in the same document, single-sourcing writers commonly omit cohesive devices between the paragraphs, sections, and other subdivisions that constitute those modules. However, because conventional writing strategies do employ many grammatical, mechanical, topical, lexical, and other cohesive devices to indicate such relationships and thereby help readers construct meaning, she questions whether the absence of these devices may affect document comprehensibility for some readers. At the global level of cohesion, she considers the preview statements her writers use routinely as advance organizers at the start of sections and subsections in the firm's product manuals; at the local level, she thinks of cohesive ties such as *however*, *in addition*, and *finally* that serve readers as textual markers. Will single sourcing preclude using some or all of these devices? If so, will readers in all the firm's markets continue to understand the manuals easily?

The research objectives for this dissertation include Greene's questions about whether readers respond differently to English texts with and without cohesive devices, and whether reading English as a first language or as a second language produces additional differences in comprehension. In considering textual cohesiveness, Greene is

concerned with the practical, everyday devices by which humans accomplish tasks. Her focus here is not computer-assisted single sourcing as a system, or the cross-cultural communicative function of single sourcing as a text, but single sourcing as a tool (Nardi & O'Day, 1999), an instrument writers use for targeted rhetorical purposes in technical discourse.

In this chapter I review several general theories of cohesion, as well as recent scholarship on the problematic relationship between cohesion and modular writing. In addition, although no scholars have published empirical research specifically on cohesion in single-sourced documents, I summarize findings from the broad categories of reader strategies, text signaling, and sociocultural factors that could be relevant to Greene in a single-sourcing enterprise.[4]

Theories of Cohesion in English

The dominant theoretical work in cohesion continues to be that of the early researchers. While scholars do not understand completely the operation of cohesive devices (Grabe & Kaplan, 1996), many generally agree that cohesion is related to "the structure of the text itself" (p. 61) and that cohesion contributes to overall textual coherence, though in a subordinate way (Halliday & Hasan, 1989; Campbell, 1995). Whereas coherence "involves connections between the discourse and the context in which it occurs" (Campbell, 1995, p. 5), including the reader's world view, prior knowledge, and expectations of the text (Thompson, 1986; Campbell, 1995; Grabe & Kaplan, 1996; Ulijn & Salager-Meyer, 1998; Hoey, 1991), cohesion is associated with

[4] In Chapter V (Methods) I analyze the between-paragraph cohesive devices originally contained in the experimental texts for this project. In Chapter VI (Results) I discuss some of the original texts' within-paragraph devices left in place, and their possible effect on participant responses.

specific linguistic cues that function within the discourse to connect sentences to other sentences that precede or follow, thereby combining "to organize text" (Hoey, 1991, p. 3). Describing cohesion as "the surface manifestation of the underlying relations that bind a text," Grabe and Kaplan (1996) suggest that while cohesion alone cannot explain a text's organization or meaning, it is nonetheless "an important indicator" that aids in interpreting that meaning (p. 56). Thompson (1986) theorizes that cohesion also contributes to a text's predictability, another factor in comprehension. Some research indicates that readers have more difficulty identifying and analyzing cohesive devices in expository texts than in fiction (MacLean & Chapman, 1989; Ulijn & Salager-Meyer, 1998). In expository, nonfiction, and instructional texts, cohesion may bear more directly on usability than on coherence to the extent that it helps users understand and accomplish tasks more efficiently (Campbell, 1995).

To date, important theories of cohesion have addressed semantic relationships, perceptual phenomena, and surface features of textual structure.

Cohesion as Semantic Relation.

Early studies of cohesion focus almost exclusively on semantic relationships among textual elements. In their seminal work, Halliday and Hasan (1976) define cohesion as a "semantic relation" or tie that occurs whenever "the interpretation of any item in the discourse requires making reference to some other item in the discourse" (p. 11). That is, the second member of the tie assumes the discursive existence of the first. The semantic relationship inherent in a cohesive tie may be one of several types (Halliday & Hasan, 1989). When the relationship is one of *co-reference*, the two members of the

cohesive tie explicitly name the same thing or event. In *co-classification*, members of the cohesive tie belong to the same general class of items but name different things. In *co-extension*, members are tied by one of the general sense relations of synonymy, antonymy, hyponymy, meronymy, or repetition (pp. 80-81). The effect of all these ties is to form from otherwise discrete sentences a text, "a unit of situational-semantic organization . . . constructed around the semantic relation of cohesion" (Halliday & Hasan, 1976, p. 25). Cohesive ties thus help readers to connect (or construct) the meaning of a given point with information that precedes or follows that point.

Frequently, cohesive ties are created by grammatical devices that can be easily identified in text. Although "there are very strong tendencies for a specific relation to be realised by a clearly definable set of items" (Halliday & Hasan, 1989, p. 74), grammatical cohesive devices can signal any of several types of semantic relationships, and cohesive ties may have features from more than one grammatical category (Halliday & Hasan, 1976). Ties of *reference* send the reader to related information elsewhere in the text, usually preceding. In English, these ties include comparatives, demonstratives, and personal pronouns. Ties of *substitution* are lexicogrammatical links that replace one word or phrase with another upon second occurrence, while *ellipses*omit the second word or phrase entirely, leaving the reader to infer the meaning of the absent item. *Conjunctive* ties of several types express "experiential" and also "interpersonal" (p. 238) relationships between two items, usually sentences. One sentence may elaborate on the meaning of the other (*additive* tie); one may reverse the meaning of the other (*adversative* tie); one may have produced the other (*causal* tie); or one may relate sequentially to the other (*temporal* tie).

An additional category of cohesive tie derives not from grammar but from *lexis*, or word choice. Lexical cohesion occurs when a writer either repeats a word or uses a second word "systematically related" (Halliday & Hasan, 1976, p. 284) to the first, such as synonyms. The result of lexical repetition is a semantic relation because "a largely similar experiential meaning is encoded in each repeated occurrence of the lexical unit" (Halliday & Hasan, 1989, p. 81). Hoey (1991) regards lexical repetition as the most common and therefore "most important" type of cohesive tie (p. 9). Indeed, Hoey argues that repetition is the basis for all cohesive ties except conjunctives, making repetition essential for textual coherence. Hoey uses the term *repetition* broadly, in much the same sense as Halliday and Hasan (1976) use *reiteration* to mean "a form of lexical cohesion which involves the repetition of a lexical item, at one end of the scale; the use of a general word to refer back to a lexical item, at the other end of the scale; and a number of things in between – the use of a synonym, near-synonym, or superordinate" (p. 278). Within the overall concept of repetition, Hoey describes a similar range of types, including simple and complex repetition, simple paraphrase (or synonymy), and complex paraphrase, among others. In Hoey's view, repetition contributes to coherence in that it produces a type of text organization analogous to networks of sentences, or "the idea of treating sentences as interconnecting packages of information or opinion" (p. 34). Shared lexis is the means by which sentences are connected.

Lexical repetition appears to function in text by enabling readers to differentiate more effectively between familiar and unfamiliar material. The cognitive process by which such differentiation occurs is replacement. When information is repeated across sentences or clauses, the repetition creates a "framework" of semantic relationships,

thereby "'opening out'" sentences (Hoey, 1983, p. 25) so that related, but different, information can replace selected elements within that framework. Readers are able to bridge the interpretive gap between old and new because the unfamiliar information is partly "constant," related semantically to information it is replacing, and partly "variable," or different from what it is replacing (p. 114). Thus the "context of known information" (p. 114) provided by repetition enables readers to focus more easily on the new or unique details provided by replacement. A similar mechanism operates in grammatical parallelism, which employs syntactic repetition to show that two clauses are compatible (Hoey, 1983) and which often complements and reinforces lexical repetition (Halliday & Hasan, 1989).

For this dissertation and for single sourcing generally, a significant property of lexical repetition is that it can apparently signal semantic relations not only between adjacent sentences but also between longer passages of text, even when separated by numerous other passages. This phenomenon, which Hoey (1991) labels *bonding*, is the basis for semantic networks, which enable readers to make connections between pairs of sentences, interpret new information, and create coherence across entire texts. Lexical bonding between sentences can also mark the beginning and ending of main topics, and it can indicate "central and marginal sentences in a text . . . [helping readers to] produce coherent sub-texts from the main text" (p. 48). Readers may be more sensitive to repetition than writers realize; for example, collocation, which can be verified statistically, implies that readers remember lexical items in context, thereby multiplying the effects of repetition when the contexts themselves are repeated (pp. 154-155). In addition, careful readers are thought to be more likely than rapid readers to make

semantic connections and to identify bonded pairs across text. Still, Hoey theorizes that, rather than inventing intelligibility in bonded pairs, readers "unearth" it (p. 161), which suggests that bonding relates more closely to writing strategies than to readers' interpretations. Rapid readers are more likely to look for "signals of large-scale patterns" or "clues of the generic structure" (p. 225), all of which writers can make explicit. Further, the responsibility may lie with writers to produce "mutually relevant sentences . . . bonded with each other" and to give readers adequate access to "the vocabulary used in the central sentences of the text," so that readers can interpret authentic text satisfactorily without understanding every word (p. 231). For single-sourcing writers, one strategy for improving reader comprehension may be to increase the bonded pairs that can function across texts even when the modules in which they appear are not adjacent. Such pairs might be developed through the use of tightly controlled vocabularies and syntax, consistent technical terminology, and contexts that repeatedly evoke the same lexical items

Cohesion as Perception.

Although Halliday and Hasan (1976) ascribe some cohesive function to structure, particularly the discourse structures that characterize specific genres, they generally describe cohesion as a catalyst operating semantically on "elements that are structurally unrelated" (p. 27). However, Campbell (1991, 1995) believes that a "purely semantic" explanation of cohesion is inadequate for some genres such as business and technical writing, arguing instead that cohesion in nonfiction texts is "better understood as a general perceptual phenomenon" in which structure is an important factor (1991, p. 222).

Applying principles of repetition (Hoey 1983, 1991) to structure instead of lexis, Campbell (1991) finds a text cohesive if it foregrounds distinctive semantic elements against a consistent background of repeated semantic and structural features. Because the repetition produces an underlying textual unity, the reader perceives and interprets the contrasting elements more easily. Campbell (1991) identifies three types of structural devices that strengthen textual cohesion in this way:

(1) "thematic progression" (p. 227), which involves repeating topics or comments in successive sentences, as in given-new construction;

(2) "syntactic parallelism," (p. 228), or repeating syntactic features across sentences, lists, or headings in order to link semantic elements; and

(3) "graphic repetition" (p. 230), or using typography, enumeration, charts, and other visual elements consistently to heighten contrasts in semantic units.

As Campbell sees it, these structural devices strengthen cohesion by using repetition to make explicit the relationships among semantic components. For example, all three of Campbell's structural devices are present in the paragraph earlier in this chapter (p. 82) on categories of cohesive ties identified by Halliday and Hasan (1976). In that paragraph, successive sentences repeat the theme ("ties") throughout the paragraph; each tie is named in the subject position of a sentence, demonstrating syntactic parallelism; and each name appears in italics, heightening visual contrast within the list. Because of the paragraph's structural and semantic unity, the differences among categories are more conspicuous and thus more easily perceived, according to Campbell's theory.

In a sense, these structural devices complement Halliday and Hasan's (1976) concept of "tight" and "loose" semantic texture (p. 296). In a passage characterized by tight textuality, cohesive ties are stronger and highly interdependent; in loose textuality, ties are less numerous and dense. Texture within or across paragraph boundaries may be of either type. It follows, then, that if structural (especially graphic) features are highly similar, the consistent background they provide helps to tighten textuality across boundaries; if the structural features are dissimilar, then the background is less consistent and textuality is looser. When texture is looser, contrasting semantic elements may be more difficult to perceive and thus less meaningful to the reader.

One additional difference between the semantic (Halliday & Hasan, 1976) and perceptual (Campbell, 1995) approaches to cohesion concerns the classification of conjunctive ties. Drawing upon Gestalt psychology to propose parallels between discourse unity and perceptual unity, Campbell (1995) suggests that conjunctives are described more accurately as "markers of coherence [instead of cohesive ties] . . . because they express coherence explicitly by virtue of their lexical meaning rather than foregrounding" (p. 56), and also because discursive continuity is only one of their semantic functions. Campbell theorizes that humans learn to comprehend and produce discourse by building upon previously learned skills in interpreting phenomena they see and hear. In Campbell's view, two psychological principles specifically – *similarity* and *proximity* – provide the basis for the later cognitive task of perceiving textual cohesiveness. In the same way that humans use likeness and spatial or temporal nearness to construct "wholeness" from visual and auditory impressions (p. 14), they rely on similar and proximate discourse elements to gain a sense of strong local cohesion, which

contributes to overall coherence by producing continuity. Against a continuous background, readers can more easily perceive dissimilar or newly introduced semantic elements in the foreground. Conversely, Campbell suggests, discourse elements with weak local cohesion will produce a sense of discontinuity, leaving readers to organize text coherently on their own by using size, symmetry, or other perceptual principles.

Cohesion as Surface Structure.

Theorists less perceptually oriented than Campbell have nonetheless supported the idea that the surface structure of a text – of which cohesion is one element – contributes significantly to coherence, either directly or through the interaction of reader and text (Williams, 1990, 2005; Ulijn & Strother, 1995; Grabe & Kaplan, 1996). While coherence is a set of conceptual relations at a deep level, involving the text and the reader's prior knowledge, cohesion operates at the surface through signals such as "explicitly stated connections" and "linkage words," enabling readers to make inferences that aid in comprehension (Ulijn & Strother, 1995, p. 139). Through strategic signaling, the writer sends messages to the reader about how best to interpret specific conceptual relations in the text. For example, reinterpreting the principles of repetition and replacement (Hoey, 1983) in terms of surface signals, Williams (1990, 2005) contends that the single most important factor in cohesive text is the physical location of key words and topics: Important information should appear near the beginning of a sentence if the content is given or familiar to the reader, and near the end of the sentence if the information is new. Without these or similar signals, interpretation is more difficult (Hoey, 1983).

Surface structure plays an important role in several research-based hypotheses of text organization, according to Grabe and Kaplan (1996), who cite studies showing that top-level structures appear to vary with text type and audience; readers' comprehension and recall seem to improve when they can discern top-level structures; and a text's "hierarchical structure" may be evident through its "cohesive harmony" (p. 61). In their own model of text construction, Grabe and Kaplan conceptualize structural components as a matrix, with syntax and cohesion at the surface level, coherence and semantics at a deeper level, and lexicon operating at all levels. For cohesion specifically, lexicon provides units that can serve as "formal signaling features" in the text, enabling writers to guide readers "to achieve the preferred coherent interpretation intended by the writer" (p. 70). Grabe and Kaplan acknowledge that coherence is more than cohesive signaling and that surface features can never reflect a text's underlying logic exactly. However, they suggest that a writer can strengthen coherence by using cohesive devices purposefully and skillfully. Surface structure may be especially influential in everyday texts. The result is what Ulijn and Salager-Meyer refer to as "considerateness of text" (1998, p. 85): the intentional production of cohesive, audience-appropriate texts that reveal their structures and purposes, show relationships among ideas, and are generally more comprehensible to readers.

Cohesion and Single Sourcing

Recent technical communication scholarship has begun to consider structured writing and cohesion from a theoretical perspective. Sapienza (2002, 2004) frames the issue of cohesion in terms of systemic constraints on the single-sourcing writer. Formally,

Sapienza contends, the writer is limited by the "predominantly restrictive rules of logic" of computer programming (2002, p. 163), a science not generally concerned with consistent communication or textual coherence (Albers, 2000). In the XML environment, schemas or document type definitions (DTDs) dictate generic form, and metadata fix the limits of rhetorical variation within a given form. The only contextual cues or interpretive aids the writer can provide the reader are those that can be tagged at the prescribed level of granularity, a solution that can easily become unacceptably "mechanistic" (Sapienza, 2002, p. 164). Moreover, an organization is unlikely to leave decisions on granularity up to individual authors, and a writer may have limited technological and political input into the design of generic forms. Rhetorically, Sapienza believes, the systemic need for decontextualization forces the single-sourcing writer to avoid such cohesive devices as obvious transitions or use of the given-new principle between modules at a specified level of granularity, because "the writer either does not know where the module will be displayed, does not know in what relation to other content it will be arranged, or must contrive multiple givens" (2004, p. 403). Within these constraints, such structural devices as thematic progression and repeated syntactic features across text blocks (Campbell, 1991) are clearly difficult to incorporate into documents. As Sapienza puts it, single-sourced text must be "meaningful yet generic" (2004, p. 403), in the sense that the writer must not restrict information units to a unique context or arrangement.

One solution to systemic limitations on cohesion has been to focus on developing tight textuality within, rather than across, the boundaries of information units. Here, Horton's (1994) earlier advice to writers of online documentation anticipates single-sourcing methodology. To maintain coherence within a decontextualized module of

information, Horton recommends that writers answer a single question in each unit, design each topic to be independent of other topics, and keep topics "rhetorically neutral" (p.105), suitable for a wide range of users and purposes. Referring to newer data-driven texts, Albers (2000) agrees that modular documents communicate most effectively if their individual components are self-contained, that is, if "the writer has encapsulated all the pertinent information [in one unit] so that it makes sense on its own" (p. 199). This strategy does produce local cohesion within modules, although it fails to address top-level structure or global cohesion across a document.

Another response to systemic constraints on cohesion is the intensive use of graphic repetition (Campbell, 1991) and visual patterning (Johnsen, 2001) throughout documents. Typefaces, bullets, numbered lists, horizontal rules, and generous white space between sections and paragraphs are structural devices likely to appear in documents produced by the single-sourcing method, providing a measure of visual cohesion. Carefully worded headings in modules can potentially reinforce semantic ties as well. A response employing visual rhetoric as a cohesive device can also strengthen textual coherence generally in that visual elements in a single-sourced document must conform to coded designs that govern overall text construction and appearance.

Ultimately, responsibility for textual cohesion in the single-sourcing environment may fall to technical editors, as more organizations implement applications that assemble document components from databases and writers focus on discrete information chunks (Albers, 2000). In addition to checking grammar, mechanics, and accuracy, editors may have the task of maintaining top-level structure and some form of global cohesion, though perhaps conceived differently from cohesion in conventionally composed texts.

Even with detailed style guides that prescribe high-level structure and low-level mechanics and terminology, individual writers still organize differently within chunks of content. Editors must therefore ensure that texts fit with other texts. This task will be particularly difficult in dynamic online applications and print-on-demand environments in which users' requests for information shape document creation instantaneously. In a web-based catalog or instruction manual, for example, human editors will be unable to check in advance the thousands of possible online combinations of content units. "Maintaining a consistent style and terminology for information written by different authors at different times requires that an editor considers each chunk's relationship to the whole, rather than just the information contained with the chunk itself" (Albers, 2000, p. 200). Albers advises editors to work closely with writers, develop detailed style guides, and get involved in content development, if necessary. In addition, editors will need to conduct regular usability tests to gauge reader reaction to online texts, although Albers notes that users in specialized fields such as software are likely to have fairly consistent levels of expertise and information needs.

Cohesion and Empirical Research

Technical communication scholarship contains little or no experimental research on single-sourced writing specifically. However, several experimental studies of cohesion applicable to single sourcing and comprehension have originated in technical writing, linguistics, educational psychology, and reading. One question important to professional communicators involved in single sourcing concerns the effect on native readers of English text with and without cohesive devices. Another question is the effect on readers

of English as a second language, a relevant issue in that global readers represent a large audience for English technical documents (Kohl, 1999), including single-sourced texts. Experimental cohesion research is also relevant to technical texts published in translation, for translators in a single-sourcing environment are subject to the same systemic constraints on cohesion as the original writers. In a content management program, translators do not change the original text by inserting cohesive ties on their own initiative. As I learned from watching product demonstrations in Europe, one of the selling points of content management software is that global organizations can use the applications to reduce their translation needs, because consistent, well-structured content in the original language can be translated once and used again and again (K. Lourdon, personal communication, June 18, 2004; also Hackos, 2002; Rockley, 2003a). Consequently, the appropriate level of cohesion for global readers must be considered at the beginning of composing and document design, because the typical production process offers few opportunities later to edit for different language groups.

In the sections below, I summarize experimental cohesion studies relevant to English reading comprehension. These studies all pertain to expository text, which has been studied less than narrative texts (Spyridakis & Standal, 1986; MacLean & Chapman, 1989; Sanders & Noordman, 2000; Geiger & Millis, 2004). Expository text is also the general text type of the data collection instruments for this project. With some overlap, the studies are grouped according to their focus on readers' rhetorical strategies, textual signaling, and sociocultural factors, respectively. In the third group, studies of non-native English readers emphasize East Asian linguistic groups in particular.

Cohesion and Rhetorical Strategies.

Some cohesion research has focused on the strategies readers use to achieve a sense of coherence in texts. In one study of compensatory strategies in native readers (Freebody & Anderson, 1983), researchers reported weak effects on comprehension when cohesive ties were manipulated in English texts. They had initially hypothesized that readers use alternative sources of knowledge such as vocabulary to analyze text when cohesive devices have been removed by a readability formula or are otherwise unavailable. The study tested native sixth graders on social studies texts modified for varying degrees of vocabulary difficulty and cohesiveness, following Halliday and Hasan's (1976) categories of cohesive ties. A key assumption in the study was that cognitive demands on readers vary with types of cohesive ties, which can be ranked accordingly. However, the lack of significant interaction between cohesiveness and vocabulary on measures of comprehension failed to support the hypothesis. The researchers suggest that readers may make "bridging inferences" (p. 286) to compensate for lack of cohesiveness, although this strategy requires effort and may contribute to "nonspecific degradation of performance because of increased cognitive load" (286), especially with unfamiliar topics. Alternatively, they suggest thatthe presence or absence of cohesiveness may be relatively unimportant to reading comprehension, with little effect on test performance. Another explanation may be that the assumption of higher- and lower-ranking cohesive ties produces text versions too subtly differentiated for clear test results.

Other research has found that readers do use cohesive relationships to achieve a sense of coherence, although micro- and macroprocessing appear to be different

operations that may be dissociated. In a study of 11- and 12-year-olds grouped according to reading ability (MacLean & Chapman, 1989), participants were asked to replace deletions that interrupted cohesive chains in a variety of fiction and nonfiction passages, as a measure of comprehension. Although both good and poor readers appeared to see cohesive relationships more easily in fiction than in nonfiction, possibly because students of that age have more experience with fiction, good readers were much more likely than poor readers to supply the author's original word(s) in the gaps. The most striking difference was that poor readers tended to process information below the sentence level and had difficulty integrating small pieces of information into the larger context, whereas good readers were more successful in working with larger pieces of information and "maintaining the global unity of the text" (p. 26). The researchers suggest that the ability to perceive cohesion at local and global levels may be a skill that develops throughout the primary and secondary years. These results may also indicate that writers aid audience comprehension most effectively by addressing both local and global processing routinely, as when technical writers use one cohesive device to reinforce another.

Cohesion and Text Signaling.

As used in the studies summarized below, *text signaling* refers to "[a] word or statement that pre-announces content or reveals relationships . . . thereby helping a reader more clearly identify superordinate content" (Spyridakis & Standal, 1986, p. 343). Text signals may include any of the following:

- headings, which are usually phrasal (Spyridakis & Standal, 1986; Lorch, 1989; Goldman & Murray, 1992; Chung, 2000)

- previews and overviews, which are usually complete sentences or paragraphs (Spyridakis & Standal, 1986; Lorch, 1989)
- logical connectives, pointer words, and signaling phrases, which reveal relationships among ideas or possibly the writer's perspective (Spyridakis & Standal, 1986; Lorch, 1989; Goldman & Murray, 1992; Chung, 2000; Sanders & Noordman, 2000)

Lorch (1989) briefly mentions repetition and enumeration as additional forms of text signaling. Otherwise, of the graphic features described by Campbell (1991, 1995) in professional texts, only headings are addressed in these studies.

In a variety of ways, studies of text signaling investigate whether and how text signals help readers mentally organize a passage, on the assumption that readers are more likely to comprehend a text when they have a greater sense of coherence at local or global levels. The underlying "network of related propositions" (Lorch, 1989, p. 210) to which signals relate has been described in terms of discursive forms and text types (Kintsch & Yarbrough, 1982; Sanders & Noordman, 2000; Geiger & Millis, 2004); mental text bases (Lorch, 1989); and domain knowledge (Goldman & Murray, 1992). Although one theoretical explanation for the role of text signals in comprehension is that they help readers select and remember information hierarchically, experimental findings appear to be inconsistent on this point (Spyridakis & Standal, 1986). The most cogent indicators of comprehension may be the reader's ability to perform "problem-solving tasks" and "make inferences" from text content (Lorch, 1989, p. 213), rather than measures of memory such as content recall.

Text signaling is thought by some scholars to function in expository prose as schemata function in narrative passages (Spyridakis & Standal, 1986). In two comprehension tests involving signaled and nonsignaled versions of expository text, readers recalled more from texts with previews than from texts with headings, possibly because the effort of processing a sentence reinforced memory (Spyridakis & Standal, 1986). In these studies, the effect on comprehension of logical connectives was insignificant. The findings suggest that previews help readers to develop organizational strategies for comprehending texts if a passage is syntactically or lexically difficult or if it presents new information. However, signals may be less helpful if the reader is already familiar with the topic and thus has an organizational strategy already in place. The signaling most effective in activating schemata may combine semantic and structural signals (Chung, 2000). In a study of secondary school ESL readers at three English proficiency levels, logical connectives and paragraph headings did not contribute significantly to local or global meaning for medium- and high-level readers (Chung, 2000). However, for low-level readers, these explicit text signals were critical. Logical connectives aided comprehension at the global level, and paragraph headings aided comprehension at both levels, apparently stimulating the development of schemata that aided interpretation. A combination of connectives and headings was the most effective of all, possibly because this version provided more clues to meaning and strengthened concepts through frequency or repetition.

Another theory of signal functioning is that these cohesive devices activate readers' schemata for specific discursive forms or text types, which may, in turn, aid comprehension. Discursive forms investigated experimentally include claim-argument,

problem-solution, lists, and cause-consequence (Sanders & Noordman, 2000); descriptions and procedures (Geiger & Millis, 2004; Kintsch & Yarbrough, 1982); and classifications, illustrations, and compare-contrast (Kintsch & Yarbrough, 1982). In one study of familiar rhetorical forms, participants were significantly more accurate in answering topic and main-idea questions for texts containing explicit text signals and "canonical ordering" of points than for texts that were less well organized (Kintsch & Yarbrough, 1982, p. 833). Cloze tests in the same study showed no differences among texts, suggesting that readers process for local and global meanings separately (see also MacLean & Chapman, 1989). If cues in well-organized texts activate schemata for specific structures, enabling readers to use comprehension strategies successfully, then writers should able to direct readers to intended meanings by inserting text signals in rhetorically familiar ways.

However, other experimental evidence indicates that readers may still comprehend texts on the basis of overall discursive structure, even when text signals are missing. Discursive types are believed to represent a set of conceptual relations among segments of text (Sanders & Noordman, 2000), which readers may perceive cognitively without explicit surface markers. In one study, readers processed text in a problem-solution structure faster and more accurately than text in a list relation, without regard to text signals. When explicit markers were also present in the text, they did appear to "guide" readers toward coherent interpretations and speed their short-term processing of the text without loss of accuracy (p. 38), though results for longer-term retention were inconclusive. Cohesive devices may thus represent surface expressions of underlying coherence relations, which are in turn "an indissoluble part of the cognitive

representation itself" (p. 56). Some research suggests that readers' goals may also interact with discursive type to affect global and local processing (Geiger & Millis, 2004).

A final explanation of the relationship between signaling and comprehension may be that these cues call reader attention to selected aspects of the underlying content domain (Goldman & Murray, 1992) or text base (Lorch, 1989), leading readers to consider information more carefully. Lorch (1989) describes composition as a three-stage process in which the writer draws information from a mental text base, transforms the information into a surface or written representation that communicates the "semantic content of the underlying text base," and then applies various cohesive devices to emphasize content and organization without adding new semantic content (p. 210). Without such devices to direct their attention, readers may fail to "make inferences about what information is important, [and] how specific propositions are related to other propositions" (Goldman & Murray, 1992, p. 504), particularly if the readers are unfamiliar with the text's content domain. In a series of experiments with native English and mixed-language ESL readers (Goldman & Murray, 1992), researchers found that participants' ability to supply missing conjunctives in college-level English science and social science texts appeared to affect their comprehension of the passages overall. As expected, results were consistent with English proficiency levels. The differences in performance between native English and ESL readers related more to "[g]eneral content-domain comprehension skills" than to connector type (p. 518). All groups tended to use additives and causals correctly more often than sequentials or adversatives, possibly because continuing a line of thought is less difficult than reversing it. The researchers

also noted a strong bias toward causals that may reflect the dominant role of these conjunctives in English-language narratives and conversations.

Cohesion and Sociocultural Factors.

In a cross-cultural context, the preceding study raises interesting questions as to whether reading comprehension relates more to linguistic proficiency or to cultural expectations for texts. According to Koda (1994), research on second-language reading in general has established that its constructs must be differentiated from those of first-language reading. Unlike native readers, second-language readers draw on prior reading experience, read across languages, and may have better readingskills than oral skills (Koda, 1994). Other variables in second-language reading include the psycholinguistic choices readers make; levels of metacognition; background knowledge and cultural schemata (Fitzgerald, 1995); and overall reading and linguistic proficiency (Upton & Lee-Thompson, 2001; Ulijn & Salager-Meyer, 1998; Fitzgerald, 1995). In contrast to earlier views that second-language reading draws on the first language mainly for mental translating, research now indicates that second-language readers use their first-language expertise on a cognitive level to "wrestle with word- and sentence-level problems, confirm comprehension, predict text structure and content, as well as monitor text characteristics and reading behavior," findings that "support a sociocultural view of language as a tool for thought" (Upton & Lee-Thompson, 2001, p. 491). Consequently, native English writers must be aware that global readers of English (in this project, East Asian readers specifically) may or may not use and comprehend conventions such as cohesive devices in the same ways native English readers do.

Researchers differ on the precise nature of cohesion in a cross-cultural context. One perspective holds that cohesion represents "the set of linguistic resources that *every language* has (as part of the textual metafunction) for linking one part of a text to another" (Halliday & Hasan, 1989, p. 48; emphasis added). Consequently, sensitivity to cohesiveness reflects a reader's linguistic competence. In an interesting comparative study of native Japanese readers and native English learners of Japanese (Horiba, 1996), the ability to make "coherence-based inferences" in Japanese texts (p. 437) increased with proficiency. Although the Japanese folk narratives used in the study contained anaphoric and causal relations, less skillful readers were generally unable to detect these ties, whereas better readers could generate backward and forward inferences, elaborations, and other knowledge associations. The study concludes that readers of limited language skills seem to produce "underdeveloped representation[s] of a text" (p. 437), because they miss the descriptive phrases on which cohesive ties depend, achieving a sense of local coherence only. Conversely, competent readers are more likely to grasp the overall content structure of a text, thereby perceiving individual causal relations.

A different perspective suggests that reading comprehension is strongly influenced by cultural rhetorical patterns, including cohesive devices. Citing language production practices in a single East Asian culture, Johns (1984) points out that in the People's Republic of China, the principal unit of language study is the sentence, rather than the text. There, composition students do not learn to see the text as a whole or to link sentences; as a result, writing expository prose (except for translations) is difficult even for advanced learners. In one study of Chinese middle-school readers of English texts (Sharp, 2002), scores were significantly higher for the single test passage constructed

without cohesive devices. Each participant read one of four versions of a secondary school science text on healthy eating, reconstructed to reflect the rhetorical forms of description, cause-effect, listing, and problem-solution. Cloze and qualitative scores were significantly higher for the descriptive text, the only version without explicit use of signaling words. Although this text was the most loosely organized of the four, researchers believe the participants' response to the absence of cohesive devices may reflect differences between Chinese and western rhetorical conventions, thus accounting for the higher comprehension scores.

Although the current dissertation research focuses on reading comprehension, findings from other modes of second-language communication research help to illustrate that cultures may structure information in different ways and may make "significantly divergent assumptions about the appropriate linguistic behavior for a given communicative task" (Young, 1982, p. 81). For example, researchers have noted differences between subject-prominent speech (characteristic of many native English and European speakers) and topic-prominent speech (common among Chinese speakers). In an analysis of a cross-cultural business discussion in English (Young, 1982), one Chinese rhetorical convention unfamiliar to the Western participants was the expanded meaning of conjunctives such as *so*, *because*, and *as*. Western participants tended to interpret these connectives locally, relating two adjacent points, whereas Chinese speakers intended them more generally as introductions to summaries. Other research studies have also found that conjunctives are "particularly problematical for Asian readers and writers of English" (Scollon & Scollon, 2001, p. 64). A study of rhetorical problems among Chinese teachers learning to compose in English (Johns, 1984) noted several common

cohesion errors that resulted in ambiguity, including inappropriate use of adversatives; overuse of conjunctives, especially additives; and erroneous use of references, such as personal pronouns. The Chinese writers also tended to use fewer lexical cohesives than native English writers, possibly because of the Chinese tendency to teach English vocabulary words in isolation "rather than as part of a semantically-related chain" (p. 70). Although native writers also make some of these errors, the negative effect on reader comprehension is the same, for inappropriate use (or understanding) of cohesive devices can result in miscommunication of the writer's purpose or direction.

Research Needs in Cohesion

Linguists, educational psychologists, and reading specialists have investigated cohesion for more than two decades but applied few of their findings to specific software issues. Conversely, technical communicators are only beginning to develop theories of cohesion in single-sourced texts. Most of the impetus for single-sourcing technology has come from software developers, information architects, and system analysts, who may be attempting to implement the technology with insufficient testing or analysis of target readers, especially non-Western audiences. However, this review of scholarship has identified several research issues that should be explored if single-sourced writing is to be generic yet truly meaningful to readers, to paraphrase Sapienza (2004). One issue concerns the best practices for writing cohesive, self-contained modules (Albers, 2000). Another issue is developing a rhetorical theory that would support those practices (Sapienza, 2004), perhaps building on an earlier question of how "texts of different kinds are constructed so as to form semantic wholes" (Halliday & Hasan, 1976, p 24). Pertinent

reading comprehension issues include the ways readers in different cultures process written materials, and how they use what they know about language to understand what they read (Koda, 1994).

This project draws from each of those research questions. The objective of the present research has been to test the effects of cohesive devices in single-sourced texts on cross-cultural reader comprehension, a type of investigation for which no published reports exist. In the chapter that follows, I outline my methodology for collecting and analyzing data on this question.

CHAPTER V

DESIGNING THE RESEARCH

To make an informed decision about implementing single sourcing in her organization, Judi Greene needs research data that are relevant in the context of a sophisticated, user-centered communications division with audiences around the world.

Consequently, to be genuinely useful in her workplace, the research should first examine reader responses to actual texts generated by single-sourcing software. In many language studies, the experimental research texts are so artificial as to be almost meaningless "textoids" (Graesser, Millis, & Zwann, 1997, p. 165; see also Sanders & Noordman, 2000; Hinds, 1984). Research must address the systemic aspect of single sourcing in authentic ways.

The research should also consider the communicative needs of the firm's global readers. Because Greene's firm provides documentation in English to markets abroad, an experimental research design relevant to her concerns should acknowledge differences in readers' linguistic backgrounds. A study of single sourcing as text, or vehicle for meaning, should examine whether and how a reader's first language affects the reader's response to English as a second language in technical texts in demonstrable ways.

Finally, the research should analyze the implications of single sourcing as a tool, specifically, the effects on comprehensibility of including or excluding cohesive devices in technical text. Findings should present evidence of readers' responses to the presence or absence of cohesiveness in English text in such a way that single-sourcing writers have some guidance in the best ways to use this specific composing strategy. The research

should indicate the extent to which readers do or do not rely on textual signaling to detect important relationships among ideas (Lorch, 1989), so that technical communicators can find ways to integrate this rhetorical device with other writing strategies as needed.

From reviewing literature in each of these areas, Judi Greene has gained some theoretical insight and learned from experimental investigations on selected points. However, none of the published research addresses all of her concerns. As a complement to the literature review, she considers qualitative research but concludes that, by themselves, highly individualistic, descriptive case studies with small numbers of participants would be more difficult to generalize to larger groups than quantitative research (Carrell, 1989). She believes an experimental design would be more likely to show trends, would be easier to replicate with different groups of participants (Clark, 1973), and would have greater credibility with other decisionmakers in her firm.

This chapter therefore describes the methodology for an experimental study of reading comprehension that attempts to test two hypotheses incorporating Greene's concerns about single-sourcing methods: (1) Do readers respond in significantly different ways to English single-sourced texts composed with and without cohesive devices? (2) Do native and non-native English readers comprehend these texts differently?

Below I describe the methods I used to identify two single-sourced texts for study, develop experimental tasks, select participants, and conduct and score the studies.

Identifying Authentic Texts

For this project I developed data collection instruments from two authentic single-sourced texts, used by permission of the organizations thatorigin ally posted the texts on

their websites. To locate suitable texts, I identified several dozen organizations that use single sourcing to produce technical documents and requested permission to test materials they had published either in print or online. I located the organizations through references in professional literature, listserv discussions on single sourcing, online newsletters and other marketing tools, website links, and personal referrals from other sources. I contacted all organizations by e-mail. I also conducted a face-to-face interview with a content management specialist in one organization and telephone interviews with content management specialists in two other organizations.

I used several criteria to evaluate the single-sourced texts I obtained. I first limited the search to material written in English by native speakers and disseminated in English. This requirement made the project practical for me as a native English reader and writer. It also supported the project's authenticity in that global readers expect to use English when reading technical material (Boiko, 2002; Kohl, 1999) and would therefore find my data collection instruments very similar to the original texts, should the readers ever encounter them on the internet.

I then restricted the passages under consideration to expository text. This requirement eliminated procedures, warnings, copyright notices, and similar text types that require writers to present information in prescribed or highly formulaic styles. It also eliminated narrative texts, the focus of many previous cohesion studies. Narrative texts have distinctive features that call forth in readers a specific set of expectations and background knowledge (Sanders & Noordman, 2000); however, expository texts, which have been studied less often, usually present readers with new information and therefore "better reflect the influence of text characteristics to guide the construction of a meaning

representation" (p. 39). Like narratives, expository texts offer opportunities to emphasize or minimize cohesive devices, but expository texts are far more typical of professional writing generally. Genres in technical communication likely to contain expository text include proposals, introductions, white papers, reports, and marketing materials.

Within those genres, I looked for topics of general interest. I assumed a college education for authentic readers who would be consulting technical material in English, and therefore I thought it reasonable to consider potential topics that were somewhat sophisticated. At the same time, I acknowledged that readers (including those in a sample university population) might or might not bring a particular expertise to the reading task. For that reason, I eliminated highly specialized material such as pharmaceutical documentation, computing manuals, and scientific proposals. I also looked for articles that were long enough to display cohesion (or the need for it) but short enough to function suitably as a data collection instrument.

From the single-sourced material made available to me, I decided on one text each from two organizations identified as clients on the website of AuthorIT (www.author-it.com, 1996-2005), a New Zealand developer and marketer of single-sourcing software. I chose an online article on using straw as a construction material (Stone, 2002-2005) from the website of the Pangea Partnership (www.pangeapartnership.org2002- 2005), a Canadian organization that conducts workshops on economical and environmentally friendly building practices. I also chose one section of a three-part online article about writing a sales proposal (Cherryleaf, 2002-2005) from the website of Cherryleaf, Ltd. (www.cherryleaf.com, 2002-2005), a technical communication consulting firm in the United Kingdom. Both articles advocate certain technologies and practices, but because

they also explain concepts I accepted them as expository text. A user could read each text from a single web page by scrolling, without the need for navigating to or appending other pages. I therefore concluded that the articles would function acceptably as test instruments when printed. [5]

Appendix A contains a copy of Institutional Review Board approval and consent forms for the project. Appendices B and C contain original texts, readability statistics for preliminary versions, and final cohesive and non-cohesive versions of the Pangea and Cherryleaf texts, respectively. Appendices D and E contain scenarios and items for the Pangea and Cherryleaf articles, respectively. Appendix F contains the instructions page and demographic form. Appendix G contains the coding key for all items.

Developing Experimental Texts

In adapting the original articles for experimental purposes, my objective was to create one version of each article that minimized cohesiveness and one version that emphasized it, while preserving as much as possible of each article's original syntax, vocabulary, and complexity (Spyridakis & Standal, 1986). In this section I describe methods for developing those versions, beginning with the issue of granularity.

Determining Granularity.

One of the first issues to address was the question of granularity, or the extent to which I would subdivide the article into discrete textual units for testing, because the

[5] Although Pangea and Cherryleaf are organizations outside the U.S., their articles met more of my selection criteria than the articles made available to me by American organizations. In each article I regularized a few instances of spelling and punctuation to conform to American usage. AuthorIT, the software manufacturer, is marketed widely in the U.S. and used by many American companies.

level I chose would determine the number and type of cohesive devices I added or deleted.[6] For this project I ultimately chose paragraph-level granularity. At least one technical communication scholar advises against granularity at the paragraph level or below, on the grounds that a paragraph "seldom makes sense outside of its larger context" (Albers, 2000, p. 199). However, paragraph-level granularity accurately reflects at least some current workplace practices (Clark, 2002). On the Pangea Partnership site I also observed instances of sentence-level granularity, and single-sourcing software can accommodate granularity at even finer levels (Hackos, 2002; Rockley, 2003a).

I found paragraph-level granularity to be proportionate to the lengths of the articles. It enabled me to test for cohesiveness between units on a manageable scale, and it provided a reasonable scope for recommendations, should the final results suggest that between-paragraph cohesion is necessary for reader comprehension.

Developing Non-cohesive Versions.

I changed the original articles incrementally to preserve as much of the authentic text as possible. After downloading each article from its web page, I deleted all formatting and structural features such as headings, photographs, and color. When I removed bullets from lists, I incorporated the list items themselves into sentences within paragraphs. To make the unformatted versions roughly equivalent in length and readability, I deleted paragraphs and list items whose content was not essential to the

[6] Online views of the articles in Page Source mode do not show the underlying XML coding that would reveal the original levels of granularity. Instead, the AuthorIT software displays only the coding appropriate to the output medium. Representatives from Cherryleaf, Ltd. and AuthorIT confirmed that because I retrieved the articles through an internet browser, the files display HTML coding in Page Source mode. Other coding can be viewed only within the Author IT software (J. Darley, Technical Director, Cherryleaf, Ltd.; personal communication, July 15, 2005; J. Goodwin, AuthorIT Tech Support; personal communication, December 12, 2005).

meaning of the passages. At each stage of editing, I checked the automatic word, sentence, and average word/sentence counts in Microsoft Word® (version 10); when necessary for equalizing the number of sentences in each passage, I divided compound and complex sentences into simple sentences.

Finally, I removed cohesive ties between paragraphs, leaving in place cohesive devices within paragraphs, as a single-sourcing writer developing discrete paragraph-level units would do. Of the few between-paragraph devices in the original Pangea article, all were referential ties: "the following," "many of these," "even better." The original Cherryleaf article included a few between-paragraph connectives such as "unfortunately" and "also"; however, structural features such as headings and bullets contributed much more to cohesiveness, mainly through lexical and graphic repetition.

When the edited articles were reasonably equivalent according to the automatic word and sentence counts, I used the counts to calculate readability statistics by hand according to the Gunning Fog Index. As Table I shows, readability scores for the final non-cohesive versions are very close. These statistics are included in this chapter as part of instrument development.

Table I. Readability Statistics for Final Non-Cohesive (NC) Versions

Text	Counted automatically in MS Word® (version 10)					Calculated by hand, Gunning Fog Index		
	counts			averages				
	words	paras	sentences	sentences/ para	words / sentence	complex words[a]	percent complex	reading score
Pangea NC	547	7	30	4.2	18.2	70	12.80%	12.4
Cherryleaf NC	488	9	30	3.3	16.2	70	14.34	12.2

[a]Words of three or more syllables (excluding the suffixes -ed, -es, -ing, and –ly, and excluding numbers and proper nouns)

Developing Cohesive Versions.

After creating non-cohesive versions of comparable length and readability, I added semantic and structural devices to the texts to develop a cohesive version of each. Well-designed cohesion studies should manipulate devices consistently and systematically (Goldman & Murray, 1992) and should preserve "the syntactical complexity of the original passage" (Spyridakis & Standal, 1986, p. 346), unlike studies based on random insertion or highly contrived texts. I therefore used similar cohesive devices for each article and inserted them with a minimum of rewriting, a constraint that would also apply to Judi Greene and her staff in a single-sourcing environment. Where appropriate and effective, I used cohesive devices that had appeared in the original articles.

The final cohesive Pangea and Cherryleaf versions contained 32 and 17 devices, respectively. At the beginning of each article, I added a title and wrote forecast statements that named the article's main topics. I then wrote headings for those main topics that repeated words or concepts from the forecast statement, to create lexical ties. Within the main topics, I inserted cohesive ties near the beginning of each paragraph, usually a referential tie, some form of conjunctive tie, or lexical repetition from the heading for that topic. For paragraph seven of the Pangea article, I wrote an entirely new topic sentence containing both connective and referential ties. I also restored two of the original bulleted lists to the Cherryleaf article and created one list for the Pangea article to increase cohesiveness within paragraphs through graphic repetition. Finally, I

emphasized titles and headings by reformatting them in a slightly larger sans serif typeface in bold.

As with the non-cohesive texts, I used the automatic word and sentence counts to calculate readability statistics by hand according to the Gunning Fog Index. Table II shows that readability scores for the final cohesive text versions are very close.

Table II. Readability Statistics for Final Cohesive (CO) Versions

Text	Counted automatically in MS Word® (version 10)					Calculated by hand, Gunning Fog Index		
	counts			averages				
	words	paras	sentences	sentences/ para	words / sentence	complex words[a]	percent complex	reading score
Pangea CO	630	18	37	3.3	15.7	83	13.17&	11.548
Cherryleaf CO	530	21	33	2.5	14.7	76	14.34%	11.6

[a]Words of three or more syllables (excluding the suffixes -ed, -es, -ing, and –ly, and excluding numbers and proper nouns)

Developing Authentic Tasks

Cohesion studies have commonly used recall as a measure of comprehension, either on its own or in combination with other measures (Sanders & Noordman, 2000; Fitzgerald, 1995; Freebody & Anderson, 1983; Horiba, 1996; Sharp, 2002), on the theory that readers' memory of a text correlates positively with their understanding of it (Chung, 2000). However, free recall tests may reflect both macroprocessing and microprocessing (Kintsch & Yarbrough, 1982) and may not be reliable measures of comprehension (Chung, 2000). Other cohesion studies have used cloze or word replacement tests (Goldman & Murray, 1992; MacLean & Chapman, 1989), multiple-choice tests (Chung, 2000; Spyridakis & Standal, 1986), sequencing of ideas (Alderson, Percsich, & Szabo,

2000), and think-aloud protocols (Horiba, 1996; Upton & Lee-Thompson, 2001). At least one researcher has criticized true-false tests as an unacceptably crude method of relating reader comprehension to cohesiveness (Chung, 2000).

To preserve as much authenticity as possible in this project, I used three types of open-ended items that would reflect the cognitive processes of actual readers who were consulting the online articles for information. In addition, to provide participants with context for what they were about to read, I introduced each article with a short scenario describing a possible real-world situation for reading.

To measure microprocessing, or comprehension of local semantic and structural relationships, I asked two-part task questions drawn from the scenario, discussed more fully in the following section.

After pilot testing with 13 native and non-native English readers, I added questions on a Likert scale to gauge participants' macroprocessing, or sense of global relationships, also discussed below.

Appendices D and E contain scenarios and item sets for the Pangea and Cherryleaf articles, respectively.

Likert-Scale Items on Global Relationships.

Each question set began with five items (1 through 5) that asked participants to rate the articles numerically on overall comprehensibility. For example, I asked whether participants considered ideas in the articles to be well connected, well organized, or easy to follow (Campbell, 1995). These items were identical for all versions.

To enable participants to answer with some precision, I used a 10-point interval scale, with 1 representing the most negative response possible and 10 representing the most positive response possible.

Task and Metalanguage Items on Local Relationships.

The second part of each question set included five short-answer, two-part task and metalanguage items (6 through 10). Three of these items measured comprehension and two assessed the text's usability on a specific point.

Tasks. The first part of items 6 through 10 required participants to use information from the passage to solve a problem, make inferences, gather information, or perform some purposeful activity related to the scenario, as they would in an authentic context (Alderson, 2000; Lorch, 1989; Geiger & Mills, 2004). The assumption underlying this measure was that textual cohesiveness would help readers to complete the task correctly.

Because items 6a through 10a were content-based, questions were different for the Pangea and Cherryleaf texts. However, items for the cohesive and non-cohesive versions of each article were identical, except that I adjusted references to line numbers to match each version. I developed items that participants could answer from either version, although I expected them to have more difficulty when using the non-cohesive texts.

Metalanguage. Items 6b through 10b asked the readers to explain which word(s) or feature(s) in the text helped them connect pieces of information to arrive at the answer for the first part. The wording of this item was identical for all versions. The objective of this measure was to determine the extent to which the participants' previous answers

depended explicitly on cohesive devices. In some ways this measure was the written equivalent of a qualitative, post-test oral interview (Goldman & Murray, 1992). I was aware that participants might respond in some way to cohesiveness but fail to recognize the actual devices or be unable to explain their operation in the text (Carrell, 1989). However, I wanted to explore this approach because in most previous cohesion studies of larger populations, researchers had not asked participants to address metalanguage explicitly.

Selecting Participants

I recruited participants at Oklahoma State University, Stillwater, and the University of Arkansas, Fayetteville. To contact potential participants, I e-mailed information about the project to presidents and advisors of registered student organizations, ran print and online ads in the student newspapers on both campuses, distributed flyers, and made other personal contacts. All recruiting materials specified that the project had been approved by the Institutional Review Board and that participants would receive monetary compensation.

To control outside variables (Jarvis, 2000), I limited participation to selected groups of readers. I accepted only graduate students for the project, because they were more likely than undergraduates to fit the profile of actual readers for the topics in the instruments. Graduate students were also more likely to be proficient English readers and to have the rhetorical skills necessary for analyzing cohesive devices. Although I did not control specifically for age or motivation (Jarvis, 2000), the graduate student requirement tended to address these issues indirectly.

I further limited participation to native English readers and non-native readers from East Asian countries such as China, Japan, and Korea, as described below.

Native Readers.

For native readers, I restricted participation to students in the first year of a master's program (including law school) to simplify recruiting and to standardize reading proficiency somewhat within this language group (Chung, 2000). I asked potential participants to confirm their educational status when they contacted me to sign up.

Non-native Readers.

For non-native readers, I limited participation to students who were in their first year of U.S. residence regardless of their academic classification, in order to minimize their exposure to American English and thereby preserve as much as possible of their authentic responses as international English readers. I accepted their admission to an American university as de facto evidence of English language performance (Chung, 2000) as measured by standardized tests.[7]

I asked potential participants to confirm their residency status when they contacted me about the project. I also administered a short demographic questionnaire at the beginning of each study to ascertain first language, number of years of formal English study, and number of months in the U.S.

[7] At both campuses, admission requirements for international graduate students include a computer-based Test of English as a Foreign Language (TOEFL) score of 213 or better, a paper-based TOEFL score of 550 or better, or an International English Language Testing System (IELTS) score of 6.5 or better.

Summary of Participant Information.

In all, I collected data from 59 eligible graduate students at Oklahoma State University and the University of Arkansas. This total included 40 native readers (67.8%) and 19 non-native readers of English from East Asia (32.2%).[8] Table III summarizes demographic information for non-native participants.

Table III. Demographic Information for Non-Native Participants

First language	N	Percent of non-native speakers	Average years of English study	Average mos of US residence
Chinese	15	78.95	11.3	4.9
Japanese	1	5.26	11.0	10.0
Indonesian	1	5.26	10.0	6.0
Korean	2	10.53	14.5	3.5
TOTAL	19	100.00	11.58	5.1

Conducting the Studies

Before conducting studies at each campus, I photocopied and assembled equal numbers of instruments with composing strategies and topics in different sequences for counterbalancing, as follows:

- Group 1: cohesive Pangea, non-cohesive Cherryleaf
- Group 2: cohesive Cherryleaf, non-cohesive Pangea
- Group 3: non-cohesive Pangea, cohesive Cherryleaf
- Group 4: non-cohesive Cherryleaf, cohesive Pangea

[8] Out of a total 64 studies conducted, I eliminated one study from a native English speaker who was a doctoral student, one from a native speaker whose answers were too ambiguous to code, one from a non-native speaker whose linguistic group was excluded from the project, and two from non-native speakers who had been in the U.S. longer than 12 months.

I then placed equal numbers of the four instruments into two separate piles for native and non-native participant sessions. I randomized the instruments by thoroughly shuffling the piles, face down. The instruments remained in that order from that point on. I distributed to each participant whichever version was at the top of the stack for that linguistic group. The instructions sheet (page 1) was identical for all instruments.

The number of participants in each session ranged from one to six. At the start of each session, I orally reviewed the consent form (and for non-native readers, the demographic form). I then discussed instructions with each participant or group, which included explaining the purpose of the scenarios and working through sample questions with the participants. With one exception, native and non-native sessions met separately. Figure 4 shows numbers and counterbalancing of participants during the studies.

ORIGINAL GROUP 1 Cohesive Pangea Non-cohesive Cherryleaf NS = 10 NNS = 5	ORIGINAL GROUP 3 Non-cohesive Pangea Cohesive Cherryleaf NS = 9 NNS = 5
ORIGINAL GROUP 2 Cohesive Cherryleaf Non-cohesive Pangea NS = 11 NNS = 4	ORIGINAL GROUP 4 Non-cohesive Cherryleaf Cohesive Pangea NS = 10 NNS = 5

Figure 4. Participants Grouped by Language, Text Version, and Text Order[9]

To preserve authentic reading processes and differentiate comprehension from memory (Lorch, 1989; Alderson, 2000), I encouraged participants to look back at the

[9] As discussed later in this chapter under Adjustments to Research Design, participant groups had to be reconfigured for a statistical test different from the test originally planned. On this page and elsewhere, any data reported according to the four original groupings are so labeled.

texts as they answered questions. In initial contacts I informed participants that they did not need to bring anything with them to the studies. However, those students who did bring dictionaries were free to use them and also ask for clarification during the procedure (although few participants did either).

Most participants required about one hour to complete the test. All participants received equal cash payments as they handed in the instruments.

Coding Procedures

Each instrument included three item types: Likert-scale items on global comprehensibility (items 1 through 5), task items on local relationships (items 6a through 10a), and items on metalinguistic devices (items 6b through 10b). Coding procedures and calculation of interrater reliability are described below.

Likert-Scale Items on Global Comprehensibility.

For each article, items 1 through 5 asked participants to rate the article for overall comprehensibility on a 10-point Likert scale. Appendix H contains all raw scores for items 1 through 5, summarized by language and text condition.

Task and Metalanguage Items on Local Relationships.

Because task items 6a through 10a were content-based, these questions were different for the Pangea and Cherryleaf texts. Appendix H contains all raw scores for items 6a through 10a, summarized by language and text condition.

Items 6b through 10b asked a single question about metalanguage, in identical wording for all versions. Appendix I contains the tallies of metalinguistic devices named by participants in items 6b through 10b, summarized by language and text condition.

Task Items. Items 6a through 10a asked participants to use information from the article to solve a problem, make inferences, gather information, or perform some purposeful activity related to the scenario. Three of these questions measured comprehension and two assessed the text's usability on a specific point. Appendix G contains the coding key for items 6a through 10a for both articles.

I used an interval scale of 5 points possible for correct answers on all questions (1 point each, with partial credit on some answers). In previous cohesion studies, researchers have differentiated between exactly correct and gist-correct cloze data (Kintsch & Yarbrough, 1982) and between replacements of an author's original wording and other, less precise responses (MacLean & Chapman, 1989). Cohesion researchers have also awarded partial credit for multiple-choice scores to acknowledge the complexity of reading performance, contending that one part of reading competence is to relate ideas correctly and "to understand authorial intention" regarding a text's organization (Alderson, Percsich, & Szabo, 2000, p. 423). I therefore allowed partial credit on these questions, but I limited correct answers to responses clearly based on cohesive relationships in the text. While readers may legitimately use personal experience or prior knowledge to draw certain conclusions from a text, such responses suggest that the readers are reporting a sense of coherence, which is subjective and difficult to quantify. Cohesion, by contrast, is related to recognizable semantic, syntactic, or

structural cues deliberately inserted by authors (Thompson, 1986; Campbell, 1995; Grabe & Kaplan, 1996; Ulijn & Salager-Meyer, 1998; Williams, 1990, 1995; Alderson, Percsich, & Szabo, 2000). Responses based on cohesive relationships therefore should be fairly clear-cut, and I scored them accordingly.

Metalanguage Items. Items 6b through 10b asked the readers to explain which words or features in the text helped them connect pieces of information to arrive at the answer for the first part. For these questions, I tallied and categorized specific between-paragraph cohesive devices named in the answers. I did not score these items on an interval or ratio scale because cohesive devices were (by design) not available equally to all participants, and because readers might be able to comprehend information without necessarily articulating correctly the specific devices involved. Participants generated their own responses and were free to name more than one device per item.

I categorized the metalinguistic responses according to Halliday and Hasan's semantic classifications (1976) and Campbell's structural classifications (1991) of cohesive devices. I also counted the number of times participants correctly identified these between-paragraph cohesive devices. A correct response meant that the reader identified a specific semantic or structural device I had intentionally inserted or left in place from the original article in order to create a more cohesive text.

Interrater Reliability.

I scored all 59 studies. In addition, two other raters used the same coding key (Appendix G) to score items 6a through 10a for ten native-reader studies and ten non-native-reader studies (Kintsch & Yarbrough, 1982; Sharp, 2002). I chose the raters on the

basis of their graduate degrees, undergraduate teaching records in English and psychology, and experience with statistical analyses. We compared and discussed scores on the first five native-reader studies and the first five non-native-reader studies. The other two raters then compared their scores on the remaining ten studies with each other, and I interspersed their results with the remaining 49 studies so that I had a regular check on my own scoring every four to seven studies thereafter.

Table IV summarizes interrater reliability coefficients for the original research design. Although we rated 20 studies in all, the table shows only 19 cases because all raters decided independently to exclude one ambiguous set of native-speaker answers.

Table IV. Interrater Reliability, Items 6a–10a

Question 6	**alpha[a]**
Under which main topic do you put the info in lines 9-14? (Pangea)	0.8724
On which line number do you find the start of this topic? (Cherryleaf)	1.0000
Question 7	
What are [the desirable characteristics of strawbale buildings? (P)	0.9753
What is the recommended order of basic steps to follow in planning a proposal? (C)	0.9703
Question 8	
Which agency would probably study the issues in lines xx-xx? (P)	1.0000
Which main topic is related to [the unfamiliar word] gerund? (C)	0.9476
Question 9	
Which [building] materials are sometimes unnecessary in strawbale? (P)	0.9853
For a list of proposal problems, do you click on Previous or Next? (C)	1.0000
Question 10	
How do you compare strawbale “breathing” with ventilation in conventional buildings? (P)	0.6200
In the last block, do you expect to read new info or info that has already appeared? (C)	0.9681

[a]n cases = 19, n ratings per case = 3

Interrater reliability was high (> .9400) on eight of ten items. For Pangea question 6a, raters disagreed in four of 19 cases concerning degree of focus, that is, the extent to which the participant clearly identified the main topic ("how construction works," "building techniques," "building process") or named the main topic only obliquely.

For Pangea question 10a, raters disagreed in nine of 19 cases, six of which were among the first ten studies scored. Again, lack of agreement concerned focus, in this case the extent to which the participant made explicit, between-paragraph comparisons between two levels of air quality ("strawbale buildings allow exchange of inside and outside air; conventional buildings do not") or wrote about air circulation more generally, without explicit comparisons. To capture the referential between-paragraph cohesion in this item, participants had to draw more inferences and write a slightly longer answer than in other items. Although discussion among raters clarified the distinction, this item was one of the most difficult to score overall.

Adjustments to Research Design

Two factors affected study results in ways that necessitated changes in the research design. Below, I discuss these problems and the adjustments I made as a result.

Observed Effect of Order.

With the original research design, I had expected participants from both language groups to rate the cohesive Pangea and Cherryleaf versions more highly than the non-cohesive versions on Likert-scale comprehensibility items. I had also expected them to answer more task items correctly on the cohesive versions, or at least to show no

significant differences between cohesive and non-cohesive versions. However, preliminary inspection of the means from original reader groupings (see descriptive statistics in Appendix H) indicated that the order in which participants encountered the texts and text conditions was functioning unexpectedly as a variable.

Specifically, when participants read the cohesive Cherryleaf version first, they gave that text lower comprehensibility ratings and scored lower on problem-solving tasks than they did for the non-cohesive Pangea text that followed. That is, they tended to rate the cohesive text as more difficult to understand than the non-cohesive text, and they also had more difficulty using the cohesive version to perform tasks.

Conversely, when participants read the non-cohesive Cherryleaf version first, their comprehensibility ratings and task scores tended to be higher on that text than on the subsequent cohesive Pangea version. Neither outcome was expected.

Because order was not a variable of interest in this study, I removed its statistical effect by analyzing only data from the first texts the participants read. While this change reduced sample sizes, it eliminated the problems with the repeated-measures, within-subjects comparisons originally planned.

Further, because the unexpected patterns within the means raised questions of equivalence between texts, I regrouped the participants and compared only groups that read the same articles; that is, I analyzed cohesive and non-cohesive Pangea readers (new groups 1 through 4) together, and cohesive and non-cohesive Cherryleaf readers (new groups 5 through 8) together.

Figure 5 shows participants regrouped by language, text condition, and first text.

NEW GROUP 1 NS Cohesive Pangea n = 10	NEW GROUP 2 NNS Cohesive Pangea n = 5	NEW GROUP 5 NS Cohesive Cherryleaf n = 11	NEW GROUP 6 NNS Cohesive Cherryleaf n = 4
NEW GROUP 3 NS Non-cohesive Pangea n = 9	NEW GROUP 4 NNS Non-cohesive Pangea n = 5	NEW GROUP 7 NS Non-cohesive Cherryleaf n = 10	NEW GROUP 8 NNS Non-cohesive Cherryleaf n = 5

Figure 5. Participants Regrouped by Language, Text Condition, and First Text

Although order affected the statistical analysis in unanticipated ways, it did indirectly support the hypothesis that readers respond to semantic and structural cohesive ties. Possible reasons for the unexpected effect of order are discussed more fully in the section on rhetorical issues in Chapter VI.

Nonparametric Analyses.

A second issue in the original research design was that the numbers of participants recruited for the project failed to meet assumptions of sample size and balance between groups as planned, a problem exacerbated by the adjustments described above. Because the study did not meet the assumptions for parametric tests, the original plan for a two-way analysis of variance (ANOVA) was inappropriate. Consequently, I used the Kruskal-Wallis test to evaluate differences of language and text condition for the Likert-scale items (1 through 5) and task items (6a through 10a).

I analyzed data from new groups 1 through 4 separately from new groups 5 through 8, treating each group as an independent sample. Each new group represented the

combined factors of language and text condition, a configuration required by the Kruskal-Wallis test parameters.

I also analyzed each item individually instead of averaging across items.

Where Kruskal-Wallis results were significant, I conducted Mann Whitney U tests as post hoc comparisons on four pairings from new groups 1 through 4 (1-2, 1-3, 1-4, 2-3, 2-4, and 3-4), and on four pairings from new groups 5 through 8 (5-6, 5-7, 5-8, 6-7, 6-8, and 7-8).

All analyses were performed with SPSS, version 11.5.

Summary of Methodology

This study tested two research hypotheses: that (1) readers would respond differently to English single-sourced texts with and without cohesive devices, and (2) native and non-native English readers would comprehend the texts differently. I developed the data collection instruments from two authentic single-sourced expository articles, modified to minimize or emphasize cohesion devices between paragraphs. Participants were native English readers and non-native readers from East Asian countries. Each participant received a cohesive version of one article and a non-cohesive version of the other article, with counterbalancing among versions.

The instrument asked for three types of responses to each article. Items 1 through 5 asked participants to rate the articles' global comprehensibility on a Likert scale; items 6a through 10a required participants to use information from the articles to complete short tasks; and items 6b through 10b asked participants to identify the metalinguistic features they used as cues during task completion.

Because order of text functioned unexpectedly as a variable, statistical analyses were conducted only on data for the first text each participant read. In addition, tests compared only groups that read Pangea versions first (reorganized as groups 1 through 4). Groups that read Cherryleaf versions first (reorganized as groups 5 through 8) were compared only with other Cherryleaf groups. Ratings for items 1 through 5 and scores on items 6a through 10a were analyzed individually with Kruskal-Wallis tests, followed by Mann Whitney U tests on significant results.

Metalinguistic features named correctly in items 6b through 10b on all versions were tallied and categorized according to Halliday and Hasan's semantic cohesive devices (1976) and Campbell's structural cohesive devices (1991).

Statistical analyses and discussion of findings follow in Chapter VI.

CHAPTER VI

ANALYZING THE RESULTS

This experimental study tested two nondirectional research hypotheses: that (1) readers comprehend English single-sourced texts with cohesive devices differently from single-sourced texts without cohesive devices, and (2) native and non-native English readers also comprehend the texts differently. Although each participant in this study read a cohesive version of one article and a non-cohesive version of the other article, I report and analyze only data from the first text each participant read. Comparisons are limited to reconfigured groups 1 through 4, all of whom read Pangea texts first, and to reconfigured groups 5 through 8, all of whom read Cherryleaf texts first.

Descriptive Statistics

Each instrument included three item types: Likert-scale items on global comprehensibility (1 through 5), local task items (6a through 10a), and items on metalinguistic devices (6b through 10b).

Appendix H contains all scores and descriptive statistics for items 1 through 5 and items 6a through 10a for the Pangea and Cherryleaf texts. Appendix I contains the tally of metalinguistic devices participants named (6b through 10b). All data are reported by language and text condition.

This section uses the following abbreviations: NS (native speaker), NNS (non-native speaker), CO (cohesive text version), and NC (non-cohesive text version).

Likert-Scale Items on Global Comprehensibility.

For all texts, items 1 through 5 asked participants to rate their version of a given text on several measures of comprehensibility: the degree to which the reader understood the article (item 1), the reader's ease or difficulty in following important points in the article (item 2), the degree to which the reader considered relationships among ideas in the article to be clear or unclear (item 3), the degree to which the reader considered ideas in the article to be well connected or poorly connected (item 4), and the degree to which the reader considered sections in the article to be well connected or poorly connected (tem 5). Readers rated each item on a Likert scale from 1 (lowest opinion) to 10 (highest opinion). The sections below discuss the descriptive statistics for Likert-scale items on the Pangea and Cherryleaf texts, respectively.

Pangea Likert-Scale Items. For the Pangea text, Likert-scale items 1 through 5 were answered by groups 1 through 4. Table V contains descriptive statistics, by item, for the Pangea versions participants read first.

On item 1, which requested a general self-assessment of comprehension, all reading groups produced the same median rating (9.0000). The high minimum ratings (8.0000) and fairly narrow range (2) in group 1 (NC / CO), group 2 (NNS / CO), and group 3 (NS / NC) indicate that most participants in those groups believed they had understood the Pangea text quite easily. However, group 4, consisting of non-native readers of the non-cohesive version, produced a lower minimum rating (4.0000) and wider range (5.0000) than the other groups, indicating that one or more of the five readers in group 4 reported at least moderate difficulty in comprehending the Pangea text.

Table V. Descriptive Statistics for Pangea Versions Read First, Items 1-5

Item 1	Group	n	Lang	Cond	Median	Mean	Min-Max	Range	SD
Overall, I understand this article . . . [with great difficulty, 1] < > [very easily, 10]	1	10	NS	CO	9.0000	9.0000	8.00-10.00	2.0000	0.6667
	2	5	NNS	CO	9.0000	9.2000	8.00-10.00	2.0000	0.8367
	3	9	NS	NC	9.0000	9.3333	8.00-10.00	2.0000	0.7071
	4	5	NNS	NC	9.0000	7.6000	4.00-9.00	5.0000	2.1909

Item 2	Group	n	Lang	Cond	Median	Mean	Min-Max	Range	SD
I can follow the developm of important points in this article . . . [with great difficulty, 1] < > [very easily, 10]	1	10	NS	CO	9.0000	8.7000	7.00-10.00	3.0000	1.1595
	2	5	NNS	CO	10.0000	9.8000	9.00-10.00	1.0000	0.4472
	3	9	NS	NC	9.0000	9.2222	8.00-10.00	2.0000	0.6667
	4	5	NNS	NC	9.0000	7.4000	4.00-9.00	5.0000	2.3022

Item 3	Group	n	Lang	Cond	Median	Mean	Min-Max	Range	SD
Relationships among ideas in this article are . . . [very unclear, 1] < > [very clear, 10]	1	10	NS	CO	8.0000	8.0000	6.00-10.00	4.0000	1.1547
	2	5	NNS	CO	10.0000	9.8000	9.00-10.00	1.0000	0.4472
	3	9	NS	NC	9.0000	8.8889	8.00-10.00	2.0000	0.7817
	4	5	NNS	NC	7.0000	6.8000	3.00-10.00	7.0000	2.5884

Item 4	Group	n	Lang	Cond	Median	Mean	Min-Max	Range	SD
Ideas in this article are . . . [very poorly connected, 1] < > [very well connected, 10]	1	10	NS	CO	8.0000	8.0000	4.00-10.00	6.0000	1.7638
	2	5	NNS	CO	9.0000	8.6000	7.00-10.00	3.0000	1.5166
	3	9	NS	NC	9.0000	8.4444	7.00-10.00	3.0000	1.0138
	4	5	NNS	NC	9.0000	7.2000	3.00-10.00	7.0000	3.0332

Item 5	Group	n	Lang	Cond	Median	Mean	Min-Max	Range	SD
Sections in this article are . . . [very poorly connected, 1] < > [very well connected, 10]	1	10	NS	CO	8.0000	8.2000	6.00-10.00	4.0000	1.3166
	2	5	NNS	CO	8.0000	8.2000	7.00-10.00	3.0000	1.3038
	3	9	NS	NC	9.0000	8.4444	7.00-10.00	3.0000	1.1304
	4	5	NNS	NC	7.0000	6.8000	4.00-10.00	6.0000	2.3875

On item 2, which requested readers to assess their sense of logical development within the Pangea text, group 2 (NNS / CO) produced the highest possible median (10.0000), and group 1 (NS / CO), group 3 (NS / NC), and group 4 (NNS / NC) produced high medians (9.0000) as well, indicating that many of these readers reported they had very easily followed the development of important points in the article. However, measures other than medians were more widely dispersed. Non-native readers in group 2 (CO) were the most likely to report that they had followed ideas easily, with the highest minimum (9.0000) and smallest range (1.0000) of all groups. Non-native readers in group

4 (NC) were least likely to report that they had easily followed the text's development, with the lowest minimum (4.0000) and largest range (5.0000) of all groups. For native speakers in groups 1 and 3, minimum ratings and ranges fell between those of the non-native groups, suggesting a tendency among native readers to report that they had followed important points fairly easily, but not extremely so.

In a shift from self-assessment to evaluation of textual features, item 3 asked readers the degree to which relationships among ideas in the Pangea text were clear or unclear. All groups produced a maximum rating of 10.0000, showing that at least some readers in each group reported relationships among ideas in the Pangea text to be very clear. Non-native readers in group 2 (CO) also indicated as a group that ideas were very clear, producing again the highest possible median (10.0000), highest minimum rating (9.0000), and smallest range (1.0000). Following in descending order were native readers in group 3 (NC) with a median of 9.0000, native readers in group 1 (CO) with a median of 8.0000, and non-native readers in group 4 (NC) with a median of 7.0000. At the same time, however, the minimum in group 1 (NS / CO) was 6.0000, indicating that some of these native readers reported only moderate clarity of relationships among ideas. The minimum rating in group 4 fell to 3.0000, with a range of 7.0000, showing that while some non-native readers of the non-cohesive version found relationships among ideas to be very clear, at least one reader in that group found relationships quite unclear. Minimums for group 2 (NNS / CO) and group 3 (NS / NC) were 9.0000 and 8.0000, respectively, indicating that readers in these two groups were more likely to consider relationships among ideas in the Pangea text to be clear than were readers in the other two groups.

On item 4, which asked readers to evaluate the level of connectedness among ideas in the Pangea texts, medians for all groups were high (8.0000 and 9.0000), as were maximum ratings (10.0000), suggesting that numerous readers had reported ideas in the texts to be well connected. However, item 4 appeared to generate more negative opinions than had other items to this point. Minimum ratings dropped to 4.0000 for group 1 (NS / CO), 7.0000 for group 2 (NNS / CO), and 7.0000 for group 3 (NS / NC), and remained at 3.0000 for group 4 (NNS / NC). Ranges also increased among all groups except group 4 (NNS / NC), which remained at 7.0000. All these measures indicated divergence of opinion within groups on the issue of connectedness of ideas. While positive ratings from some readers in each group tended to raise the measures of central tendency, in all groups more readers than previously reported problems with the way ideas had been linked.

Item 5 asked readers to evaluate connectedness among sections, rather than ideas, in the Pangea texts, and data for item 5 resembled those of item 4. Medians for all groups were fairly high (7.0000 to 9.0000), as were maximum ratings (10.0000), suggesting that numerous readers had reported sections in the texts to be well connected. As with item 4, however, minimum ratings for item 5 were noticeably lower than the medians: at 6.0000 for group 1 (NS / CO), 7.0000 for group 2 (NNS / CO), 7.0000 for group 3 (NS / NC), and 4.0000 for group 4 (NNS / NC). Group 4 continued to show the largest range (6.0000). On item 5, all readers tended to report problems with connections among sections. Given their high self-assessment ratings for items 1 and 2, group 1 (NS / CO), group 2 (NNS / CO), and group 3 (NS / NC) apparently did not believe that these problems had affected their own comprehension adversely. However, the consistently

lower ratings from group 4 (NNS / NC) may indicate that they did relate some of their comprehension difficulties to problems with connectedness within the Pangea text.

Summary of Pangea Likert-Scale Items. For the Pangea texts, Likert-scale items indicated that non-native readers of the cohesive version (group 2) regarded the text's comprehensibility most favorably of all the groups, while non-native readers of the non-cohesive version (group 4) tended to be the most critical but also the most sharply divided in their evaluations of the text's cohesiveness, showing the lowest minimums and widest ranges on all items. Native readers of both versions (groups 1 and 3) often fell between the non-native extremes, indicating that they generally found the Pangea text comprehensible but also noted some problems with clarity and connectedness of ideas. Because of the small sample sizes, the low ratings of one or two readers may have had a disproportionate effect on these measures of central tendency.

Cherryleaf Likert-Scale Items. The same Likert-scale items 1 through 5 were answered for the Cherryleaf texts by groups 5 through 8. Table VI contains descriptive statistics, by item, for the Cherryleaf versions participants read first.

The Cherryleaf texts tended to produce lower overall reader evaluations than the Pangea texts. On item 1, which asked readers to assess their own comprehension of the Cherryleaf text, the high median was only 8.5000, produced by non-native readers of the cohesive version (group 6), followed by 8.0000 for group 5 (NS / CO) and group 8 (NNS / NC). Group 7 (NS / NC) produced the lowest median, at 7.5000. Some readers in all

Table VI. Descriptive Statistics for Cherryleaf Versions Read First, Items 1-5

Item 1	Group	n	Lang	Cond	Median	Mean	Min-Max	Range	SD
Overall, I understand this article . . . [with great difficulty, 1] < > [very easily, 10]	5	11	NS	CO	8.0000	7.6364	4.00-10.00	6.0000	1.9117
	6	4	NNS	CO	8.5000	8.7500	8.00-10.00	2.0000	0.9574
	7	10	NS	NC	7.5000	7.6000	6.00-9.00	3.0000	1.1738
	8	5	NNS	NC	8.0000	7.8000	5.00-9.00	4.0000	1.6432

Item 2	Group	n	Lang	Cond	Median	Mean	Min-Max	Range	SD
I can follow the developm of important points in this article . . . [with great difficulty, 1] < > [very easily, 10]	5	11	NS	CO	7.0000	7.1818	3.00-10.00	7.0000	2.4008
	6	4	NNS	CO	8.5000	8.2500	6.00-10.00	4.0000	1.7078
	7	10	NS	NC	7.5000	7.4000	4.00-9.00	5.0000	1.7127
	8	5	NNS	NC	9.0000	8.4000	6.00-10.00	4.0000	1.5166

Item 3	Group	n	Lang	Cond	Median	Mean	Min-Max	Range	SD
Relationships among ideas in this article are . . . [very unclear, 1] < > [very clear, 10]	5	11	NS	CO	8.0000	7.0000	2.00-10.00	8.0000	2.2804
	6	4	NNS	CO	9.0000	9.2500	9.00-10.00	1.0000	0.5000
	7	10	NS	NC	7.5000	7.2000	3.00-10.00	7.0000	2.2509
	8	5	NNS	NC	8.0000	7.6000	7.00-8.00	1.0000	0.5477

Item 4	Group	n	Lang	Cond	Median	Mean	Min-Max	Range	SD
Ideas in this article are . . . [very poorly connected, 1] < > [very well connected, 10]	5	11	NS	CO	7.0000	6.8182	4.00-10.00	6.0000	2.1363
	6	4	NNS	CO	9.0000	8.7500	8.00-9.00	1.0000	0.5000
	7	10	NS	NC	6.5000	6.1000	3.00-9.00	6.0000	2.2828
	8	5	NNS	NC	8.0000	8.4000	8.00-9.00	1.0000	0.5477

Item 5	Group	n	Lang	Condition	Median	Mean	Min-Max	Range	SD
Sections in this article are . . . [very poorly connected, 1] < > [very well connected, 10]	5	11	NS	CO	7.0000	6.6364	3.00-10.00	7.0000	2.2033
	6	4	NNS	CO	8.5000	8.5000	8.00-9.00	1.0000	0.5774
	7	10	NS	NC	5.5000	5.5000	3.00-9.00	6.0000	1.8409
	8	5	NNS	NC	7.0000	6.8000	4.00-9.00	5.0000	1.9235

groups reported high maximum ratings of 9.0000 or 10.0000, and group 6 (NNS / CO) reported a high minimum (8.0000) and small range (2.0000), suggesting that the non-native readers in that group all found the text easy to understand. However, the minimum ratings dropped to 4.0000 for group 5 (NS / CO), 6.0000 for group 7 (NS / NC), and 5.0000 for group 8 (NNS / NC), with ranges of 6.0000, 3.0000, and 4.0000, respectively, indicating that some readers in other groups, including both groups of native readers, reported at least moderate difficulty in comprehending the article.

On item 2, which asked readers to assess their ability to follow the development of important points in the Cherryleaf article, a pattern of language-related differences appeared. The non-native readers in groups 6 (CO) and 8 (NC) produced high medians of 8.5000 and 9.0000, respectively. By contrast, native readers in groups 5 (CO) and 7 (NC) produced medians of only 7.0000 and 7.5000, respectively, suggesting that these readers were reporting more uncertainty about their ability to track key points. As with item 1, all groups showed at least some high maximum ratings of 9.0000 or 10.0000, but in all groups, minimum ratings were much lower. Group 5 (NS / CO) reported a minimum of 3.0000, with a range of 7.000; group 6 (NNS / CO), a minimum of 6.0000, with a range of 4.0000; group 7 (NS / NC), a minimum of 4.0000, with a range of 5.0000; and group 8 (NNS / NC), a minimum of 6.0000, with a range of 4.0000. While all groups indicated at least some problems in following the development of important points in the article, the degree of difficulty reported and the spread between high and low ratings were greater for native readers than for non-native readers.

A similar pattern of language-related differences appeared for item 3, which asked readers to rate the relative clarity of relationships among ideas in the Cherryleaf text. The non-native readers in groups 6 (CO) and 8 (NC) produced high medians of 9.0000 and 8.0000, respectively, but native readers in groups 5 (CO) and 7 (NC) produced medians of 8.0000 and 7.5000, respectively, indicating that native readers reported conceptual relationships to be slightly less clear than did non-native readers. In addition, although both groups of native readers showed at least some maximum ratings of 10.0000, their minimum ratings were quite low. Group 5 (CO) produced a minimum of 2.0000, with a range of 8.0000, while group 7 (NC) produced a minimum of 3.0000, with a range of

7.0000, indicating that favorable and unfavorable opinions of the text's clarity diverged considerably within groups. Among the non-native readers, group 6 (CO) produced a very high minimum of 9.0000, with a range of only 1.0000, while group 8 (NC) produced a minimum of 7.0000, also with a range of 1.0000. Non-native readers not only rated the clarity of conceptual relationships more highly than did native speakers, but they also showed greater consensus on this point.

This language-related pattern intensified in item 4, which addressed the connectedness of ideas in the Cherryleaf text. The non-native readers in groups 6 (CO) and 8 (NC) produced high medians of 9.0000 and 8.0000, respectively, but native readers in groups 5 (CO) and 7 (NC) produced medians of only 7.0000 and 6.5000, respectively, indicating that native readers found connections among ideas less effective than did non-native readers. In addition, although both groups of native readers showed at least some maximum ratings of 9.0000 or 10.0000, their minimum ratings continued to be much lower. Group 5 (CO) produced a minimum of 4.0000, with a range of 6.0000, while group 7 (NC) produced a minimum of 3.0000, with a range of 6.0000, again indicating considerable divergence of opinion within groups. Among the non-native readers, both groups (6 and 8) produced a high minimum of 8.0000, with a range of only 1.0000. As with item 3, non-native readers indicated a more favorable opinion of the connectedness of ideas than did native readers and were also were more likely to agree with their groups on this point.

Item 5, which addressed connectedness among sections rather than ideas, continued to show some patterns related to language difference, although these were less pronounced than in items 3 and 4. The non-native readers in groups 6 (CO) and 8 (NC)

produced fairly high medians of 8.5000 and 7.0000, respectively, while native readers in groups 5 (CO) and 7 (NC) produced medians of 7.0000 and 5.5000, respectively, indicating that some native readers found less connectedness among sections in the Cherryleaf text than did some non-native readers. In addition, although at least some readers in all groups reported maximum ratings of 9.0000 or 10.0000, minimum ratings continued to be lower among native readers. Group 5 (CO) and group 7 (NC) both produced minimums of 3.0000, with ranges of 7.0000 and 6.0000, respectively. Non-native readers in group 8 (NC) produced a minimum (4.0000) and range (5.0000) closer to those of native readers, a level of dissatisfaction not previously reported by non-native readers. However, consistent with previous ratings, non-native readers in group 6 (CO) produced a minimum of 8.0000, with a range of 1.0000. Thus, except for group 8 (NNS / NC), ratings of connectedness among sections continued to show consistent, language-related patterns. Both groups of native readers were more likely to report problems with connectedness in the Cherryleaf text, and non-native readers of the cohesive version were more likely to rate the text favorably.

Summary of Cherryleaf Likert-Scale Items. For the Cherryleaf texts, Likert-scale items indicated that non-native readers of the cohesive version (group 6) were the most likely of all groups to rate the text's comprehensibility positively, followed by non-native readers of the non-cohesive version (group 8). By contrast, native readers of both versions (groups 5 and 7) tended to be the most critical but also the most sharply divided in their evaluations of the text's cohesiveness, showing the lowest minimums and widest ranges in almost all cases. Although outliers may have had a disproportionate effect on

these measures, the extreme low ratings nevertheless appear more consistently in the native reading groups than in the non-native reading groups.

Later in this chapter, I offer some possible reasons for the language-related differences evident among Cherryleaf readers.

Task Items on Local Relationships.

Whereas items 1 through 5 elicited readers' opinions about the overall comprehensibility of the texts, items 6a through 10a asked readers to use information in the articles to complete short tasks, as a measure of the degree to which readers understood what they had read. These items were scored from 0 (completely incorrect) to 1 (completely correct), with partial credit for tasks with several answers. Because items were content-specific, they differed for the Pangea and Cherryleaf texts.

Pangea Task Items. For the Pangea text, task items were answered by readers in groups 1 through 4. Table VII summarizes descriptive statistics for task items 6a through 10a for the Pangea versions participants read first.

Item 6a asked readers to name the main topic under which a specific piece of information would fit most logically. Readers of the cohesive version saw a bolded heading and bulleted points, introduced by . . . *the following*, whereas readers of the non-cohesive version saw only a series of paragraphs. The high median (1.0000) produced by group 1 (NC / CO), group 2 (NNS / CO), and group 3 (NS / NC) indicates that many participants in those groups identified the main topic correctly, although the minimum score of 0.0000 in each of these groups shows that at least some readers answered incorrectly. Group 4, consisting of non-native readers of the non-cohesive version,

Table VII. Descriptive Statistics for Pangea Versions Read First, Items 6a-10a

Item 6a	Group	n	Lang	Cond	Median	Mean	Min-Max	Range	SD
Under which main topic do you put the info in lines 9-15?	1	10	NS	CO	1.0000	0.8000	0.00-1.00	1.0000	0.4216
	2	5	NNS	CO	1.0000	0.6000	0.00-1.00	1.0000	0.5477
	3	9	NS	NC	1.0000	0.7778	0.00-1.00	1.0000	0.4410
	4	5	NNS	NC	0.0000	0.4000	0.00-1.00	1.0000	0.5477
Item 7a	**Group**	**n**	**Lang**	**Cond**	**Median**	**Mean**	**Min-Max**	**Range**	**SD**
What are [the desirable characteristics of strawbale buildings]?	1	10	NS	CO	1.0000	0.9250	0.50-1.00	0.5000	0.1687
	2	5	NNS	CO	1.0000	1.0000	1.00-1.00	0.0000	0.0000
	3	9	NS	NC	0.5000	0.4722	0.25-1.00	0.7500	0.2320
	4	5	NNS	NC	0.2500	0.3000	0.25-0.50	0.2500	0.1118
Item 8a	**Group**	**n**	**Lang**	**Cond**	**Median**	**Mean**	**Min-Max**	**Range**	**SD**
Which agency would probably study the issues in lines xx-xx?	1	10	NS	CO	1.0000	0.9000	0.00-1.00	1.0000	0.3162
	2	5	NNS	CO	1.0000	1.0000	1.00-1.00	0.0000	0.0000
	3	9	NS	NC	1.0000	0.9444	0.50-1.00	0.5000	0.1667
	4	5	NNS	NC	1.0000	0.7000	0.00-1.00	1.0000	0.4472
Item 9a	**Group**	**n**	**Lang**	**Cond**	**Median**	**Mean**	**Min-Max**	**Range**	**SD**
Which [building] materials are sometimes unnecessary in strawbale?	1	10	NS	CO	0.1250	0.3750	0.00-1.00	1.0000	0.4449
	2	5	NNS	CO	0.2500	0.3500	0.00-1.00	1.0000	0.4183
	3	9	NS	NC	0.0000	0.0000	0.00-0.00	0.0000	0.0000
	4	5	NNS	NC	0.0000	0.0500	0.00-0.25	0.2500	0.1118
Item 10a	**Group**	**n**	**Lang**	**Cond**	**Median**	**Mean**	**Min-Max**	**Range**	**SD**
How do you compare strawbale "breathing" with ventilation in conventional buildings?	1	10	NS	CO	0.5000	0.5000	0.00-1.00	1.0000	0.5271
	2	5	NNS	CO	0.0000	0.4000	0.00-1.00	1.0000	0.5477
	3	9	NS	NC	1.0000	0.7778	0.00-1.00	1.0000	0.4410
	4	5	NNS	NC	1.0000	0.6000	0.00-1.00	1.0000	0.5477

produced a very low median (0.0000), indicating that these readers misidentified the main topic more often than not. These results suggest that readers of the cohesive version (groups 1 and 2) used several types of surface signals to answer correctly, native readers of the non-cohesive version (group 3) used cues other than surface signals to answer correctly, and non-native readers of the non-cohesive version (group 4) tended to use cues rather ineffectively.

Item 7a asked readers to list the desirable characteristics of strawbale buildings. In the cohesive version, these characteristics were introduced with a clause ending in a colon, which signaled a list to follow, and three bolded subheadings; in the non-cohesive

version, readers were told only that *strawbale buildings have several desirable characteristics*. Because this item offered partial credit, all readers named at least some of the characteristics, with less dispersion in the range as a result. All non-native readers in group 2 (CO) answered this item fully, producing a median of 1.0000. Native readers in group 1 (CO) also produced a median of 1.0000, although the minimum score of 0.5000 indicates that some readers in this group received only partial credit. By contrast, native readers in group 3 (NC) and non-native readers in group 4 (NC) produced medians of 0.5000 and 0.2500, respectively. Each non-cohesive group showed a minimum score of 0.2500, and the non-native, non-cohesive group scored a maximum of only 0.5000. On this item, readers given structural and semantic cues were much more likely to name the desirable characteristics of strawbale construction accurately than were readers without such cues, regardless of language.

In contrast to the clear results in item 7a, results for items 8a were somewhat ambiguous. Item 8a asked readers which of two government agencies would be more likely to study the issues named in specific lines of the Pangea text. In the cohesive version of item 8a, the specific lines of text occurred under the same subheading as the correct agency name; in the non-cohesive version, the lines were closer to the correct agency name than to the incorrect name, but not conspicuously grouped with it. The high median (1.0000) produced by all groups indicates that more participants, including all the non-native readers in group 2 (CO), identified the agency correctly rather than incorrectly. However, at least some readers in group 1 (NS / CO) and group 4 (NNS / NC) answered incorrectly, producing a minimum score of 0.0000 for these groups. All readers in group 3 (NS / NC) received at least partial credit, producing a minimum score

0.5000. Reader comments on the metalinguistic portion of this item (8b) suggest that, aside from cohesive cues, extra-textual knowledge of government agencies may have influenced some participants' answers. Still, cohesive devices in the Pangea text may have contributed to the particularly high performance of group 2 (NNS / CO).

Item 9a asked readers to list building materials sometimes unnecessary in strawbale construction. In the cohesive version of the Cherryleaf text, the demonstrative *these* served as the between-paragraph semantic tie, which was removed from the non-cohesive version. Although this item offered partial credit, no native readers of the non-cohesive version (group 3) received a score higher than 0.0000, and non-native readers of the non-cohesive version (group 4) scored a maximum of only 0.2500. The median for these two groups was 0.0000. Results for readers of the cohesive version were slightly higher. Native readers (group 1) produced a median of 0.1250, while non-native readers (group 2) produced a median of 0.2500. Minimum and maximum scores for these two groups ranged from 0.0000 to 1.0000. Although all scores were low on this item, the data suggest that the presence of a between-paragraph semantic tie did enable readers of the cohesive version to list the building materials more accurately.

Somewhat surprisingly, results were reversed for item 10a, which asked readers to compare air circulation in strawbale buildings with ventilation in conventional buildings. Comparatives such as *worse* and *even better* served as semantic ties across paragraphs for the cohesive Cherryleaf version; these ties had been removed from the non-cohesive version. Native and non-native readers of the cohesive version (groups 1 and 2) produced medians of 0.5000 and 0.0000, respectively, with a minimum of 0.0000 for each group and a range of 1.0000. By contrast, native and non-native readers of the non-cohesive

version (groups 3 and 4) both produced medians of 1.0000, also with a minimum of 0.0000 for each group and a range of 1.0000. Although the semantic ties had been removed from the non-cohesive version, some readers were able to compare the two types of ventilation acceptably without specific cues. This factor may have compensated for the absence of explicit comparatives in the non-cohesive version, thereby improving task performance sufficiently to raise the scores of non-cohesive groups 3 and 4.

Summary of Pangea Task Items. Scores on most task items for the Pangea texts tended to align with the Likert-scale ratings discussed earlier. Except for item 10a, when group 1 (NS / CO) outscored group 2 (NNS / CO) on the comparison of ventilation types, group 2 produced or tied the highest medians on all items, followed closely by group 1. This result paralleled the strong tendency of group 2 to rate the Pangea text's comprehensibility most favorably of all the groups. At the other extreme, except for item 10a, non-native readers of the non-cohesive version (group 4) consistently produced or tied the lowest medians on all items, which also paralleled their tendency to criticize but also diverge in their evaluations of the text's cohesiveness. As with the Likert-scale items, native readers of both versions (groups 1 and 3) tended to tie or score between the non-native extremes, indicating that their task performances generally paralleled their mid-level ratings of the text's comprehensibility.

Cherryleaf Task Items. For the Cherryleaf text, task items were answered by readers in groups 5 through 8. Table VIII summarizes descriptive statistics for task items 6a through 10a for the Cherryleaf versions participants read first.

Table VIII. Descriptive Statistics for Cherryleaf Versions Read First, Items 6a-10a

Item 6a	Group	n	Lang	Cond	Median	Mean	Min-Max	Range	SD
On which line number do you find the start of this topic?	5	11	NS	CO	1.0000	1.0000	1.00-1.00	0.0000	0.0000
	6	4	NNS	CO	1.0000	1.0000	1.00-1.00	0.0000	0.0000
	7	10	NS	NC	1.0000	0.7000	0.00-1.00	1.0000	0.4831
	8	5	NNS	NC	1.0000	0.8000	0.00-1.00	1.0000	0.4472

Item 7a	Group	n	Lang	Cond	Median	Mean	Min-Max	Range	SD
What is the recommended order of basic steps to follow in planning a proposal?	5	11	NS	CO	0.6700	0.7000	0.34-1.00	0.6600	0.2312
	6	4	NNS	CO	0.6700	0.5875	0.34-0.67	0.3300	0.1650
	7	10	NS	NC	0.1700	0.2030	0.00-0.67	0.6700	0.2355
	8	5	NNS	NC	0.6700	0.4700	0.00-0.67	0.6700	0.2991

Item 8a	Group	n	Lang	Cond	Median	Mean	Min-Max	Range	SD
Which main topic is related to [the unfamiliar word] gerund?	5	11	NS	CO	1.0000	0.7273	0.00-1.00	1.0000	0.4671
	6	4	NNS	CO	1.0000	0.7500	0.00-1.00	1.0000	0.5000
	7	10	NS	NC	0.0000	0.3000	0.00-1.00	1.0000	0.4831
	8	5	NNS	NC	0.0000	0.4000	0.00-1.00	1.0000	0.5477

Item 9a	Group	n	Lang	Cond	Median	Mean	Min-Max	Range	SD
For a list of proposal problems, do you click on Previous or Next?	5	11	NS	CO	0.0000	0.4545	0.00-1.00	1.0000	0.5222
	6	4	NNS	CO	1.0000	0.7500	0.00-1.00	1.0000	0.5000
	7	10	NS	NC	1.0000	0.7000	0.00-1.00	1.0000	0.4831
	8	5	NNS	NC	0.0000	0.2000	0.00-1.00	1.0000	0.4472

Item 10a	Group	n	Lang	Cond	Median	Mean	Min-Max	Range	SD
In the last block, do you expect to read new info or info that has already appeared?	5	11	NS	CO	1.0000	0.9091	0.00-1.00	1.0000	0.3015
	6	4	NNS	CO	1.0000	1.0000	1.00-1.00	0.0000	0.0000
	7	10	NS	NC	0.5000	0.5000	0.00-1.00	1.0000	0.5271
	8	5	NNS	NC	1.0000	0.6000	0.00-1.00	1.0000	0.5477

Item 6a (which resembled Pangea item 6a) asked readers to identify the first line of the main topic *planning*, signaled by a main heading in the cohesive version only. In both versions, the original lexical cue *plan* was retained. The high median (1.0000) produced by all groups indicates that participants across groups were more likely than not to complete this task correctly. Indeed, all readers of the cohesive version (groups 5 and 6, respectively) answered this item correctly, regardless of language. For group 7 (NS / NC) and group 8 (NNS / NC), the minimum score (0.0000) and range (1.0000) indicate that at least some readers of the non-cohesive version answered incorrectly. Although accuracy on this item was generally high across groups, the results suggest that structural,

semantic, or both types of cues enabled more readers of the cohesive version (groups 5 and 6) to identify the start of the main topic. Conversely, with limited access to textual cues, fewer native and non-native readers of the non-cohesive version (groups 7 and 8, respectively) may have been able to identify the topic's starting point.

In item 7a, readers were asked to list the steps recommended in the Cherryleaf article for planning a sales proposal. Cues in the cohesive version were a series of temporal conjunctives: *first* and *next* at the beginning of paragraphs, and *you then* retained in its original position within a paragraph. The only cue in the non-cohesive version was the temporal cue *you then* within a paragraph. Because the correct answer involved three discrete steps, readers could receive partial credit. Native and non-native readers of the cohesive version (groups 5 and 6, respectively) and non-native readers of the non-cohesive version (group 8) all produced medians of 0.6700. Group 5 (NS / CO) showed a minimum-maximum spread of 0.3400 to 1.0000; group 6 (NNS / CO), 0.3400 to 0.6700; and group 8, 0.0000 to 0.6700. These results indicate that all readers in groups 5 and 6 identified at least one step correctly, and some native readers of the cohesive version (group 5) identified all steps correctly. By contrast, native readers of the non-cohesive version (group 7) produced a median of 0.1700 with a minimum-maximum spread of 0.0000 to 0.6700, indicating that these readers were much less likely to name any steps correctly. The tendency of cohesive readers (groups 5 and 6) to identify the cues *first* and *next* through strategic placement appears to have been balanced by the ability of some non-native readers in group 8 (NC) to identify the within-paragraph cue *you then*.

Item 8a asked readers to determine the main topic under which a (possibly unfamiliar) word, *gerund*, belonged. In the cohesive version, *gerund* occurred in one of three paragraphs under a bolded heading on writing tips; in the non-cohesive version, the heading was missing. Responses to this item were clearly differentiated by text condition. Native and non-native readers of the cohesive version (groups 5 and 6, respectively) both produced medians of 1.0000, with minimums of 0.0000 and a range of 1.0000. However, native and non-native readers of the non-cohesive version (groups 7 and 8, respectively) produced medians of 0.0000, also with minimums of 0.0000 and a range of 1.0000. Because of the weak lexical cohesion within paragraphs in this part of the Cherryleaf article, readers in cohesive groups 5 and 6, who had access to structural cues such as bolded headings, were more likely than readers in non-cohesive groups 7 and 8 to place *gerund* under the correct main topic, regardless of their linguistic backgrounds.

In contrast to the well-defined results for item 8a, results for item 9a were mixed. Item 9a asked readers to decide whether to click on *Previous* or *Next* in order to locate information said to be in *Part One*. Readers of the cohesive version were cued by the title of the article, which included the phrase *Part Three*, while readers of the non-cohesive version saw no title. Group 6 (NNS / CO) and group 7 (NS / NC) produced the high median (1.0000), with minimums of 0.0000 and a range of 1.0000. Group 5 (NS / CO) and group 8 (NNS / NC) produced the low median (0.0000), with minimums of 0.0000 and a range of 1.0000. Although readers of the untitled non-cohesive version could have reasoned their way to the correct answer, only one reader did so in the small sample represented by group 8. These somewhat contradictory results suggest that item 9a may have involved the extra-textual ability to visualize and rehearse actions mentally, a skill

not measured in this study. That is, readers who understood (correctly) that they should click on *Previous* in order to reach *Part One* may have drawn on navigational aptitudes or experience not necessarily addressed by explicit cohesive devices.

Item 10a asked readers whether they expected to read new or old information in the last block of the Cherryleaf article. In the cohesive version, a heading and introductory phrase were the structural and semantic features signaling the conclusion; these features were removed from the non-cohesive version. Group 5 (NS / CO), group 6 (NNS / CO), and group 8 (NNS / NC) all produced a high median of 1.0000, with a minimum of 0.0000 and a range of 1.0000. By contrast, group 7 (NS / NC) produced a median of only 0.5000, with a minimum of 0.0000 and a range of 1.0000, a somewhat unexpected pattern that also occurred in item 7a. The results suggest that native and non-native readers of the cohesive version (groups 5 and 6) responded appropriately to the heading and introductory phrase they saw, while non-native readers of the non-cohesive version (group 8) may have analyzed the last paragraph as they had been instructed in English classes to evaluate closings, even without explicit guidance from cohesive devices. By contrast, the native readers in non-cohesive group 7 seemed confused by the absence of a rhetorical convention they had expected to see. As I discuss later in this chapter, this item generated more negative comments than any other item in either text, particularly from native readers, largely because they approached the final Cherryleaf paragraph with rhetorical expectations that were contradicted or unfulfilled.

Summary of Task Items. Results for the Cherryleaf task items were moderately differentiated by text condition, and unexpectedly differentiated by language. Non-native readers of the cohesive version (group 6) produced slightly more high medians (ties) and

fewer low medians (ties) than native readers of the cohesive version (group 5), followed by non-native readers of the non-cohesive version (group 8). For the four groups, the comparatively high performance of readers in group 6 (NNS / CO) tracked most closely with their high Likert-scale ratings of the text's comprehensibility. The most unexpected result was that native readers of the non-cohesive version (group 7) scored fewer high medians and tied for more low medians than non-native readers of the non-cohesive version, suggesting that native readers had more difficulty comprehending the non-cohesive text. On Likert-scale items, native readers in groups 5 and 7 tended to be the most critical but also the most sharply divided in their evaluations of the text's cohesiveness, showing the lowest minimums and widest ranges in almost all cases. The relatively low task performance of readers in group 7 appears to parallel their unfavorable Likert-scale ratings of the Cherryleaf text. Later in this chapter, I discuss some of the textual factors that may have affected Cherryleaf results.

Tallies of Items on Metalanguage.

The second part of items 6 through 10 asked readers to identify words or features in the text that helped them connect pieces of information to arrive at the corresponding answer for the first part. Tables IX and X summarize the semantic and structural devices named at least three times in the versions participants read first. Appendix I contains complete tallies for all devices, reported by language and text condition.

In all, the 59 participants correctly[10] identified 183 occurrences of cohesive devices in all first texts, 78 occurrences in the Pangea texts and 105 occurrences in the

[10] A "correct" response means that the reader has identified a device the researcher has intentionally inserted or left in place from the original in order to create a more cohesive text.

Table IX. Semantic and Structural Devices in Pangea Versions Read First (named at least three times)

Item	Semantic devices named	NS CO	NNS CO	NS NC	NNS NC	Structural devices named	NS CO	NNS CO	NS NC	NNS NC
6b	First line, "str building techni involves..." (lexical)	3	3	5	1	Three subheadings in bold	8			
	Wording of main heading (lexical)	3								
7b	"...several desirable characteristics... (referential)		1	5						
8b	"...constantly exchanging the air" and other references to air (lexical)	3	2	4	3					
	Links to info in preceding para (lexical)	3								
9b	"these materials" (referentail)	2	1							
10b	"...exchanging the air inside..." (lexical)	8	2	2	2					

Table X. Semantic and Structural Devices in Cherryleaf Versions Read First (named at least three times)

Item	Semantic devices identified	NS CO	NNS CO	NS NC	NNS NC	Structural devices identified	NS CO	NNS CO	NS NC	NNS NC
6b	"First, develop a plan" (temporal conjunctive)	4	1			Bold heading, "Planning . . ."	8	2		
	"It is important to have a plan" (lexical)			6	3					
7b	"First" (temporal conjunctive)	8	3							
	"Next" (temporal conjunctive)	9	3			Bold heading, "Writing tips..."	6	1		
	"You then..." (temporal conjunctive)	2			1					
8b	Ref to "writing" or "words you use" (lexical)	2		3		Title; included "Part 3"	3			
9b	Reference to Part One (referential)	8	1	7	2	Bold heading, "Conclusion"	7	3		
10b	"In summary" at start of paragraph (referential)	7	2							

Cherryleaf texts. Of the 49 discrete devices inserted or left in the texts, 20 were named by three or more participants across the reconfigured groups. Fourteen devices were named from one to two times across the reconfigured groups, and 15 devices received no mention in any group.

Semantic Devices. As shown in Table IX, readers of both Pangea versions noted more lexical ties than any other type of semantic cohesive device. In the Pangea article, lexical ties accounted for most of the connections readers made between main topics and supporting statements, or between related points in adjacent paragraphs or within sections. In the case of Pangea item 8a, which asked readers to relate issues of *air* to either the Environmental Protection Agency or the Department of Energy, readers appeared to combine a lexical tie with prior knowledge of the environment or the EPA's specific jurisdiction.

Readers of Cherryleaf texts identified a wider range of cohesive devices. Of conjunctive cohesive ties named three times in either text, both instances involved the word *first* in the Cherryleaf article. Elements of the *first-next-you-then* series of conjunctive/temporal ties in the Cherryleaf article were named 26 times. Readers of the cohesive version named 23 occurrences of *first* or *next*, which had been inserted as between-paragraph devices. In addition, two cohesive readers (and one non-cohesive reader) also identified *you then,* which had been left in place within the paragraph as originally constructed.

The single most commonly cited device in either Cherryleaf version (in item 9b) was the reference to *Part One* in the second half of article. This referential tie had been left in place from the original download that referred to an earlier section of the article,

not included in the instrument. In equal numbers, readers of both versions identified *Part One* as a critical cue, with a total of 18 occurrences, although some participants made an erroneous inference from the cue and therefore answered item 9a correctly. Three readers of the cohesive version explicitly linked *Part One* in the text with *Part Three* in the title, a structural cohesive tie that did not appear in the non-cohesive version.

Structural Devices. As expected, the most frequently named structural features in the texts were the bolded headings and subheadings, identified 35 times in all. Participants' comments supported the concept of structural cohesion through graphic repetition, syntactic parallelism, and thematic progression (Campbell, 1991). For example, responses indicated that participants noticed in varying degrees the headings' boldface type, and also the clear distinction between the headings' brevity and the complete sentences that followed. Participants also noted the connections between the main ideas introduced in the headings and points developed later in paragraph.

Results of Nonparametric Analyses

Likert-scale ratings for items 1 through 5 and scores on task items 6a through 10a were analyzed item by item with Kruskal-Wallis tests, followed by Mann Whitney U tests on significant results.[11] All post hoc comparisons were corrected with the Bonferroni method.

Appendices J and K contain all scores, ranks and statistical analyses for items 1 through 5 and items 6a through 10a for the Pangea and Cherryleaf texts, respectively.

[11] For all Kruskal-Wallis tests in this study, SPSS reported only asymptotic p-values. Asymptotic p-values were accepted for all Pangea tests because $n \geq 5$ in all groups. However, asymptotic p-values were not accepted for Cherryleaf tests because $n < 5$ for group 6. For Mann Whitney U tests, only exact significances were reported because $n < 20$ in all groups (Garcia-Granero, 2001).

Tables and discussions in this section use the following abbreviations: NS (native speaker), NNS (non-native speaker), CO (cohesive text version), and NC (non-cohesive text version).

Likert-Scale Items on Global Comprehensibility.

For all texts, items 1 through 5 asked participants to rate their version of a given text on several measures of comprehensibility: the degree to which the reader understood the article (item 1), the reader's ease or difficulty in following important points in the article (item 2), the degree to which the reader considered relationships among ideas in the article to be clear or unclear (item 3), the degree to which the reader considered ideas in the article to be well connected or poorly connected (item 4), and the degree to which the reader considered sections in the article to be well connected or poorly connected (tem 5). Readers rated each item on a Likert scale from 1 (lowest opinion) to 10 (highest opinion). The sections below summarize the results of the Kruskal-Wallis and Mann Whitney U tests conducted on ranked participant ratings.

Results of Kruskal-Wallis Tests. A series of Kruskal-Wallis tests compared ranked participant ratings for items 1 through 5, item by item, from the following four groups: group 5 (NS / CO), group 6 (NNS / CO), group 7 (NS / NC), and group 8 (NNS / NC). All these groups had read Cherryleaf texts first. For Cherryleaf texts, none of the individual tests on items 1 through 5 showed significant differences among ranked participant ratings for the four groups. That is, differences in participants' first languages and in the text conditions they read failed to affect the groups' ratings of the text in statistically significant ways.

A different series of Kruskal-Wallis tests compared ranked participant ratings for items 1 through 5, item by item, from four other groups: group 1 (NS / CO), group 2 (NNS / CO), group 3 (NS / NC), and group 4 (NNS / NC). All these groups had read Pangea texts first. For Pangea texts, the tests of individual items 1 through 5 showed a significant difference among ranked participant ratings for the four groups for item 3, which asked readers to rate the clarity of relationships among ideas in the text, on a scale from 1 (very unclear) to 10 (very clear).

The test for Pangea item 3 was significant, $\chi 2$ (3, N = 29) = 10.947, p = 0.012. This result indicated that readers differed significantly, by group, in their opinions about whether relationships among ideas in the Pangea text were clear or unclear. The proportion of variability in the ranked dependent variable was 0.39, a fairly strong indication that between-group differences in language, text condition, or both were related to participants' opinions that relationships among ideas in the text were clear or unclear. Table XI summarizes information from the significant Kruskal-Wallis test for Pangea item 3.

Table XI. Significant Kruskal-Wallis Outcome, Pangea Item 3

Item	Groups compared	Group n	Mean ranks	Total n	$\chi 2$	df	Signif	$\eta 2$
3	1 (NS/CO)	10	11.60	29	10.947	3	0.012	0.3910
	2 (NNS / CO)	5	24.00					
	3 (NS / NC)	9	17.17					
	4 (NNS / NC)	5	8.90					

Results of Mann-Whitney U Tests. To identify more specifically the source(s) of significant difference(s) among the four reading groups for Pangea item 3, Mann Whitney U tests were conducted on all possible pairings among the groups, as follows:

group 1 (NS / CO) and group 2 (NNS / CO)
group 1 (NS / CO) and group 3 (NS / NC)
group 1 (NS / CO) and group 4 (NNS / NC)
group 2 (NNS / CO) and group 3 (NS / NC)
group 2 (NNS / CO) and group 4 (NNS / NC)
group 3 (NS / NC) and group 4 (NNS / NC)

In these post hoc comparisons, one statistically significant difference for language ($p = 0.008$) emerged between the native readers in group 1 and the non-native readers in group 2, all of whom read the cohesive Pangea text first. For native readers in group 1, the mean rank was 5.90; for the non-native readers in group 2, the mean rank was 12.20. Table XII summarizes information for this comparison for Pangea item 3.

Table XII. Significant Post Hoc Comparison, Pangea Item 3

Item	Groups paired	Group n	Mean rank	Total n	Exact significance
3	1 (NS / CO)	10	5.90	15	0.008
	2 (NNS / CO)	5	12.20		

The lower mean rank for the native readers in group 1 indicates that they considered the relationships among ideas in the text significantly less clear than did non-native readers, even with the interpretive guidance of semantic and structural cohesive devices in the version they read. The tendency of non-native readers in group 2 to find relationships in the cohesive Pangea text very clear appears to be confirmed by their high performance on the task questions as well.

Task Items on Local Relationships.

For each text, items 6a through 10a asked readers to use information from that text to complete short tasks, as a measure of the degree to which readers understood what they had read. Because items were content-specific, they differed for the Pangea and

Cherryleaf texts. All items 6a through 10a were scored from 0 (completely incorrect) to 1 (completely correct), with partial credit for tasks on some items. The sections below summarize the results of the Kruskal-Wallis and Mann Whitney U tests conducted on the medians of ranked scores for Pangea and Cherryleaf items 6a through 10a.

Results of Kruskal-Wallis Tests. One series of Kruskal-Wallis tests compared ranked scores for items 6a through 10a, item by item, from the following four groups: group 5 (NS / CO), group 6 (NNS / CO), group 7 (NS / NC), and group 8 (NNS / NC). All these groups had read Cherryleaf texts first. For Cherryleaf texts, none of the individual tests for items 6a through 10a showed significant differences among ranked comprehension scores for the four reading groups. That is, differences in participants' first languages and in the text conditions they read failed to affect the groups' scores on task items in statistically significant ways.

A different series of Kruskal-Wallis tests compared ranked scores for items 6a through 10a, item by item, from four other groups: group 1 (NS / CO), group 2 (NNS / CO), group 3 (NS / NC), and group 4 (NNS / NC). All these groups had read Pangea texts first.

For Pangea texts, the individual tests for items 6a through 10a showed a significant difference in ranked comprehension scores among the four groups on item 7a, $\chi 2$ (3, N = 29) = 20.612, p = 0.000. This item had asked readers to name the desirable characteristics of strawbale construction. For readers of the cohesive Pangea version, the desirable characteristics had been introduced in the text with a forecast statement and colon, which signaled a list to follow, and three bolded subheadings that named the characteristics. By contrast, in the non-cohesive Pangea version, readers had seen only a

series of paragraphs in the text without clear topic sentences or visual cues. This statistical result indicated that readers differed significantly, by group, in their abilities to name correctly the desirable characteristics of strawbale construction.

For item 7a, the proportion of variability in the ranked dependent variable was 0.7361, which strongly indicated that participants' ability to name the desirable characteristics of strawbale correctly was related to between-group differences in language, text condition, or both. Table XIII summarizes information for the significant Kruskal-Wallis test for Pangea item 7a.

Table XIII. Significant Kruskal-Wallis Outcome, Pangea Item 7a

Item	Groups compared	Group n	Mean ranks	Total n	$\chi 2$	df	Signif	$\eta 2$
7a	1 (NS/CO)	10	20.60	29	20.612	3	<0.001	0.7361
	2 (NNS / CO)	5	22.50					
	3 (NS / NC)	9	9.94					
	4 (NNS / NC)	5	5.40					

Results of Mann-Whitney U Tests. To identify more specifically the source(s) of significant difference(s) in the participants' ability to name correctly the desirable characteristics of strawbale, Mann Whitney U tests were conducted on ranked scores for item 7a with all possible pairings among the four groups, as follows:

group 1 (NS / CO) and group 2 (NNS / CO)
group 1 (NS / CO) and group 3 (NS / NC)
group 1 (NS / CO) and group 4 (NNS / NC)
group 2 (NNS / CO) and group 3 (NS / NC)
group 2 (NNS / CO) and group 4 (NNS / NC)
group 3 (NS / NC) and group 4 (NNS / NC)

These post hoc comparisons identified a total of four statistically significant differences in groups' ability to name correctly the desirable characteristics of strawbale. Two of

these comparisons clearly appear to relate to differences in the cohesiveness of the version groups had read. The other two comparisons were less conclusive.

First, post hoc tests on scores for item 7a showed a significant difference between groups 1 and 3 ($p = 0.001$), who were native speakers reading cohesive and non-cohesive versions, respectively. For group 1 (NS / CO), the mean rank was 13.65; for group 3 (NS / NC), the mean rank was 5.94. Because this test compared readers of a shared linguistic background who had read different text versions, the data strongly suggest that semantic and structural cues in the cohesive version enabled readers in group 1 to understand the text more completely and therefore to name the desirable characteristics of strawbale more accurately than readers in group 3, who read the non-cohesive version and therefore lacked such interpretive cues.

Similarly, post hoc tests for item 7a showed a second significant difference in the mean ranks for groups 2 and 4 ($p = 0.008$), who were non-native speakers reading cohesive and non-cohesive versions, respectively. For group 2 (NNS / CO), the mean rank was 8.00; for group 3 (NNS / NC), the mean rank was 3.00. Again, because this test compared readers with a shared linguistic background who had read different text versions, the data strongly suggest that cohesive devices had contributed to higher comprehension for readers in group 2, enabling them to name the desirable characteristics of strawbale construction more accurately than readers in group 4, who had read the non-cohesive version.

Results were less conclusive for two other comparisons. Post hoc tests for item 7a showed a significant difference ($p = 0.001$) between the mean ranks for group 1 and group 4 (NS / CO and NNS / NC, respectively), and also showed a significant difference

($p = 0.004$) between the mean ranks for group 2 and group 3 (NNS / CO and NS / NC, respectively). For group 1, the mean rank was 10.45, while for group 4, the mean rank was 3.10, indicating that native readers of the cohesive version named desirable characteristics of strawbale more accurately and therefore appeared to comprehend more of the text than did non-native readers of the non-cohesive version. For group 2, the mean rank was 11.50, while for group 3, the mean rank was 5.28, suggesting that task performance and therefore comprehension were higher for non-native readers of the cohesive version than for native readers of the non-cohesive version. However, both language and text condition differed in the groups in each pairing (NS / CO vs NNS / NC, and NNS / CO vs NS / NC), and neither the Kruskal-Wallis test nor the Mann Whitney U test were able to pinpoint the factor(s) that produced the significant between-group differences in reading comprehension. Consequently, no firm conclusions can be drawn from these two comparisons.

It is nevertheless interesting to note that the only non-significant post hoc tests for Pangea item 7a occurred with pairings of groups that had dissimilar linguistic backgrounds but encountered the same text condition first. For groups 1 (NS) and 2 (NNS), which both read the cohesive version, the (non-significant) difference between mean ranks (7.50 and 9.00, respectively) was 0.594. For groups 3 (NS) and 4 (NNS), which both read the non-cohesive version, the (non-significant) difference between mean ranks (8.72 and 5.30, respectively) was 0.147. This outcome suggests the possibility that, at least among these two pairings of readers, sameness of text condition did more to close the gap between the groups' comprehension scores than language differences did to widen that gap. For single-sourcing writers, these findings imply that, in some cases,

efforts at making English text cohesive for readers of technical texts may ultimately contribute more to reader comprehension than attempts to adjust text for linguistic differences.

Table XIV summarizes all post hoc comparisons for Pangea item 7a, including the non-significant results described above.

Table XIV. Significant Post Hoc Comparisons, Pangea Item 7a

Item	Groups compared	Group n	Mean ranks	Total n	Exact significance
7a	1 (NS / CO)	10	7.50	15	0.594
	2 (NNS / CO)	5	9.00		
	1 (NS / CO)	10	13.65	19	0.001
	3 (NS / NC)	9	5.94		
	1 (NS / CO)	10	10.45	15	0.001
	4 (NNS / NC)	5	3.10		
	2 (NNS / CO)	5	11.50	14	0.004
	3 (NS / NC)	9	5.28		
	2 (NNS / CO)	5	8.00	10	0.008
	4 (NNS / NC)	5	3.00		
	3 (NS / NC)	9	8.72	14	0.147
	4 (NNS / NC)	5	5.30		

Discussion of Results

Data from the Likert-scale, task, and metalinguistic items provide some support for the research hypothesis that native and non-native English readers comprehend single-sourced texts differently. In particular, the data suggest some linguistic or cultural differences in readers' attitudes toward the texts. The data provide stronger support for the research hypothesis that readers comprehend English single-sourced texts with cohesive devices differently from single-sourced texts without cohesive devices. Further, the tally of metalinguistic devices indicates that readers in this study report greater

awareness of certain semantic and structural cohesive devices than of other devices. In this section I discuss these results. In addition, by comparing patterns of repetition in the two texts, I examine the relationship between textual cohesiveness and the problematic effect of order observed in the original research design.

Effects of Language on Reader Attitude and Comprehension.

The most striking language-related difference in this study concerned native readers' attitudes toward the Cherryleaf article in both versions. In responses to the Pangea text, the differences between native and non-native readers' attitudes were less pronounced. Only one significant language-related difference emerged, when non-native readers reported that ideas in the cohesive Pangea version were more clearly related than did native readers. Moreover, in Pangea Likert-scale data for groups 2 and 3 (NNS / CO and NS / NC, respectively), the factors of cohesiveness and English proficiency often seemed to balance out. However, for the Cherryleaf text, native readers of both versions produced low Likert-scale medians on every item. Some native readers also expressed negative opinions about the Cherryleaf text through written comments, particularly concerning metalanguage they considered confusing. For example, several readers noted (correctly) that the closing paragraph contained mostly new information, despite the rhetorical convention that ends English expository text with a summary. In the cohesive version, as in the original download from the Cherryleaf website, a bolded *Conclusion* heading and the referential semantic tie *In summary* introduced the closing paragraph, cues that further contradicted readers' expectations. Native readers, who assume certain norms in English non-narrative text, may have expected a certain degree of textual

cohesiveness or organization and felt frustrated when they did not find it, which was reflected in their responses to Likert-scale items.

By contrast, non-native readers, less accustomed to explicit textual cohesiveness in their first languages, may have been less likely to transfer this feature or to expect it in English. For example, for the Cherryleaf texts, non-native readers of the cohesive version produced four of five of the highest Likert-scale medians, and non-native readers of the non-cohesive version produced the other high median. These readers may have been sufficiently familiar with English rhetorical conventions to respond positively and interpret text accurately when cohesiveness was present, but not so familiar that they would express strong negative opinions in its absence.

On task items, language appears to have produced some differences in measures of comprehension, although the data are somewhat ambiguous. On Pangea task items, native readers tended to outscore non-native readers, though none of these comparisons were significant. However, on Cherryleaf task items, non-native readers tended to outscore native readers. The relatively small differences between native and non-native reading groups suggests that this small sample of non-native readers has either adapted successfully to a second-language rhetorical pattern or learned to respond effectively to cues other than between-paragraph cohesiveness.

Indeed, one point of genuine interest in this study may be that the effect of language on comprehension of cohesive or non-cohesive texts is the opposite of what was expected. Somewhat surprisingly, native readers in this study appeared to be less perceptive readers than did non-native readers. The native readers may have been more comfortable in an American university test setting and therefore more casual in their

responses, possibly reading quickly and relying more on simple lexical cues than on referential or other between-paragraph devices. By contrast, non-native readers from East Asia likely received more English grammar instruction before beginning graduate education in the US than did native readers. Consequently, they may have read the articles more carefully, with greater attention to lexical cues but also to the textual devices not commonly found in their first languages.

Effects of Cohesion on Reader Attitude and Comprehension.

For the Pangea article, readers' attitudes toward text comprehensibility appeared more unambiguously related to textual cohesiveness than to linguistic or cultural differences. On Likert-scale items, no statistical tests for effects of cohesiveness were significant, but large descriptive differences did occur between readers of cohesive and non-cohesive versions. On task items, the presence or absence of textual cohesion appears to be the main difference between pairings, with language background held constant in comparisons between groups. Although small sample sizes affected statistical significance, readers clearly responded more positively and with greater accuracy to texts with strong semantic and structural cohesion than to texts lacking such cohesion. For non-native readers, textual cohesiveness may have helped to compensate for lower English proficiency, given that non-native readers of cohesive texts performed at consistently higher levels than non-native readers of non-cohesive texts.

This dissertation was limited to a study of between-paragraph cohesion, but its findings suggest that within-paragraph cohesion, and specifically lexical cohesion, may be even more important to reading comprehension. Up to a point, readers may tolerate a

lack of between-paragraph cohesion if within-paragraph cohesion is adequate. For example, as I discuss in the following sections, the Pangea article was more cohesive within paragraphs than the Cherryleaf article, and this difference may have accounted for some of the more pronounced reader reactions. Except for non-native readers of the non-cohesive version, readers' opinions of the Pangea article were generally high (medians of 8.0000 or above, based on a highest possible rating of 10) among all groups, even among native readers of the non-cohesive version. By contrast, readers' opinions of the Cherryleaf article were generally lower, particularly among native readers, who may have expected a well-written text to exhibit a level of within-paragraph cohesiveness this text did not achieve. Although conspicuous, between-paragraph cohesive devices are a useful form of surface signaling, they may be less helpful to readers if the within-paragraph lexical cohesiveness beneath the text's surface is weak or inconsistent.

Metalinguistic Issues within Texts.

As noted in Chapter V, in the original research design for this study, the order in which participants encountered texts functioned unexpectedly as a variable, particularly when participants read either version of the Cherryleaf text first. The effect of order was particularly noticeable on the Likert-scale measures of comprehensibility. Consequently, the repeated-measures, within-subjects design for this study was adjusted. The unanticipated effect of order may have been related to textual cohesiveness in two ways: as a sign of "rhetorical ineptness" (Hoey, 1983, p. 180) resulting from inconsistent textual signaling, and as an indicator of subtle but critical differences in levels of repetition within the Pangea and Cherryleaf texts. I analyze these factors below, using as the basis

for discussion the cohesive versions of the Pangea and Cherryleaf articles (contained in Appendices B and C, respectively).

Rhetorical Ineptness. Hoey (1983) describes two types of writing that fail to provide readers with the textual relationships necessary for producing meaning: fragmented discourse, in which one or more sentences are unrelated to any other sentences, and rhetorically inept discourse, in which "writers or speakers relate allthe parts of their discourses but fail to show their readers a clear pathway through the parts" (p. 180). In turn, Hoey suggests that writing may be rhetorically inept if it is under-signaled, with poorly formed semantic relations and "no clear focus of attention," or if it is mis-signaled, containing inaccurate interpretive information (p. 180).

Both types of signaling problems occurred in the Cherryleaf text. For example, the first main section of the cohesive Cherryleaf text contained three temporal conjunctives to signal the main steps of planning a proposal: *First-next-you-then. First* and *next* appeared at the beginnings of paragraphs, and as the metalinguistic tally showed, readers of the cohesive version clearly noticed these cues. However, *you then* remained in its original, under-signaled position within the paragraph, where it was identified as a cohesive device only a few times. Presumably, readers would have named this cue more frequently, had it been placed more strategically in a conspicuous position.

A more serious, mis-signaling problem at the end of the Cherryleaf text has already been noted in the discussion of native reader attitudes. Mis-signaling occurs when "[t]he writer has in effect told the reader to expect a particular question to be answered and then delayed supplying information that could serve as an acceptable answer to that question" (Hoey, 1983, p. 183). In the cohesive version, as in the original download from

the Cherryleaf website, a bolded *Conclusion* heading and the referential semantic tie *In summary* introduced the closing paragraph. In the original research design, about 52% of participants reading the cohesive version named one or both of these devices as the reason(s) they expected to read information that had previously appeared in the article. However, many of these readers stated that the actual content of the paragraph was new information, which frustrated the expectations generated by the devices' semantic content. Participants commented that the ending introduced a new topic, was "confusing" and "contrary to what it's been writing about for the entire article," "seems to come out of nowhere," and "didn't make the expected connection." The lack of cohesiveness resulted from an error of hierarchy not unique to single-sourced documents: In the original online document, the *Conclusion* referred to material on a different web page, and in that context the B-level *Conclusion* heading should have been an A-level heading on a separate page. Nevertheless, when participants encountered this rhetorical contradiction in the first text, they may have perceived the second (Pangea) text as less frustrating and easier to follow, even without cohesive markers. Perhaps because the headings were such effective cohesive devices in other respects, numerous readers responded strongly to this one negative case of thematic progression near the end of the Cherryleaf text.

In the original research design, the 30 readers of the non-cohesive Cherryleaf version, who did not see the problematic heading and introductory phrase, were somewhat less critical of the closing paragraph's new information. Still, several commented that, on the basis of the English rhetorical conventions they had learned, they had expected a final paragraph that would summarize points rather than develop them.

These reactions suggest that, while readers may initially respond as desired to an author's structural devices, a text's overall comprehensibility will ultimately suffer if structural and semantic cues are contradictory. Because this experimental study was based on authentic single-sourced texts, the Cherryleaf conclusion is an example of an actual comprehension problem created for readers when a block of text has been incorporated into a document out of sequence, or with inappropriate cohesive signals.

Differences in Levels of Repetition. In this study, the negative effects of surface mis-signaling may have been reinforced by interpretive processes at a deeper level. In the cohesive version of each article, the short first paragraph functioned as a forecast statement to prepare readers for the main topic and subtopics to follow. According to Hoey's theories of lexical repetition (1983, 1991), these introductory paragraphs should have been ideal starting points for building networks of bonded or linked sentences across each article, which readers could then use (unconsciously) as frameworks for identifying and processing new information. However, the articles differed considerably in their strategic use of repetition in the forecasts and thereafter.

In the Pangea article, the key term *strawbale* occurred in the title and forecast statement and was repeated 17 times thereafter, with *straw* occurring separately in the article an additional five times and *bale*, an additional three times. One or more of these three words appeared at least once in every paragraph and main heading. *Building*, another key term, occurred 21 times in all, with related terms *materials*, *construction*, and *technique* occurring eight, six, and three times, respectively. The words *building* or *construction* appeared at least once in every paragraph and main heading. *Air*, which was introduced later in the context of strawbale's important ventilating properties, occurred

seven times in all. The article also made strategic use of the referential *it*, which occurred twice in the forecast statement alone, referring to strawbale construction, and 11 other times elsewhere in the article. Of the key words listed here, *straw*, *bale*, *building*, *material*, and *it* were repeated in the final, three-sentence paragraph. At least for key terms, repetition in the Pangea article tended to involve exact words rather than synonyms, which are more complex forms of repetition (Hoey, 1991) that some readers may overlook or fail to recognize as lexical matches. When synonyms were used, such as *building* and *construction*, they tended to be familiar words that were themselves repeated regularly as exact matches.

In the Cherryleaf article, the key term *proposal* occurred first in the title and forecast statement and 17 times thereafter. Except for the A-level section heading, *proposal* did not occur in the three paragraphs discussing writing tips. In various forms (not always exact matches), the key verb *write* occurred a total of 11 times, including one occurrence in the title and two in the forecast. However, *write* occurred in only one of the three paragraphs on writing tips and was also missing from a paragraph on planning. Other important words occurred even less frequently. *Plan* and *tool*, which both named subtopics in the forecast statement, occurred only three times and four times, respectively. *Sale*, which was sufficiently important to appear in the title, occurred only four times, as did *headings*, a theoretically important concept addressed in two subsections. Of the key words *plan, tool, sale,* and *headings,* none appeared in every paragraph. The referential *it* occurred only once, in a relatively unimportant context. In the final, six-sentence paragraph, *sale* and *proposal* were repeated, but *write*, a word essential to the article's stated main point, occurred only once, as *written*. At key points,

other examples of repetition in the Cherryleaf article sometimes involved synonyms rather than exact words, such as *buyer / client / people*, and *member of the team / relevant people / writers,* but few of these synonyms were repeated regularly. In short, the Cherryleaf article was less likely than the Pangea article to repeat key terms; to place key terms systematically throughout the text, creating an effective lexical network; and to repeat synonyms strategically so that, as exact matches, they would be less likely to distract or confuse readers.

In this study, the striking difference in the articles' use of repetition as a composing strategy suggests that, apart from headings, bullets, conjunctives, or other surface-level, between-paragraph devices, readers may have reacted unconsciously to the level of repetition within and across paragraphs. The quantitative data in this study have already suggested that native readers in particular may have been somewhat more likely than non-native readers to construct meaning on the basis of simple lexical cues, rather than referential or other between-paragraph devices. As a result, when participants' first reading experience involved an unfamiliar topic but a repetitive composing style that helped them build a lexical framework for integrating new terms and concepts, they may have been better prepared to answer as expected on measures of comprehensibility. Conversely, when readers encountered an unfamiliar topic with few opportunities to create a network of lexical bonds within and across paragraphs, they may have reacted negatively, regardless of surface-level cohesive devices inserted in the text as interpretive guides.

This limited analysis suggests that single-sourcing writers will need to consider not only surface-level lexical cues but also less obvious patterns of repetition when

developing content that readers can understand easily. For non-native readers and also for readers encountering new topics, exact-word repetition may be preferable to the use of synonyms. Exact words reduce translation efforts and make fewer assumptions about readers' prior contextual knowledge, which is a necessary element in synonym use. Exact-word repetition may also increase readers' sense of confidence, proficiency, and comprehension (as evidenced in this study by higher Likert-scale ratings for the more repetitive Pangea text), because it allows readers more opportunities to take advantage of words they have already mastered.

Summary of Findings

Data from the study provide some support for the hypothesis that native and non-native readers comprehend single-sourced texts differently, particularly with regard to readers' attitudes toward the texts. One statistically significant difference ($p = 0.008$) occurred between native and non-native readers on item 3 of the cohesive Pangea text. In post hoc tests, non-native readers (mean rank 12.20) reported relationships among ideas in the text to be significantly clearer than did native readers (mean rank 5.90).

The data also provide some support for the hypothesis that readers comprehend English single-sourced texts with cohesive devices differently from single-sourced texts without cohesive devices. For Pangea item 7a, which asked readers to name the desirable characteristics of strawbale, significant differences ($p = 0.001$) occurred between groups 1 and 3, who were native cohesive and non-cohesive readers, respectively. The cohesive readers (mean of ranked scores 13.65) named the desirable characteristics of strawbale buildings more accurately than did the non-cohesive readers (mean rank 5.94).

On Pangea item 7a, significant differences ($p = 0.008$) also occurred between groups 2 and 4, who were non-native cohesive and non-cohesive readers, respectively. Again, the cohesive readers (mean rank 8.00) named the characteristics of strawbale buildings more accurately than did the non-cohesive readers (mean rank 3.00).

Two other comparisons for Pangea item 7a were also significant, but less conclusive. Significant differences ($p = 0.001$) occurred between groups 1 and 4, who were native cohesive and non-native, non-cohesive readers, respectively. Readers in group 1 (mean rank 10.45) named desirable characteristics of strawbale more accurately than did readers in group 4 (mean rank 3.10). Similarly, a significant difference ($p = 0.004$) occurred between groups 2 and 3, who were non-native cohesive and native non-cohesive readers, respectively. Readers in group 2 (mean rank 11.50) named characteristics of strawbale more accurately than did readers in group 3 (mean rank 5.28). However, because both language and text condition differed in the groups in each of these pairings, statistical tests were unable to identify the specific factor(s) that produced the significant between-group differences in reading comprehension.

Of the semantic cohesive devices identified in the text, participants named more lexical cues than any other type, followed by referentials and temporal conjunctives. Of the structural devices identified, participants named bolded headings and subheadings most frequently. Differing patterns of within-paragraph lexical repetition (not measured in this study) appear to have influenced readers' attitudes toward the texts and levels of comprehension. Lexical repetition may reinforce the effectiveness of surface-level cohesive devices by creating frameworks within which readers can integrate concepts and process new information.

In the closing chapter, I relate the quantitative findings to the original questions that framed this study.

CHAPTER VII

APPLYING THE FINDINGS TO CURRENT PRACTICES

I have based this dissertation on three issues raised by Judi Greene, a technical communication manager whose North American firm is weighing the costs and benefits of computer-assisted single sourcing. Greene knows that single sourcing could increase efficiency and savings by enabling writers to reuse blocks of text, without change, in a variety of documents and media. But she has also questioned the effects of this composing strategy on the firm's audiences, who include native and non-native readers of English. She has asked the following questions regarding this method:

- How well can single sourcing accommodate rhetorical variations that would improve reader comprehension?
- Is highly standardized English text appropriate for cross-cultural audiences?
- Does removing metalanguage, particularly cohesive devices, from single-sourced texts significantly affect comprehension for specific groups of readers?

Because technical communication scholars are only beginning to study single sourcing experimentally, Greene has access to very little relevant empirical data. My objective in this project has been to contribute research-based findings to the discussion, with her questions framing the study.

In this chapter I return to *tool, text,* and *system* – the metaphors for technology proposed by Nardi and O'Day (1999) — to relate my findings to the questions Greene has raised, and to propose issues for additional research.

Implications for Single Sourcing as a Tool

I begin with Greene's most specific question, which concerns the relationship of metalanguage to the comprehensibility of single-sourced texts. Here, she has focused on single sourcing as a composing *tool*, and she has considered the constraints it places on more traditional composing tools, specifically on cohesive devices. The results from the limited study in this dissertation indicate that readers are more likely to comprehend expository text when it contains well-defined cohesive devices. When texts are cohesive, readers also are more likely to consider information within those texts to be clear, well organized, and easy to follow. Moreover, readers appear to notice some cohesive devices – lexical cues and graphical repetition, for example – more than others, such as adversatives, comparatives, and other conjunctives. Consequently, the relationships among cohesion, single sourcing, and comprehensibility are issues Greene's staff must consider.

Organizations have several possibilities for integrating cohesive devices into single-sourced text, although these options may reduce efficiency, at least at the beginning of a writing project. One important strategy is to coordinate carefully the work of content developers to take full advantage of the power of repetition in text, particularly lexical repetition. As Hoey (1991) has suggested, readers may unconsciously use lexical repetition to create bonded pairs of sentences, thereby relating concepts and processing new information, even when the sentences are separated by many pages. In this study, participants commonly identified lexical cohesion as the basis by which they connected certain ideas in the test passages. Participants rated more highly the single-sourced text

that repeated important terms exactly and systematically throughout the article, limited synonym use to a few well-known words, and then repeated those synonyms in turn. By contrast, readers (particularly native English readers) expressed negative opinions of the text with weaker lexical cohesion within and across paragraphs. Without a strong underlying lexical framework based on repetition, surface-level structural and semantic features are less likely to support reader comprehension effectively. Organizations and future researchers must therefore investigate ways to strengthen cohesion within single-sourced modules by repeating comprehensible terminology and syntax across information blocks, perhaps by building on current Controlled English, Plain English, or International English practices.

Another option for single sourcing as a cohesive tool involves using metadata to insert or remove conditional text. Organizations already use metadata to include or exclude information according to audience, context, purpose, and other factors. In the European firm that hosted my internship, for example, the company's software demonstrations regularly displayed a common core of product information along with textual variants for different product versions. Writers could use the same technique to include or exclude between-paragraph or between-section cohesive devices, depending on how a particular block of information fit into a larger section. With present technology, conditional text is less manageable when used on a large scale (H. Meyerding, personal communication, July 22, 2005). However, it offers a partial solution.

In this study, readers responded decisively to a few elements of structural cohesion, mainly the repetition of headings, and the XML style sheet, which prescribes

the formatting of documents on paper and on-screen, is a promising tool for governing different types of graphic repetition (Campbell, 1991). When grounded in design research and visual language theory, style sheets help designers to connect key visual elements in single-sourced texts, thereby strengthening cohesiveness. As they become more sophisticated, style sheets may evolve into "design knowledge bases" that enable designers to capture "explicit, formalized knowledge about documents, their structure and content, and the way users interact with them," perhaps incorporating structural, semantic, and other principles in "rule-based form" (Johnsen, 2001, pp. 64-65). If future style sheets can integrate genre requirements, audience expectations, and design theory, they may help single-sourcing writers strengthen cohesiveness more efficiently and consistently.

A final option is to incorporate reader-centered features into the document type definition (DTD), where usability originates (or is lost) in single-sourced texts (Sapienza, 2004). Analysts develop a document by first creating a model; then, from that model, they define the document's metadata requirements within the framework of a DTD, which governs the ways pieces of information are assembled. At every level of production, from content development to text assembly, document quality "lives and dies on the quality of the metadata" (Albers, 2003b, p. 341). This process is thus one of "using data management and computer programming skills to solve a *rhetorical* problem, not a *computer* problem" (Sapienza, 2002, p. 167). If designers provide sufficiently in the DTDs for reader-centered blocks of information such as introductions, forecast statements, headings, conclusions, and summaries, the cohesiveness and comprehensibility of the final texts will improve.

Implications for Single Sourcing as a Text

Greene has also asked whether rhetorical variation is necessary for the global readers in her firm's audiences. The results of this study suggest that as a *text* or "carrier of meaning" (Nardi & O'Day, 1999, p. 31), single sourcing in English may not need to accommodate cultural differences for international audiences in every case.

In this study, significant language-related differences did emerge on one measure of reader attitudes, when non-native readers reported relationships among ideas in one of the single-sourced texts to be clearer than did native readers of the same text. Other significant differences between native and non-native readers may have occurred on a comprehension item for which native readers named the desirable characteristics of a specific building technique more accurately than did non-native readers, although statistical analyses were unable to distinguish conclusively between factors of language or cohesiveness. However, on most items in this study, language background appeared to have less effect on reader comprehension than did textual cohesiveness. For Greene's firm, therefore, the need to accommodate cross-cultural audiences on textual features will likely depend on reader profile, linguistic group, and the feature of interest.

Much of the current literature on cross-cultural communication advises organizations to evaluate the need for cultural accommodation empirically, instead of relying on functionalist stereotypes of culture. For writers in any organization, good information design should involve analyzing problems, establishing objectives to address those problems, developing strategies, executing the strategies, and evaluating the outcomes (Carliner, 2000). For writers in single-sourcing organizations, who are

expected to meet audience needs while developing information in chunks, guidance from experimental data will be even more essential. Although the XML that underlies many single-sourcing programs offers information designers an efficient way to reach many types of readers simultaneously, "every rhetorical task will involve a conceptualization of many different groups with different capabilities," particularly for online publishing (Sapienza, 2002, p. 165). For Greene's firm, as for many others, cross-cultural audience analysis at deep levels will be a fact of life.

Because cohesion represents one of the most conspicuous differences between traditionally composed and single-sourced texts, researchers will need to continue studying its effects in different types of texts disseminated cross-culturally. While this study found that reader comprehension was affected by the presence or absence of cohesive devices between paragraphs or sections, more work is needed on the function of cohesive devices within paragraphs or other blocks of text. Another issue is the relationship of cohesion to text organization, the subject of previous cross-cultural scholarship (Kobayashi, 2002; Fukuoka & Spyridakis, 2000; Scollon & Scollon, 2001; Fukuoka & Spyridakis, 1999; Carrell, 1984). One scholar has also proposed research into cultural preferences for (or against) traditional markers and headings, to determine whether readers use these features to form "content mental models" (Sapienza, 2004, p. 406). For more complex analyses, communicators will need to collaborate cross-culturally to develop authentic test instruments and research designs. Researchers will also need to learn more about the effects of role, text type, and medium on reader expectations of single-sourced material.

Implications for Single Sourcing as a System

For Greene, this study began with the issue of whether rhetorical variation is feasible in single-sourced texts, and a literature search has been the method by which I have attempted to answer this question. The literature is clear that as a *system* of reusing content, single sourcing strongly favors standardized texts with minimal variation. Consequently, rhetorical variation is unlikely to occur unless Greene's firm encourages accommodation to balance the system's bias for uniformity when comprehensibility requires it.

However, the literature has also confirmed that technical writers can indeed vary content for rhetorical purposes. As mentioned earlier, one approach is to use metadata strategically to mark conditional text for insertion or deletion from a text, depending on audience needs. Another approach is to strengthen semantic and structural cohesiveness within and between information blocks that might otherwise be decontextualized in single-sourced text, particularly by repeating key lexical items exactly and systematically. But if lack of cohesiveness between or within blocks affects reader comprehension, as this study suggests, then cohesiveness is a feature communicators will have to provide. The system can produce cohesive text only to the extent humans direct it to do so. In this project, many of the participants reading one of the cohesive texts commented that they expected one type of information from the devices *Conclusion – In summary,* while the subsequent paragraph actually presented a different type. The contradiction confused several readers, affecting both cohesiveness and comprehensibility. The problem illustrates in a modest way that the perspectives of discerning readers, writers, and editors

will be important in a single-sourcing environment. The online error occurred within a writing system that minimizes editorial intervention; readers noticed regardless. When a single-sourcing writer assembles decontextualized material inappropriately, as in this case, the system's bias for the general is in tension with the reader's need for the specific and local. Hence human editorial oversight will continue to be essential for comprehensibility, even when composing is partially automated.

As single-sourcing systems move to finer levels of granularity, similar rhetorical problems will surface (Albers, 2003b), but the solution need not be a return to the traditional handcrafted composing model. Instead, with proper analysis, lexical repetition, cohesive devices, and other textual features can be "engineered" or written carefully to specifications (Weiss, 2002, p. 6) during document planning. An engineered model may even protect certain reader-centered features more consistently than the handcrafted model insofar as it incorporates user profiles and testing, and thereby takes a less writer-centered view of the reader. However, to be effective, the model must "[c]onsider how many places in the interface are opportunities for error, and protect against them" (Quesenbery, 2002, p. 95). The writing organization must also be committed to providing and soliciting feedback from users (Quesenbery, 2002; Sless, 2002).

Organizational changes in communicators' roles will likely be necessary if systems are to integrate user needs with design criteria effectively (Albers, 2003b). For example, reorganization might mean distinguishing between senior-level communicators responsible for broad issues such as information requirements, structure, and audience analyses, and junior-level communicators who concentrate on details, writing content blocks for the central repository as they learn to analyze (Albers, 2003b). Communicators

in single-sourcing environments will also need to participate actively in the politics of determining document structures (Sapienza, 2002; Sless, 2002; Williams, 2003). A single sourcing system tends to preoccupy communicators with technical and project management details, perhaps at the expense of audience (Kramer, 2003). The organization must therefore be committed to the extra effort accommodation requires.

In short, Judi Greene's writers will need to resist system efficiency as an overarching goal. Rather, they will need to attach "equal importance . . . to the technological, perceptual, and rhetorical aspects of document design" (Johnsen , 2001, p. 65) so that they provide the rhetorical variation their readers need.

Conclusion

Any successful single-sourcing initiative requires planning, along with budgetary support from upper management. For a project that addresses specific reader needs, as do many of the options in this concluding chapter, the planning is even more extensive. Therefore, long before writing can begin, a documentation group must determine which content is important, to whom, and in what forms. Studying reader preferences for certain rhetorical and cultural forms may be necessary as well, as this study suggests. Only through such research and planning can organizations truly understand how audiences comprehend technical material, and how best to use single-sourcing methods to provide text accordingly. Efficiency matters, but not when realized at the expense of human values. The key is finding a balance between the extremes of accepting technology uncritically and avoiding it altogether. As Nardi & O'Day (1999) have expressed it,

> We see ourselves as ourselves as critical friends of technology. We believe we can find ways to enjoy the fruits of technology without being diminished by it. It is possible to use technology with pleasure and grace if we make thoughtful decisions in the context of our 'local habitation,' to borrow Shakespeare's phrase. By this we mean settings in which we as individuals have an active role, a unique and valuable local perspective, and a say in what happens . . . . (p. x).

Using single sourcing in this way is what Judi Greene and her writers hope to achieve for their readers.

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APPENDIX A

IRB APPROVAL AND PARTICIPANT CONSENT FORMS

Oklahoma State University Institutional Review Board

Date:	Wednesday, October 26, 2005
IRB Application No:	AS0626
Proposal Title:	Influence of Composing Strategy on the Comprehensibility of Technical Documents in English
Reviewed and Processed as:	Expedited

Status Recommended by Reviewer(s): Approved **Protocol Expires: 10/25/2006**

Principal Investigator(s:

Lyn F. Gattis	Thomas Warren
2844 Hyland Park Road	205 Morrill
Fayetteville, AR 72701	Stillwater, OK 74078

The IRB application referenced above has been approved. It is the judgment of the reviewers that the rights and welfare of individuals who may be asked to participate in this study will be respected, and that the research will be conducted in a manner consistent with the IRB requirements as outlined in section 45 CFR 46.

☒ The final versions of any printed recruitment, consent and assent documents bearing the IRB approval stamp are attached to this letter. These are the versions that must be used during the study.

As Principal Investigator, it is your responsibility to do the following:

1. Conduct this study exactly as it has been approved. Any modifications to the research protocol must be submitted with the appropriate signatures for IRB approval.
2. Submit a request for continuation if the study extends beyond the approval period of one calendar year. This continuation must receive IRB review and approval before the research can continue.
3. Report any adverse events to the IRB Chair promptly. Adverse events are those which are unanticipated and impact the subjects during the course of this research; and
4. Notify the IRB office in writing when your research project is complete.

Please note that approved protocols are subject to monitoring by the IRB and that the IRB office has the authority to inspect research records associated with this protocol at any time. If you have questions about the IRB procedures or need any assistance from the Board, please contact Beth McTernan in 415 Whitehurst (phone: 405-744-5700, beth.mcternan@okstate.edu).

Sincerely,

Sue C. Jacobs, Chair
Institutional Review Board

INFORMED CONSENT DOCUMENT

Project title

Influence of Composing Strategy on the Comprehensibility of Technical Documents in English

Researcher

Lyn F. Gattis, PhD candidate in the Department of English, Oklahoma State University, Stillwater

Purpose

The purpose of this research is to collect experimental data on the effect of a particular type of English technical text on native English readers and readers from East Asian countries. You were invited to participate in this project because you are a member of one of these general groups of readers.

Procedures

You will read and answer about 10 written questions on each of two texts, one about a new building material and one about writing a sales proposal. You do not need any special knowledge on these topics to participate in the project. Your participation will not be timed, but many participants will finish in about one hour. Not all participants will read the same texts. This is the only task you will be asked to complete.

Risks of participation

There are no known risks associated with this project that are greater than those ordinarily encountered in daily life.

Benefits

Your participation will help technical communicators learn about writing documents that end users can understand more easily.

Confidentiality

Your name will not appear on any materials other than this consent form, and no one (including the researcher) will know which answers are yours. Data will be reported as aggregates, not by individuals. Data will be stored at the researcher's home in Fayetteville, Arkansas, for five years and then destroyed. No one except the researcher will have access to the stored data except for the OSU Institutional Review Board, which has the authority to inspect consent records and data files to assure compliance with approved procedures.

Compensation

For your participation in this project, you will receive $20.00 USD.

Contacts

- If you have questions about the research project itself, contact: Lyn Gattis (researcher), Department of English, 205 Morrill Hall, Oklahoma State University, Stillwater, OK 74078
  tel 479-444-8991 (home) lyn.gattis@okstate.edu

OSU
Institutional Review Board
Approved 10/21/05
Expires 10/20/06
Initials GBH

- If you have questions about research at OSU or your rights as a test subject, contact:
  Dr. Sue Jacobs, Institutional Review Board Office, 415 Whitehurst, Oklahoma State University, Stillwater, OK 74078, tel 405-744-1676

Participant rights

Your participation in this project is completely voluntary. You may stop the research activity at any time and for any reason without penalty.

Signatures

I have read and fully understand the consent form. I sign it freely and voluntarily. A copy has been given to me.

Signature: _____ Date: _____
Signature of participant

I certify that I have personally explained this document before requesting that the participant sign it.

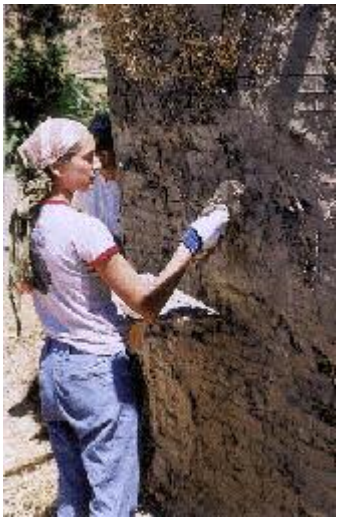
Signature: _____ Date: _____
Signature of researcher

APPENDIX B

PANGEA PARTNERSHIP TEXTS

Facts about Strawbale Construction

What is Strawbale Construction?



Strawbale construction is an increasingly popular eco-alternative for housing and other low-rise buildings. Reasons for the growing interest include its cost-effectiveness, energy efficiency, the fact that it is a sustainable use of a renewable resource, and the attractive, almost artistic finished appearances that can be achieved. Strawbale has its origins in the Great Plains region of the United States, and it has seen wide adoption in North America, Europe and Australia. Its low cost and use of natural, readily available materials are making it a successful choice in developing countries as well.

The strawbale building technique involves using bales of straw like bricks, building up walls in courses, which are then plastered over with cement or some other material, often clay. While this is a simple explanation, the result is strong, environmental, attractive, very well insulated, earthquake and fire resistant and most importantly, inexpensive. Indeed, single floor strawbale buildings do not normally require framing, the roof weight being carried directly by the walls. The whole process of erecting and plastering the external walls can take as little as a couple of days for a small building.

Straw is the stalk left over after cereal crops such as rice, wheat and barley are harvested. Tough and durable, it does not easily break down and is often burned in the field. When baled into large rectangular blocks it is strong, fire resistant, a great thermal and acoustic insulator and makes an ideal building material for homes, schools, community centers and other low-rise buildings. Because straw is available all over the world, and the insulating characteristics of strawbale buildings are an advantage in both hot and cold climates, this is an eco-building technique that is as applicable to Africa as it is to Mongolia.

Strawbale construction has been recognized as a valid alternative and integrated into the building codes of such places as Bolder Colorado, Austin Texas, Tucson/Pima Country Arizona and all of California.

Strawbale buildings have the following desirable characteristics:

Energy Efficient ...

Strawbale walls are rated to a thermal insulating value of over R40. Compared with an average home, which has an insulating value of R12 to R15, strawbale buildings are a great way to keep the inhabitants warm or cool using an economical and environmentally sound technology. In fact, studies by the United States Department Of Energy have shown that the cost of owning a strawbale home is over 50% less than the cost of owning a conventional wood-frame home over the same period, due largely to the reduced energy consumption.

Healthy ...

Did you know that according to the U.S. Environmental Protection Agency the air inside the average building is five to six times more polluted than the air outside? Building materials, paints, furniture carpets and other items release toxic gasses into the air, and worse, most buildings,

including homes, are sealed to prevent moisture and thermal leaks - a design that prevents the free exchange of air between the indoor and outdoor environments that would remove toxins.

There is a better way. Strawbale buildings greatly reduce or eliminate the need for many of these materials. Even better, the external walls of strawbale buildings breath, constantly exchanging the air inside the building for clean air outside even while providing superior thermal insulation. Strawbale buildings are also hypoallergenic, making them ideal spaces for people with chemical sensitivities.

Environmental ...

Straw is an annually renewable material that is commonly thought of as an agricultural waste product. In many parts of the world it is simply burned in the fields. Yet when baled, it makes a wonderful building material.

Building with strawbales is good for the environment in a number of ways.

1. By turning a waste product into a building material, farmers gain another source of income. This reduces the pressure on them to engage in environmentally unsound agricultural practices such as burning straw or deforesting land to increase yields.
2. Straw, unlike wood, is an annually renewable resource, giving the earth a realistic opportunity to keep-up with demand. Indeed, enough straw is wasted in the United States alone to build over 5 million 2000 square foot homes every year. Every strawbale building represents a considerable reduction in the use of lumber over a wood-frame structure of the same design, and that leaves more trees in the ground where they hold soil in place and filter greenhouse gases from the atmosphere.
3. Wall systems built with strawbales are incredibly well insulated. Depending on the quality of the building's design and construction, they can be rated anywhere between R40 and R50. Compare this with a conventional external wall in a North American home with an effective R rating of 12. As a result strawbale buildings are far more energy efficient and less expensive to heat and cool.
4. Conventional buildings are a major source of the pollution that causes air quality problems and climate change. Conventional buildings produce 35 percent of our carbon dioxide emissions, the chief culprit in climate change. They also account for 49 percent of sulfur dioxide emissions, 25 percent of nitrous oxide emissions, and 10 percent of particulate emissions. Strawbale buildings, reducing the energy needed for heating, cooling, air exchange and other systems, also reduces the related pollutants created by these processes.

	Readability statistics as calculated in Microsoft Word								Gunning-Fog index		
	counts			averages		readability					
version	words	paras	sent	sentence per para	wds per sentence	passive sentences	Fl-K read ease	Fl-K grade level	complex words	percent complex	score
original text, first A-level	875	19	40	2.8	21.5	35%	34.9	12			
Revision 1	863	14	39	3	21.9	35%	34.5	12			
Revision 2	559	8	24	3.4	23	45%	35.7	12			
Revision 3	558	8	30	4.2	18.3	26%	39.4	12			
Revision 4	547	7	30	4.2	18.2	26%	38.4	12	70	12.80%	12.4
Revision 5	630	18	37	3.3	15.7	18%	41.4	11.3	83	13.17%	11.548

Revision 1:	Remove photo, title, headings, list numbers
Revision 2:	Delete paragraphs 4, 10-14 to reduce word count
Revision 3:	Make simple sentences from compound / complex sentences (3,5,10,11,12,19) to decrease average sentence length; insert *and* before last item of series in paragraph 3
Revision 4:	Remove cohesive devices between paragraphs, including combining paragraphs 4 and 5; regularize punctuation and spelling
Formatting:	Change original typeface to Times New Roman 11, change line spacing to 1.5, insert line numbers, insert Start/End signals
Revision 5:	Add semantic and structural cohesive devices, including title, A- and B-level headings, and bullets
Formatting:	Change title and headings to boldface Arial 14, center title

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Strawbale construction is an increasingly popular eco-alternative for housing and other low-rise buildings. Reasons for the growing interest include its cost-effectiveness, energy efficiency, the fact that it is a sustainable use of a renewable resource, and the attractive, almost artistic finished appearances that can be achieved. Strawbale has its origins in the Great Plains region of the United States. It has seen wide adoption in North America, Europe and Australia. Its low cost and use of natural, readily available materials are making it a successful choice in developing countries as well.

The strawbale building technique involves using bales of straw like bricks, building up walls in courses. They are then plastered over with cement or some other material, often clay. While this is a simple explanation, the result is strong, environmental, attractive, very well insulated, earthquake and fire resistant, and most importantly, inexpensive. Indeed, single floor strawbale buildings do not normally require framing, the roof weight being carried directly by the walls. The whole process of erecting and plastering the external walls can take as little as a couple of days for a small building.

Straw is the stalk left over after cereal crops such as rice, wheat and barley are harvested. Tough and durable, it does not easily break down. It is often burned in the field. When baled into large rectangular blocks it is strong, fire resistant, and a great thermal and acoustic insulator. It makes an ideal building material for homes, schools, community centers and other low-rise buildings. Straw is available all over the world, and the insulating characteristics of strawbale buildings are an advantage in both hot and cold climates. This is an eco-building technique that is as applicable to Africa as it is to Mongolia.

Strawbale buildings have several desirable characteristics. Strawbale walls are rated to a thermal insulating value of over R40. Compared with an average home, which has an insulating value of R12 to R15, strawbale buildings are a great way to keep the inhabitants warm or cool using an economical and environmentally sound technology. In fact, studies by the United States Department Of Energy have shown that the cost of owning a strawbale home is over 50% less than the cost of owning a conventional wood-frame home over the same period, due largely to the reduced energy consumption.

Did you know that according to the U.S. Environmental Protection Agency the air inside the average building is five to six times more polluted than the air outside? Building materials, paints, furniture, carpets and other items release toxic gasses into the air. Worse, most buildings, including homes, are sealed to prevent moisture and thermal leaks – a design that prevents the free exchange of air between the indoor and outdoor environments that would remove toxins.

Strawbale buildings greatly reduce or eliminate the need for some materials. The external walls of strawbale buildings breathe, constantly exchanging the air inside the building for clean air outside even while providing superior thermal insulation. Strawbale buildings are hypoallergenic, making them ideal spaces for people with chemical sensitivities.

Straw is an annually renewable material that is commonly thought of as an agricultural waste product. In many parts of the world it is simply burned in the fields. Yet when baled, it makes a wonderful building material.

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Facts about strawbale construction

Welcome to strawbale! Read on to learn why strawbale construction is becoming more popular, how it works, and the desirable characteristics it offers.

Why do people choose strawbale construction?

Strawbale construction is an increasingly popular eco-alternative for housing and other low-rise buildings. Reasons for the growing interest include the following:

- its cost-effectiveness
- energy efficiency
- the fact that it is a sustainable use of a renewable resource
- the attractive, almost artistic finished appearances that can be achieved

Strawbale has its origins in the Great Plains region of the United States. It has seen wide adoption in North America, Europe and Australia. Its low cost and use of natural, readily available materials are making it a successful choice in developing countries as well.

How does strawbale construction work?

The strawbale building technique involves using bales of straw like bricks, building up walls in courses. They are then plastered over with cement or some other material, often clay. While this is a simple explanation, the result is strong, environmental, attractive, very well insulated, earthquake and fire resistant, and most importantly, inexpensive. Indeed, single floor strawbale buildings do not normally require framing, the roof weight being carried directly by the walls. The whole process of erecting and plastering the external walls can take as little as a couple of days for a small building.

The raw material for this technique is straw, the stalk left over after cereal crops such as rice, wheat and barley are harvested. Tough and durable, straw does not easily break down. It is often burned in the field. When baled into large rectangular blocks it is strong, fire resistant, and a great thermal and acoustic insulator. It makes an ideal building material for homes, schools, community centers and other low-rise buildings. Straw is available all over the world, and the insulating characteristics of strawbale buildings are an advantage in both hot and cold climates. This is therefore an eco-building technique that is as applicable to Africa as it is to Mongolia.

What are the benefits of strawbale construction?

Strawbale buildings have the following desirable characteristics:

Economical and energy efficient. First, strawbale walls are rated to a thermal insulating value of over R40. Compared with an average home, which has an insulating value of R12 to R15, strawbale buildings are a great way to keep the inhabitants warm or cool using an economical and environmentally sound technology. In fact, studies by the United States Department Of Energy have shown that the cost of owning a strawbale home is over 50% less than the cost of owning a conventional wood-frame home over the same period, due largely to the reduced energy consumption.

Healthy. In addition, the air inside strawbale buildings is cleaner than the air in conventional buildings. Did you know that according to the U.S. Environmental Protection Agency the air inside the average building is five to six times more polluted than the air outside? Building materials, paints, furniture, carpets and other items release toxic gasses into the air. Worse, most buildings, including homes, are sealed to prevent moisture and thermal leaks – a design that prevents the free exchange of air between the indoor and outdoor environments that would remove toxins.

Fortunately, strawbale buildings greatly reduce or eliminate the need for many of these materials. Even better, the external walls of strawbale buildings breathe, constantly exchanging the air inside the building for clean air outside even while providing superior thermal insulation. Strawbale buildings are also hypoallergenic, making them ideal spaces for people with chemical sensitivities.

Renewable. Finally, straw is an annually renewable material that is commonly thought of as an agricultural waste product. In many parts of the world it is simply burned in the fields. Yet when baled, it makes a wonderful building material.

- - - ARTICLE ENDS HERE - - -

APPENDIX C

CHERRYLEAF, LTD. TEXTS

Advice on how to write a sales proposal - Part 3

Contact us if you would like a PDF version of this article.

In this section, we look at the process of writing your proposals. We'll cover planning, writing tips and tools.

Have a plan

It is important to have a plan so that you can ensure your proposal in ready in time and, if more than one person is involved, the responsibilities of each member of the team. You may wish to have a sign-off process. We suggest someone not involved in writing the proposal proofreads the proposal, and that you have a checklist. You can use the checklist to verify you have met the requirements fully (or have explained how you will address any shortcomings) and to check there is the necessary "sizzle" to win a competitive situation.

Create a "skeleton" document

You can break your proposal down into chunks, organised around a skeleton of topic headings. These headings can be structured to form a storyboard that will guide the buyer through your proposal. These headings can help you to be consistent and to be complete. You then delegate responsibility for each section to the relevant people.

Writing tips

Take care over the vocabulary you use

Here is some advice regarding the words you use:

- Keep your vocabulary simple to aid the buyer's understanding. For example, "use" is better than "utilise".
- Use the buyer's words and phrases, where possible.
- Be consistent with the terminology you use.
- Check your document for any spelling mistakes

Have a clear presentation format

As the proposal may be confirming what the buyer already knows, he is likely to scan the document. So it makes sense to help the buyer by having a clear presentation format with all the major sections labelled.

- Keep the look and feel clean and simple
- Make sure your pages are numbered and that you have a table of contents
- Be consistent in your organisation and the description of headings
- Make sure you have a meaningful heading that describes every "chunk" of information.

- Try to ensure the buyer reads the proposal on paper rather than on screen. If you email your proposals, then send them as Word or Acrobat files rather than in HTML format.

Use a pyramid style of writing

The pyramid style of writing, devised by RGI International, recommends you:

- Start every section with a summary statement to encourage people to read on.
- Follow this with the supporting details that justify your summary statement.
- Have an introductory sentence before every list, table and picture, so the buyers know what they relate to.
- Use the active voice ("we will...") to avoid being ambiguous.

We'd also suggest you:

- Use gerunds ("-ing") frequently in your headings (e.g. meeting, improving, solving)
- Follow up any statement you make with "this means that..."
- Be credible

Use the right tools

Unfortunately, the most commonly used tool that people use to write their proposals (Microsoft Word) doesn't help you address the problems listed in Part One of this article. We have developed a solution, SalesProp, for writing sales proposals that provides a "database" of reusable chunks of information.

The benefits of this approach

With a "database" of reusable chunks of information you can:

- Make a change only once and have it implemented in all proposals.
- Re-use content in proposals, fact sheets, Web sites and newsletters.
- Have simultaneous authoring of the proposal.
- Guide writers on what to say.

Conclusion

In summary:

- Apart from situations where you need to establish large amounts of technical or legal detail before you can present a final solution and price, your proposal should only be a written confirmation of what has already been agreed with the client. Indeed, sometimes a proposal isn't necessary at all.
- You may need to address two different groups if you respond to a RFQ.

- Often sales proposals are presented at the wrong time in the buying/selling process or they are done instead of closing the sale verbally.
- A poorly developed proposal can also sink a sale by showing the buyer that you don't really understand their requirements nor have a solution that meets their needs.
- Remember, people buy from people not proposals.
- People buy for emotional reasons, but will justify their decision with rational reasons.

[Retrieved 9/5/05 from http://www.cherryleaf.com/salesprop3.htm]

	Readability statistics as calculated in Microsoft Word								Gunning-Fog index		
	counts			averages		readability					
version	words	paras	sent	sentence per para	words per sentence	passive sentences	Fl-K read ease	Fl-K grade level	complex words	percent complex	score
orig text, Part 3	(MS Word unable to process)										
retyped original	708	46	39	1.5	14.8	7%	55.2	9.2			
Revision 1	654	10	42	5.2	15.3	4%	50.9	9.9			
Revision 2	490	9	30	3.7	16.2	6%	48.3	10.5			
Revision 3	488	9	30	3.3	16.2	10%	48.3	10.5	70	14.34%	12.2
Revision 4	530	21	33	2.5	14.7	6%	48.7	10.1	76	14.34%	11.6

Revision 1: Remove title, contact sentence, headings, subheadings;reconfigure lists as paragraphs

Revision 2: For the one a-level section with more than two subsections, remove middle subsection (current paragraph 5)
In previously bulleted lists of more than three items, delete second item
Remove cohesive devices between paragraphs, such as preview sentence in paragraph 1
Add internal connectives to paragraph 8; regularize spelling; correct typos

Revision 3: Remove trademarked names

Formatting: Change line spacing to 1.5; insert Start/End signals; insert line numbers

Revision 4:

Formatting: Change title and headings to boldface Arial 12, center title

- - - ARTICLE BEGINS HERE - - -

Here we look at the process of writing your proposals. We'll cover several main topics containing useful information.

It is important to have a plan so that you can ensure your proposal is ready in time and, if more than one person is involved, the responsibilities of each member of the team. You may wish to have a sign-off process. We suggest someone not involved in writing the proposal proofreads the proposal, and that you have a checklist. You can use the checklist to verify you have met the requirements fully (or have explained how you will address any shortcomings) and to check there is the necessary "sizzle" to win a competitive situation.

You can break your proposal down into chunks, organized around a skeleton of topic headings. These headings can be structured to form a storyboard that will guide the buyer through your proposal. These headings can help you to be consistent and to be complete. You then delegate responsibility for each section to the relevant people.

Here is some advice regarding the words you use. Keep your vocabulary simple to aid the buyer's understanding. For example, "use" is better than "utilize." Be consistent with the terminology you use. Check your document for any spelling mistakes.

The pyramid style of writing, devised by a well-known consulting firm, recommends you start every section with a summary statement to encourage people to read on. Have an introductory sentence before every list, table and picture, so the buyers know what they relate to. Use the active voice ("we will...") to avoid being ambiguous.

We'd suggest you use gerunds ("-ing") frequently in your headings (e.g. meeting, improving, solving). Follow up any statement you make with "this means that...." Be credible.

The most commonly used word-processing tool that people use to write their proposals doesn't help you address the problems listed in Part One of this article. We have developed a solution, [TradeName], for writing sales proposals that provides a database of reusable chunks of information.

With a database of reusable chunks of information, you can make a change only once and have it implemented in all proposals, have simultaneous authoring of the proposal, and guide writers on what to say.

Apart from situations where you need to establish large amounts of technical or legal detail before you can present a final solution and price, your proposal should only be a written confirmation of what has already been agreed with the client. Indeed, sometimes a proposal isn't necessary at all. Often sales proposals are presented at the wrong time in the buying / selling process or they are done instead of closing the sale verbally. A poorly developed proposal can also sink a sale by showing the buyer that you don't really understand their requirements nor have a solution that meets their needs. Remember, people buy from people, not proposals. People buy for emotional reasons, but will justify their decisions with rational reasons.

- - - ARTICLE ENDS HERE - - -

- - - ARTICLE BEGINS HERE - - -

Advice on how to write a sales proposal – Part 3

In this section, we look at the process of writing your proposals. We'll cover planning, writing tips, and tools.

Planning your proposal

First, develop a plan so that you can ensure your proposal is ready in time and, if more than one person is involved, the responsibilities of each member of the team. You may wish to have a sign-off process. We suggest someone not involved in writing the proposal proofreads the proposal, and that you have a checklist. You can use the checklist to verify you have met the requirements fully (or have explained how you will address any shortcomings) and to check there is the necessary "sizzle" to win a competitive situation.

Next, you can break your proposal down into chunks, organized around a skeleton of topic headings. These headings can be structured to form a storyboard that will guide the buyer through your proposal. These headings can help you to be consistent and to be complete. You then delegate responsibility for each section to the relevant people.

Writing tips for your proposal

Use vocabulary with care. Here is some advice regarding the words you use:

- Keep your vocabulary simple to aid the buyer's understanding. For example, "use" is better than "utilize."
- Be consistent with the terminology you use.
- Check your document for any spelling mistakes.

In addition, use a pyramid style of writing. This style of writing, devised by a well-known consulting firm, recommends you:

- Start every section with a summary statement to encourage people to read on.
- Have an introductory sentence before every list, table and picture, so the buyers know what they relate to.
- Use the active voice ("we will...") to avoid being ambiguous.

Finally, explain concepts clearly. We'd also suggest you use gerunds ("-ing") frequently in your headings (e.g. meeting, improving, solving). Follow up any statement you make with "this means that...." Be credible.

Tools for your proposal

Use the right tools to write your proposal. Unfortunately, the word-processing tool that people most commonly use doesn't help you address the problems listed in Part One of this article. We have developed a solution, [TradeName], for writing sales proposals that provides a database of reusable chunks of information.

With your database of reusable information, you can make a change only once and have it implemented in all proposals, have simultaneous authoring of the proposal, and guide writers on what to say.

Conclusion

In summary, apart from situations where you need to establish large amounts of technical or legal detail before you can present a final solution and price, your proposal should only be a written confirmation of what has already been agreed with the client. Indeed, sometimes a proposal isn't necessary at all. Often sales proposals are presented at the wrong time in the buying / selling process or they are done instead of closing the sale verbally. A poorly developed proposal can also sink a sale by showing the buyer that you don't really understand their requirements nor have a solution that meets their needs. Remember, people buy from people, not proposals. People buy for emotional reasons, but will justify their decisions with rational reasons.

- - - ARTICLE ENDS HERE - - -

APPENDIX D

PANGEA SCENARIO AND ITEM SET

- - - SITUATION BEGINS HERE - - -

You work for a small company that needs a new office building. The company's president wants the new building to be environmentally sound, and he asks you to find out about different types of building materials. While searching the Internet, you find the article on strawbale construction that has been reprinted on the next pages. You are not familiar with this type of construction, so you decide to read the article to learn more. As you read, you consider which information will be most helpful to the president.

- - - SITUATION ENDS HERE - - -

- - - QUESTIONS ON ARTICLE BEGIN HERE - - -

For items 1-5, circle the number on the scale that best expresses your opinion of the article.

(1) Overall, I understand this article . . .

[with great difficulty]	1	2	3	4	5	6	7	8	9	10	[very easily]

(2) I can follow the development of important points in this article . . .

[with great difficulty]	1	2	3	4	5	6	7	8	9	10	[very easily]

(3) Relationships among ideas in this article are . . .

[very unclear]	1	2	3	4	5	6	7	8	9	10	[very clear]

(4) Ideas in this article are . . .

[very poorly connected]	1	2	3	4	5	6	7	8	9	10	[very well connected]

(5) Sections within this article are . . .

[very poorly connected]	1	2	3	4	5	6	7	8	9	10	[very well connected]

For items 6-10, answer each question briefly.

(6) You decide to organize your notes for the president according to the article's main topics. Under which main topic do you put the information in lines 9-15?

Which feature(s) or key word(s) in the article helped you make this connection?

---

(7) You are sure the president will want to know the desirable characteristics of strawbale buildings, mentioned in line 23. What are those characteristics?

Which feature(s) or key word(s) in the article helped you make this connection?

---

(8) You think the president will be interested in the issues studied by the Department of Energy (lines 26-29) and the Environmental Protection Agency (lines 30-34). Which of these agencies would probably study the issues described in lines 35-38?

Which feature(s) or key word(s) in the article helped you make this connection?

_____

(9) You decide to list the building materials thatare sometimes unnecessary in strawbale construction, mentioned in line 35. Which specific materials do you list?

Which feature(s) or key word(s) in the article helped you make this connection?

_____

(10) Line 36 states that the walls of strawbale buildings "breathe." When you report to the president, how will you compare this quality with the ventilation of conventional buildings?

Which feature(s) or key word(s) in the article helped you make this connection?

_____

- - - QUESTIONS ON ARTICLE END HERE - - -

APPENDIX E

CHERRYLEAF SCENARIO AND ITEM SET

- - - SITUATION BEGINS HERE - - -

Several months ago you started your own consulting firm. Although you have gained a few clients, you decide that you need to improve the quality of your written sales proposals in order to attract more clients. A friend tells you about a website that offers helpful information on business communications. On the website, you locate the article that has been reprinted on the next two pages. As you read, you are thinking about how to use the information in the article to write better sales proposals for your firm.

- - - SITUATION ENDS HERE - - -

- - - QUESTIONS ON ARTICLE BEGIN HERE - - -

For items 1-5, circle the number on the scale that best expresses your opinion of the article.

(1) Overall, I understand this article . . .

[with great difficulty]	1	2	3	4	5	6	7	8	9	10	[very easily]

(2) I can follow the development of important points in this article . . .

[with great difficulty]	1	2	3	4	5	6	7	8	9	10	[very easily]

(3) Relationships among ideas in this article are . . .

[very unclear]	1	2	3	4	5	6	7	8	9	10	[very clear]

(4) Ideas in this article are . . .

[very poorly connected]	1	2	3	4	5	6	7	8	9	10	[very well connected]

(5) Sections within this article are . . .

[very poorly connected]	1	2	3	4	5	6	7	8	9	10	[very well connected]

For items 6-10, answer each question briefly.

(6) After skimming the article to locate the main topics, you decide to go back and read about planning the proposal. Where (on which line number) do you find the start of this topic?

Which feature(s) or key word(s) in the article helped you make this connection?

_____

(7) What is the recommended order of the basic steps to follow when planning your proposal?

Which feature(s) or key word(s) in the article helped you make this connection?

_____

(8) Although the word *gerunds* in line 21 is somewhat unfamiliar, you decide this information relates to one of the article's main topics. Which main topic is related to *gerunds*?

Which feature(s) or key word(s) in the article helped you make this connection?

_____

(9) From lines 23-24, you realize that you will have to look elsewhere on the website to find a list of common problems with sales proposals. To find this list, will you probably have to click on Previous, or will you probably have to click on Next?

Which feature(s) or key word(s) in the article helped you make this connection?

_____

(10) When you begin the last block of text (lines 30-37), do you expect to read new information, or do you expect to read information that has already appeared in the article?

Which feature(s) or key word(s) in the article helped you make this connection?

_____

- - - QUESTIONS ON ARTICLE END HERE - - -

APPENDIX F

INSTRUCTIONS AND DEMOGRAPHIC FORM

- - - YOUR TASK IN THIS PROJECT - - -

This project is not a test of your reading ability. The purpose of this research is to help writers improve the connections between ideas in certain types of technical documents.

In this project, you will read two articles in English. These are actual Internet articles that have been written by real writers for real readers. Lines are numbered for your convenience.

Before each article, you will see a short paragraph describing a situation in which a real person might use information from the article.

Read the first situation and article. Then answer the questions that follow it.

SAMPLE QUESTION 1:

The vocabulary in this article is . . .

[very difficult]	1	2	3	4	5	6	7	8	9	10	[very easy]

SAMPLE QUESTION 2:

These lines are adapted from one of the articles:

16 “Straw is the stalk left over after cereal crops such as rice, wheat, and barley are harvested.
17 Tough and durable, it does not easily break down. It is often burned in the field. . . .”

Line 16 begins with the word “straw.” Do the two sentences in line 17 refer to straw, or do the sentences refer to something different?

Which feature(s) or key word(s) in the article helped you make this connection?

As you answer the questions, you may look back at the article.

When you finish the questions for the first article, read the second situation and article, and answer the questions that follow.

You may take as much time as you need for this task. Do not write your name on the articles.

Thank you very much for your help!

My first (native) language is _____ .

I have studied English for _____ year(s).

I have lived in the US for _____ month(s).

APPENDIX G

CODING KEY

Participant # _____

Pangea text:

Question	PoInts	Answers	Features identified
6	+1 (any)	how strawbale construction works the strawbale building techniques building process	First line, “the str building techniques involves...” Forecast statement at beginning, “...how it works...” Wording of main heading Boldface emphasis Larger typeface, “How does str work?”
7	+0.25 +0.25 +0.25 +0.25	economical energy efficient healthy renewable	“...the following desirable ...” or “several desirable...” Three subheadings in bold Main heading in bold: “What are the benefits of..?” “First,” “In addition,” “Finally”
8	+1	EPA	“Fortunately” “these materials” “...constantly exchanging the air inside...”; references to air Paragraphs are under the same heading (Links info in lines 53-57 [35-38] to info in preceding para Topics in two adjacent paras are linked
9	+0.25 +0.25 +0.25 +0.25	Building materials Paints Furniture Carpets	“these materials” “Building materials” “fortunately” Materials are listed in previous paragraph
10	+1 (any)	Unlike strawbale buildings... Strawbale ventilation is better... (should make comparison)	“Even better” “...exchanging the air inside...” “Sealed” and “breathe” are opposites

Cherryleaf text:

Question	PoInts	Answers	Features identified
6	+1	line 6 or 7 (CO) line 4 (NC)	“First, develop a plan” or “It is important to have a plan” Forecast stmt: “We’ll cover planning” Main heading in bold: “Planning your proposal”
7	+0.34 +0.33 +0.33	Develop a plan Break proposal down into chunks Delegate responsibility...	“First” “Next” “You then...”
8	+1	Writing tips, or advice regarding words... (should refer to writing)	“Finally” “We’d also suggest” Word occurs in para under main heading, “Writing tips...” Reference to “writing” or “words you use”
9	+1	Previous	Reference to “problems listed in Part One”
10	+1	Already appeared	“In summary” “Conclusion”

APPENDIX H

RAW SCORES AND DESCRIPTIVE STATISTICS

DESCRIPTIVE STATISTICS, Group 1 (n = 10) and Group 2 (n = 5)

FIRST TEXT READ: COHESIVE PANGEA

Gr	L	Item1	Item2	Item3	Item4	Item5	Item6a	Item7a	Item8a	Item9a	Itm10a
1	NS	9.00	7.00	7.00	4.00	6.00	1.00	0.50	1.00	0.00	1.00
1	NS	9.00	9.00	7.00	9.00	9.00	1.00	1.00	1.00	0.25	0.00
1	NS	8.00	9.00	8.00	8.00	7.00	0.00	1.00	1.00	1.00	1.00
1	NS	9.00	10.00	8.00	8.00	8.00	1.00	1.00	1.00	1.00	0.00
1	NS	9.00	7.00	6.00	7.00	7.00	1.00	0.75	1.00	0.75	1.00
1	NS	9.00	8.00	8.00	7.00	8.00	1.00	1.00	1.00	0.00	0.00
1	NS	9.00	8.00	9.00	8.00	9.00	1.00	1.00	1.00	0.75	1.00
1	NS	8.00	9.00	8.00	9.00	8.00	1.00	1.00	0.00	0.00	1.00
1	NS	10.00	10.00	9.00	10.00	10.00	0.00	1.00	1.00	0.00	0.00
1	NS	10.00	10.00	10.00	10.00	10.00	1.00	1.00	1.00	0.00	0.00
	Median =	9.0000	9.0000	8.0000	8.0000	8.0000	1.0000	1.0000	1.0000	0.1250	0.5000
	Mean =	9.0000	8.7000	8.0000	8.0000	8.2000	0.8000	0.9250	0.9000	0.3750	0.5000
	Min-Max=	8.-10.	7.-10.	6.-10.	4.-10.	6.-10.	0.0-1.0	0.5-1.0	0.0-1.0	0.0-1.0	0.0-1.0
	Range =	2.0000	3.0000	4.0000	6.0000	4.0000	1.0000	0.5000	1.0000	1.0000	1.0000
	SD =	0.6667	1.1595	1.1547	1.7638	1.3166	0.4216	0.1687	0.3162	0.4449	0.5271
2	NNS	10.00	10.00	10.00	7.00	7.00	1.00	1.00	1.00	0.25	1.00
2	NNS	9.00	10.00	10.00	9.00	8.00	1.00	1.00	1.00	1.00	0.00
2	NNS	10.00	10.00	9.00	10.00	9.00	0.00	1.00	1.00	0.00	0.00
2	NNS	9.00	10.00	10.00	10.00	10.00	0.00	1.00	1.00	0.00	0.00
2	NNS	8.00	9.00	10.00	7.00	7.00	1.00	1.00	1.00	0.50	1.00
	Median =	9.0000	10.000	10.000	9.0000	8.0000	1.0000	1.0000	1.0000	0.2500	0.0000
	Mean =	9.2000	9.8000	9.8000	8.6000	8.2000	0.6000	1.0000	1.0000	0.3500	0.4000
	Min-Max =	8.-10.	9.-10.	9.-10.	7.-10.	7.-10.	0.0-1.0	1.0-1.0	1.0-1.0	0.0-1.0	0.0-1.0
	Range =	2.0000	1.0000	1.0000	3.0000	3.0000	1.0000	0.0000	0.0000	1.0000	1.0000
	SD=	0.8367	0.4472	0.4472	1.5166	1.3038	0.5477	0.0000	0.0000	0.4183	0.5477

SECOND TEXT READ: NON-COHESIVE CHERRYLEAF

Gr	L	Item1	Item2	Item3	Item4	Item5	Item6a	Item7a	Item8a	Item9a	Itm10a
1	NS	5.00	4.00	6.00	4.00	7.00	0.00	0.00	0.00	0.00	0.00
1	NS	9.00	7.00	7.00	8.00	6.00	1.00	0.67	0.00	1.00	0.00
1	NS	6.00	5.00	5.00	4.00	4.00	1.00	0.34	1.00	1.00	1.00
1	NS	8.00	8.00	7.00	7.00	7.00	1.00	0.00	0.00	1.00	1.00
1	NS	4.00	3.00	3.00	3.00	2.00	1.00	0.67	1.00	1.00	0.00
1	NS	7.00	5.00	3.00	3.00	4.00	1.00	0.00	1.00	1.00	0.00
1	NS	7.00	6.00	6.00	5.00	6.00	1.00	0.00	1.00	0.00	0.00
1	NS	5.00	5.00	6.00	3.00	2.00	0.00	0.34	1.00	1.00	1.00
1	NS	3.00	2.00	1.00	1.00	1.00	1.00	0.34	0.00	0.00	0.00
1	NS	7.00	5.00	3.00	3.00	2.00	1.00	0.34	0.00	1.00	1.00
	Median =	6.5000	5.0000	5.5000	3.5000	4.0000	1.0000	0.3400	0.5000	1.0000	0.0000
	Mean =	6.1000	5.0000	4.7000	4.1000	4.1000	0.8000	0.2700	0.5000	0.7000	0.4000
	Min-Max =	3.-9.	2.-8.	1.-7.	1.-8.	1.-7.	0.0-1.0	0.-0.67	0.0-1.0	0.0-1.0	0.0-1.0
	Range =	6.0000	6.0000	6.0000	7.0000	6.0000	1.0000	0.6700	1.0000	1.0000	1.0000
	SD =	1.8529	1.7638	2.0575	2.0790	2.2828	0.4216	0.2648	0.5271	0.4831	0.5164
2	NNS	9.00	10.00	7.00	9.00	7.00	1.00	0.00	0.00	1.00	0.00
2	NNS	8.00	8.00	8.00	7.00	6.00	1.00	0.34	0.00	1.00	0.00
2	NNS	10.00	10.00	10.00	10.00	9.00	0.00	0.67	0.00	1.00	0.00
2	NNS	8.00	8.00	7.00	8.00	7.00	1.00	0.00	0.00	0.00	1.00
2	NNS	8.00	7.00	5.00	5.00	5.00	1.00	0.00	0.00	0.00	0.00
	Median =	8.0000	8.0000	7.0000	8.0000	7.0000	1.0000	0.0000	0.0000	1.0000	0.0000
	Mean =	8.6000	8.6000	7.4000	7.8000	6.8000	0.8000	0.2020	0.0000	0.6000	0.2000
	Min-Max =	8.-10.	7.-10.	5.-10.	5.-10.	5.-9.	0.0-1.0	0-0.67	0.0-0.0	0.0-1.0	0.0-1.0
	Range =	2.0000	3.0000	5.0000	5.0000	4.0000	1.0000	0.6700	0.0000	1.0000	1.0000
	SD =	0.8944	1.3416	1.8166	1.9235	1.4832	0.4472	0.3002	0.0000	0.5477	0.4472

DESCRIPTIVE STATISTICS, Group 3 (n = 9) and Group 4 (n = 5)

FIRST TEXT READ: NON-COHESIVE PANGEA

Gr	Lang	Item1	Item2	Item3	Item4	Item5	Item6a	Item7a	Item8a	Item9a	Itm10a
3	NS	10.00	10.00	9.00	9.00	10.00	1.00	0.25	1.00	0.00	1.00
3	NS	9.00	9.00	10.00	7.00	7.00	1.00	0.50	1.00	0.00	0.00
3	NS	9.00	9.00	9.00	9.00	9.00	1.00	0.50	0.50	0.00	1.00
3	NS	10.00	10.00	8.00	8.00	9.00	1.00	0.50	1.00	0.00	1.00
3	NS	10.00	9.00	9.00	9.00	9.00	1.00	0.50	1.00	0.00	0.00
3	NS	9.00	9.00	8.00	9.00	9.00	1.00	0.50	1.00	0.00	1.00
3	NS	10.00	10.00	10.00	10.00	7.00	1.00	0.25	1.00	0.00	1.00
3	NS	9.00	8.00	9.00	7.00	7.00	0.00	0.25	1.00	0.00	1.00
3	NS	8.00	9.00	8.00	8.00	9.00	0.00	1.00	1.00	0.00	1.00
	Median =	9.0000	9.0000	9.0000	9.0000	9.0000	1.0000	0.5000	1.0000	0.0000	1.0000
	Mean =	9.3333	9.2222	8.8889	8.4444	8.4444	0.7778	0.4722	0.9444	0.0000	0.7778
	Min-Max =	8.-10.	8.-10.	8.-10.	7.-10.	7.-10.	0.0-1.0	.25-1.0	0.5-1.0	0.0-0.0	0.0-1.0
	Range =	2.0000	2.0000	2.0000	3.0000	3.0000	1.0000	0.7500	0.5000	0.0000	1.0000
	SD =	0.7071	0.6667	0.7817	1.0138	1.1304	0.4410	0.2320	0.1667	0.0000	0.4410
4	NNS	9.00	9.00	6.00	9.00	8.00	0.00	0.25	0.00	0.00	1.00
4	NNS	9.00	9.00	7.00	9.00	7.00	1.00	0.25	0.50	0.00	0.00
4	NNS	9.00	9.00	10.00	10.00	10.00	0.00	0.50	1.00	0.25	1.00
4	NNS	4.00	4.00	3.00	3.00	5.00	0.00	0.25	1.00	0.00	1.00
4	NNS	7.00	6.00	8.00	5.00	4.00	1.00	0.25	1.00	0.00	0.00
	Median =	9.0000	9.0000	7.0000	9.0000	7.0000	0.0000	0.2500	1.0000	0.0000	1.0000
	Mean =	7.6000	7.4000	6.8000	7.2000	6.8000	0.4000	0.3000	0.7000	0.0500	0.6000
	Min-Max =	4.-9.	4.-9.	3.-10.	3.-10.	4.-10.	0.0-1.0	.25-0.5	0.0-1.0	0-0.25	0.0-1.0
	Range =	5.0000	5.0000	7.0000	7.0000	6.0000	1.0000	0.2500	1.0000	0.2500	1.0000
	SD =	2.1909	2.3022	2.5884	3.0332	2.3875	0.5477	0.1118	0.4472	0.1118	0.5477

SECOND TEXT READ: COHESIVE CHERRYLEAF

Gr	Lang	Item1	Item2	Item3	Item4	Item5	Item6a	Item7a	Item8a	Item9a	Itm10a
3	NS	4.00	7.00	4.00	3.00	3.00	1.00	0.67	1.00	1.00	1.00
3	NS	5.00	4.00	3.00	3.00	3.00	0.00	0.67	0.00	1.00	1.00
3	NS	8.00	7.00	6.00	8.00	6.00	1.00	1.00	1.00	1.00	1.00
3	NS	6.00	7.00	4.00	4.00	4.00	1.00	0.67	0.00	1.00	1.00
3	NS	9.00	9.00	10.00	10.00	10.00	1.00	0.67	1.00	1.00	1.00
3	NS	4.00	4.00	4.00	3.00	4.00	1.00	0.34	1.00	0.00	1.00
3	NS	7.00	6.00	6.00	6.00	4.00	1.00	0.00	0.00	0.00	0.00
3	NS	4.00	6.00	4.00	3.00	4.00	1.00	0.67	1.00	0.00	1.00
3	NS	5.00	9.00	8.00	6.00	6.00	1.00	1.00	1.00	1.00	1.00
	Median =	5.0000	7.0000	4.0000	4.0000	4.0000	1.0000	0.6700	1.0000	1.0000	1.0000
	Mean =	5.7778	6.5556	5.4444	5.1111	4.8889	0.8889	0.6322	0.6667	0.6667	0.8889
	Min-Max =	4.-9.	4.-9.	3.-10.	3.-10.	3.-10.	0.0-1.0	0.0-1.0	0.0-1.0	0.0-1.0	0.0-1.0
	Range =	5.0000	5.0000	7.0000	7.0000	7.0000	1.0000	1.0000	1.0000	1.0000	1.0000
	SD =	1.8559	1.8105	2.2973	2.5712	2.2048	0.3333	0.3088	0.5000	0.5000	0.3333
4	NNS	7.00	8.00	8.00	7.00	8.00	1.00	0.00	0.00	1.00	1.00
4	NNS	9.00	9.00	10.00	10.00	10.00	1.00	0.67	0.00	0.00	0.00
4	NNS	5.00	5.00	5.00	6.00	7.00	0.00	0.34	1.00	0.00	0.00
4	NNS	7.00	8.00	7.00	7.00	8.00	0.00	0.67	0.00	0.00	1.00
4	NNS	8.00	8.00	7.00	9.00	8.00	1.00	0.00	0.00	1.00	1.00
	Median =	7.0000	8.0000	7.0000	7.0000	8.0000	1.0000	0.3400	0.0000	0.0000	1.0000
	Mean =	7.2000	7.6000	7.4000	7.8000	8.2000	0.6000	0.3360	0.2000	0.4000	0.6000
	Min-Max =	5.-9.	5.-9.	5.-10.	6.-10.	7.-10.	0.0-1.0	.0-0.67	0.0-1.0	0.0-1.0	0.0-1.0
	Range =	4.0000	4.0000	5.0000	4.0000	3.0000	1.0000	0.6700	1.0000	1.0000	1.0000
	SD =	1.4832	1.5166	1.8166	1.6432	1.0955	0.5477	0.3350	0.4472	0.5477	0.5477

DESCRIPTIVE STATISTICS, Group 5 (n = 11) and Group 6 (n = 4)

FIRST TEXT READ: COHESIVE CHERRYLEAF

Gr	Lang	Item1	Item2	Item3	Item4	Item5	Item6a	Item7a	Item8a	Item9a	Itm10a
5	NS	7.00	7.00	4.00	4.00	5.00	1.00	0.67	0.00	0.00	1.00
5	NS	9.00	6.00	6.00	6.00	7.00	1.00	1.00	0.00	0.00	1.00
5	NS	5.00	7.00	9.00	7.00	7.00	1.00	0.34	0.00	1.00	1.00
5	NS	8.00	7.00	7.00	8.00	6.00	1.00	1.00	1.00	1.00	1.00
5	NS	10.00	10.00	10.00	9.00	10.00	1.00	0.67	1.00	0.00	1.00
5	NS	9.00	9.00	8.00	10.00	10.00	1.00	0.67	1.00	1.00	1.00
5	NS	8.00	9.00	8.00	7.00	6.00	1.00	0.67	1.00	0.00	1.00
5	NS	9.00	9.00	8.00	9.00	8.00	1.00	0.67	1.00	1.00	1.00
5	NS	6.00	3.00	7.00	4.00	3.00	1.00	1.00	1.00	0.00	0.00
5	NS	4.00	3.00	2.00	4.00	4.00	1.00	0.67	1.00	1.00	1.00
5	NS	9.00	9.00	8.00	7.00	7.00	1.00	0.34	1.00	0.00	1.00
	Median =	8.0000	7.0000	8.0000	7.0000	7.0000	1.0000	0.6700	1.0000	0.0000	1.0000
	Mean =	7.6364	7.1818	7.0000	6.8182	6.6364	1.0000	0.7000	0.7273	0.4545	0.9091
	Min-Max =	4.-10.	3.-10.	2.-10.	4.-10.	3.-10.	1.0-1.0	0.34-1.0	0.0-1.0	0.0-1.0	0.0-1.0
	Range =	6.0000	7.0000	8.0000	6.0000	7.0000	0.0000	0.6600	1.0000	1.0000	1.0000
	SD =	1.9117	2.4008	2.2804	2.1363	2.2033	0.0000	0.2312	0.4671	0.5222	0.3015
6	NNS	8.00	6.00	9.00	8.00	8.00	1.00	0.34	1.00	1.00	1.00
6	NNS	8.00	8.00	9.00	9.00	9.00	1.00	0.67	0.00	1.00	1.00
6	NNS	10.00	9.00	9.00	9.00	8.00	1.00	0.67	1.00	0.00	1.00
6	NNS	9.00	10.00	10.00	9.00	9.00	1.00	0.67	1.00	1.00	1.00
	Median =	8.5000	8.5000	9.0000	9.0000	8.5000	1.0000	0.6700	1.0000	1.0000	1.0000
	Mean =	8.7500	8.2500	9.2500	8.7500	8.5000	1.0000	0.5875	0.7500	0.7500	1.0000
	Min-Max =	8.-10.	6.-10.	9.-10.	8.-9.	8.-9.	1.0-1.0	0.34-0.67	0.0-1.0	0.0-1.0	1.0-1.0
	Range =	2.0000	4.0000	1.0000	1.0000	1.0000	0.0000	0.3300	1.0000	1.0000	0.0000
	SD =	0.9574	1.7078	0.5000	0.5000	0.5774	0.0000	0.1650	0.5000	0.5000	0.0000

SECOND TEXT READ: NON-COHESIVE PANGEA

Gr	Lang	Item1	Item2	Item3	Item4	Item5	Item6a	Item7a	Item8a	Item9a	Itm10a
5	NS	10.00	10.00	10.00	9.00	9.00	1.00	0.50	1.00	0.00	1.00
5	NS	10.00	10.00	10.00	10.00	10.00	1.00	0.25	0.00	0.00	0.00
5	NS	10.00	8.00	5.00	2.00	2.00	1.00	0.50	1.00	0.00	0.00
5	NS	9.00	8.00	8.00	8.00	8.00	1.00	1.00	1.00	0.00	0.00
5	NS	9.00	10.00	9.00	9.00	7.00	1.00	0.50	1.00	0.00	0.00
5	NS	10.00	10.00	9.00	9.00	8.00	1.00	0.50	1.00	0.00	1.00
5	NS	9.00	7.00	7.00	7.00	7.00	1.00	0.50	1.00	0.00	0.00
5	NS	10.00	10.00	4.00	2.00	2.00	1.00	0.50	1.00	0.50	1.00
5	NS	9.00	8.00	10.00	9.00	9.00	1.00	0.50	1.00	0.00	0.00
5	NS	9.00	9.00	9.00	6.00	9.00	1.00	0.25	1.00	0.00	1.00
5	NS	10.00	10.00	10.00	10.00	10.00	1.00	0.50	1.00	0.00	0.00
	Median =	10.000	10.000	9.0000	9.0000	8.0000	1.0000	0.5000	1.0000	0.0000	0.0000
	Mean =	9.5455	9.0909	8.2727	7.3636	7.3636	1.0000	0.5000	0.9091	0.0455	0.3636
	Min-Max =	9.-10.	7.-10.	4.-10.	2.-10.	2.-10.	1.0-1.0	0.25-10	0.0-1.0	0.0-0.5	0.0-1.0
	Range =	1.0000	3.0000	6.0000	8.0000	8.0000	0.0000	0.7500	1.0000	0.5000	1.0000
	SD =	0.5222	1.1362	2.1020	2.9077	2.8381	0.0000	0.1937	0.3015	0.1508	0.5045
6	NNS	7.00	7.00	6.00	6.00	7.00	1.00	0.50	1.00	0.00	1.00
6	NNS	9.00	9.00	9.00	8.00	8.00	1.00	0.25	1.00	0.00	1.00
6	NNS	10.00	10.00	10.00	8.00	7.00	1.00	1.00	1.00	0.00	0.00
6	NNS	9.00	9.00	4.00	3.00	4.00	1.00	0.50	1.00	0.25	1.00
	Median =	9.0000	9.0000	7.5000	7.0000	7.0000	1.0000	0.5000	1.0000	0.0000	1.0000
	Mean =	8.7500	8.7500	7.2500	6.2500	6.5000	1.0000	0.5625	1.0000	0.0625	0.7500
	Min-Max =	7.-10.	7.-10.	4.-10.	3.-8.	4.-8.	1.0-1.0	0.25-1.0	1.0-1.0	0.-0.25	0.0-1.0
	Range =	3.0000	3.0000	6.0000	5.0000	4.0000	0.0000	0.7500	0.0000	0.2500	1.0000
	SD =	1.2583	1.2583	2.7538	2.3629	1.7321	0.0000	0.3146	0.0000	0.1250	0.5000

DESCRIPTIVE STATISTICS, Group 7 (n = 10) and Group 8 (n = 5)

FIRST TEXT READ: NON-COHESIVE CHERRYLEAF

Gr	L	Item1	Item2	Item3	Item4	Item5	Item6a	Item7a	Item8a	Item9a	Itm10a
7	NS	6.00	4.00	5.00	3.00	4.00	1.00	0.00	0.00	0.00	0.00
7	NS	6.00	7.00	6.00	7.00	4.00	1.00	0.00	1.00	1.00	0.00
7	NS	9.00	8.00	8.00	7.00	7.00	1.00	0.67	0.00	1.00	1.00
7	NS	9.00	9.00	7.00	6.00	6.00	0.00	0.00	0.00	0.00	1.00
7	NS	7.00	6.00	6.00	4.00	3.00	1.00	0.00	0.00	1.00	0.00
7	NS	8.00	9.00	10.00	9.00	5.00	1.00	0.00	1.00	1.00	0.00
7	NS	9.00	9.00	9.00	9.00	9.00	1.00	0.34	1.00	1.00	0.00
7	NS	7.00	6.00	3.00	3.00	4.00	0.00	0.34	0.00	1.00	1.00
7	NS	8.00	9.00	10.00	5.00	6.00	1.00	0.34	0.00	0.00	1.00
7	NS	7.00	7.00	8.00	8.00	7.00	0.00	0.34	0.00	1.00	1.00
	Median =	7.5000	7.5000	7.5000	6.5000	5.5000	1.0000	0.1700	0.0000	1.0000	0.5000
	Mean =	7.6000	7.4000	7.2000	6.1000	5.5000	0.7000	0.2030	0.3000	0.7000	0.5000
	Min-Max =	6.-9.	4.-9.	3.-10.	3.-9.	3.-9.	0.0-1.0	0.-0.67	0.0-1.0	0.0-1.0	0.0-1.0
	Range =	3.0000	5.0000	7.0000	6.0000	6.0000	1.0000	0.6700	1.0000	1.0000	1.0000
	SD =	1.1738	1.7127	2.2509	2.2828	1.8409	0.4831	0.2355	0.4831	0.4831	0.5271
8	NNS	8.00	8.00	8.00	9.00	9.00	0.00	0.34	0.00	0.00	1.00
8	NNS	9.00	10.00	8.00	9.00	7.00	1.00	0.00	0.00	0.00	1.00
8	NNS	5.00	6.00	7.00	8.00	4.00	1.00	0.67	1.00	0.00	1.00
8	NNS	9.00	9.00	8.00	8.00	8.00	1.00	0.67	1.00	0.00	0.00
8	NNS	8.00	9.00	7.00	8.00	6.00	1.00	0.67	0.00	1.00	0.00
	Median =	8.0000	9.0000	8.0000	8.0000	7.0000	1.0000	0.6700	0.0000	0.0000	1.0000
	Mean =	7.8000	8.4000	7.6000	8.4000	6.8000	0.8000	0.4700	0.4000	0.2000	0.6000
	Min-Max =	5.-9.	6.-10.	7.-8.	8.-9.	4.-9.	0.0-1.0	0.-0.67	0.0-1.0	0.0-1.0	0.0-1.0
	Range =	4.0000	4.0000	1.0000	1.0000	5.0000	1.0000	0.6700	1.0000	1.0000	1.0000
	SD =	1.6432	1.5166	0.5477	0.5477	1.9235	0.4472	0.2991	0.5477	0.4472	0.5477

SECOND TEXT READ: COHESIVE PANGEA

Gr	L	Item1	Item2	Item3	Item4	Item5	Item6a	Item7a	Item8a	Item9a	Itm10a
7	NS	10.00	10.00	9.00	9.00	8.00	1.00	1.00	1.00	1.00	0.00
7	NS	10.00	10.00	10.00	10.00	10.00	1.00	1.00	1.00	0.50	0.00
7	NS	10.00	10.00	5.00	4.00	4.00	1.00	0.50	1.00	1.00	0.00
7	NS	10.00	10.00	9.00	8.00	8.00	0.00	1.00	1.00	0.00	0.00
7	NS	10.00	10.00	10.00	10.00	10.00	1.00	1.00	1.00	1.00	1.00
7	NS	10.00	10.00	9.00	10.00	9.00	0.00	1.00	1.00	1.00	0.00
7	NS	10.00	10.00	10.00	10.00	10.00	1.00	1.00	1.00	1.00	0.00
7	NS	10.00	10.00	9.00	9.00	9.00	1.00	1.00	1.00	0.25	0.00
7	NS	10.00	10.00	10.00	10.00	10.00	1.00	1.00	1.00	0.25	1.00
7	NS	9.00	10.00	10.00	9.00	10.00	1.00	0.50	1.00	0.00	0.00
	Median =	10.0000	10.0000	9.5000	9.5000	9.5000	1.0000	1.0000	1.0000	0.7500	0.0000
	Mean =	9.9000	10.0000	9.1000	8.9000	8.8000	0.8000	0.9000	1.0000	0.6000	0.2000
	Min-Max =	9.-10	10.-10.	5.-10.	4.-10.	4.-10.	0.0-1.0	0.5-1.0	1.0-1.0	0.0-1.0	0.0-1.0
	Range =	1.0000	0.0000	5.0000	6.0000	6.0000	1.0000	0.5000	0.0000	1.0000	1.0000
	SD =	0.3162	0.0000	1.5239	1.8529	1.8738	0.4216	0.2108	0.0000	0.4441	0.4216
8	NNS	10.00	10.00	10.00	10.00	10.00	0.00	1.00	1.00	0.00	1.00
8	NNS	10.00	10.00	10.00	10.00	10.00	0.00	0.75	1.00	0.50	0.00
8	NNS	10.00	10.00	9.00	9.00	9.00	1.00	1.00	1.00	1.00	1.00
8	NNS	10.00	10.00	10.00	10.00	10.00	0.00	1.00	1.00	0.00	1.00
8	NNS	10.00	10.00	10.00	10.00	10.00	1.00	1.00	1.00	0.00	1.00
	Median =	10.0000	10.0000	10.0000	10.000	10.000	0.0000	1.0000	1.0000	0.0000	1.0000
	Mean =	10.0000	10.0000	9.8000	9.8000	9.8000	0.4000	0.9500	1.0000	0.3000	0.8000
	Min-Max =	10.-10.	10.-10.	9.-10.	9.-10.	9.-10.	0.0-1.0	.75-1.0	1.0-1.0	0.0-1.0	0.0-1.0
	Range =	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000	0.2500	0.0000	1.0000	1.0000
	SD =	0.0000	0.0000	0.4472	0.4472	0.4472	0.5477	0.1118	0.0000	0.4472	0.4472

APPENDIX I

TALLIES OF METALINGUISTIC DEVICES

Cohesive devices named in first Pangea texts

by language group (NS / NNS) and text condition (CO / NC)

Item	Semantic devices named	NS CO	NNS CO	NS NC	NNS NC	Structural devices named	NS CO	NNS CO	NS NC	NNS NC
6a	Title of article	1				Boldface emphasis	1			
	First line, "the str building techni involves..."	3	3	5	1	Larger typeface, "How does str work?"				
	Forecast at beginning, "...how it works..."					Section title on separate line	1			
	Wording of main heading	3								
7a	"...the following desirable ..."	1				Three subheadings in bold	8			
	"...several desirable..."		1	5		Main head in bold: "...the benefits of..?"				
	"First," "In addition," "Finally"					Line 35 punctuation	2			
	Supporting stmts after named features	2				Spatial separation of ideas				
						Initial words of paragraphs	1	1		
8a	"Fortunately"					Paragraphs are under the same				
	"these materials"					heading				
	"...constantly exchanging the air inside";	1								
	other references to air	2	2	4	3					
	Links to info in preceding para	3								
9a	"these materials"	2	1			Paragraph under main heading				
	"Building materials"	1								
	"fortunately"		1							
	Materials are listed in previous paragraph	2								
	Some materials									
10a	"Even better"									
	"...exchanging the air inside..."	8	2	2	2					
	"Sealed" and "breathe" are opposites	1		1						
	Superior		1							
	SEMANTIC OCCURRENCES	30	11	17	6	STRUCTURAL OCCURRENCES	13	1		
	TOTAL OCCURRENCES, ALL TYPES =	78								

Cohesive devices named in first Cherryleaf texts

by language group (NS / NNS) and text condition (CO / NC)

Item	Semantic devices identified	NS CO	NNS CO	NS NC	NNS NC	Structural devices identified	NS CO	NNS CO	NS NC	NNS NC
6a	"plan"				1	Main heading in bold: "Planning your	8	2		
	"First, develop a plan"	4	1			proposal"				
	"It is important to have a plan"			6	3					
	Forecast statement: "We'll cover planning"									
7a	"First"	8	3			Topics in different paragraphs				
	"Next"	9	3							
	"You then..."	2			1					
8a	"Finally"					Word occurs in para under bold main	6	1		
	"We'd also suggest"			1	1	heading, "Writing tips..."				
	Reference to "writing" or "words you use"	2		3		Chunking, separation of topic into paras				
9a	Reference to Part One	8	1	7	2	Part 3 included in title	3			
10a	"In summary" at start of paragraph	7	2			"Conclusion" subhead in bold	7	3		
	SEMANTIC OCCURRENCES	40	10	17	8	STRUCTURAL OCCURRENCES	24	6		
	TOTAL OCCURRENCES, ALL TYPES =	105								

Cohesive devices identified in Pangea texts (original research design)
by language group (NS / NNS) and composing strategy (CO / NC)

Item	Semantic devices identified	NS CO	NS NC	NN CO	NN NC	Structural devices identified	NS CO	NS NC	NN CO	NN NC
6a	Title of article	3	0	0	0	Boldface emphasis	2	0	1	0
	First line, "the str building techni involves..."	7	14	3	1	Larger typeface, "How does str work?"	0	0	1	0
	Forecast at beginning, "...how it works..."	1	0	1	0	Section title on separate line	1	0	0	0
	Wording of main heading	3	0	1	0					
7a	"...the following desirable ..."	3	0	1	0	Three subheadings in bold	13	0	6	0
	"...several desirable..."	1	7	0	0	Main head in bold: "...the benefits of..?"	3	0	0	0
	"First," "In addition," "Finally"	0	0	1	0	Line 35 punctuation	2	0	0	0
	Supporting stmts after named features	1	0	0	1	Spatial separation of ideas	1	1	0	0
						Initial words of paragraphs	1	0	0	0
8a	"Fortunately"	0	0	0	0	Paragraphs are under the same	4	0	2	0
	"these materials"	0	0	2	0	heading				
	"...constantly exchanging the air inside"; other references to air	8	16	6	8					
	Links to info in preceding para	7	4	0	0					
9a	"these materials"	3	0	3	0	Paragraph under main heading	1	0	0	0
	"Building materials"	1	0	1	1					
	"fortunately"	0	0	1	0					
	Materials are listed in previous paragraph	9	0	0	0					
	Some materials	0	1	0	0					
10a	"Even better"	0	0	1	0					
	"...exchanging the air inside..."	9	7	3	3					
	"Sealed" and "breathe" are opposites	1	2	1	2					
	Superior	1	0	1	0					
	SEMANTIC DEVICES IDENTIFIED	57	51	26	16	STRUCTURAL DEVICES IDENTIFIED	28	1	10	0
	TOTAL DEVICES, ALL TYPES = 189									

Cohesive devices identified in Cherryleaf texts (original research design)
by language group (NS / NNS) and composing strategy (CO / NC)

Item	Semantic devices identified	NS CO	NS NC	NN CO	NN NC	Structural devices identified	NS CO	NS NC	NN CO	NN NC
6a	"plan"	0	2	1	4	Main heading in bold: "Planning your	13	0	4	0
	"First, develop a plan"	7	0	2	0	proposal"				
	"It is important to have a plan"	0	12	0	3					
	Forecast statement: "We'll cover planning"	0	0	0	0					
7a	"First"	13	0	4	0	Topics in different paragraphs	0	1	0	0
	"Next"	13	0	4	0					
	"You then..."	3	0	1	2					
8a	"Finally"	0	0	0	0	Word occurs in para under bold main	10	0	1	0
	"We'd also suggest"	0	0	0	0	heading, "Writing tips..."				
	Reference to "writing" or "words you use"	2	7	2	0	Chunking, separation of topic into paras	0	1	0	0
9a	Reference to Part One	9	12	3	5	Part 3 included in title	1	0	0	0
10a	"In summary" at start of paragraph	11	0	4	0	"Conclusion" subhead in bold	12	0	3	0
	SEMANTIC DEVICES IDENTIFIED	58	33	21	14	STRUCTURAL DEVICES IDENTIFIED	36	2	8	0
	TOTAL DEVICES, ALL TYPES = 172									

APPENDIX J

PANGEA RANKED SCORES AND ANALYSES

Pangea item 1: Descriptive statistics for ranked scores and nonparametric analyses for cohesive and non-cohesive versions

Item 1: "Overall, I understand this article [with great difficulty, 1] <--> [very easily, 5]"

DESCRIPTIVE STATISTICS FOR RANKED SCORES

Group 1 NS / CO		Group 2 NNS / CO		Group 3 NS / NC		Group 4 NNS / NC	
n=10		n=5		n=9		n=5	
Score	Rank	Score	Rank	Score	Rank	Score	Rank
9.00	14.00	10.00	25.50	10.00	25.50	9.00	14.00
9.00	14.00	9.00	14.00	9.00	14.00	9.00	14.00
8.00	4.50	10.00	25.50	9.00	14.00	9.00	14.00
9.00	14.00	9.00	14.00	10.00	25.50	4.00	1.00
9.00	14.00	8.00	4.50	10.00	25.50	7.00	2.00
9.00	14.00			9.00	14.00		
9.00	14.00			10.00	25.50		
8.00	4.50			9.00	14.00		
10.00	25.50			8.00	4.50		
10.00	25.50						
Sum=	144.00	Sum=	83.50	Sum=	162.50	Sum=	45.00
Median=	14.00	Median=	14.00	Median=	14.00	Median=	14.00
Mean=	14.40	Mean=	16.70	Mean=	18.06	Mean=	9.00

KRUSKAL-WALLIS

$\chi 2$ (3, N = 29) = 4.638, p = 0.200 [asymp]

Pangea item 2: Descriptive statistics for ranked scores and nonparametric analyses for cohesive and non-cohesive versions

Item 2: "I can follow development of important points in this article [with great difficulty, 1] <--> [very easily, 5]"

DESCRIPTIVE STATISTICS FOR RANKED SCORES

Group 1 NS / CO n=10		Group 2 NNS / CO n=5		Group 3 NS / NC n=9		Group 4 NNS / NC n=5	
Score	Rank	Score	Rank	Score	Rank	Score	Rank
7.00	3.50	10.00	24.50	10.00	24.50	9.00	13.50
9.00	13.50	10.00	24.50	9.00	13.50	9.00	13.50
9.00	13.50	10.00	24.50	9.00	13.50	9.00	13.50
10.00	24.50	10.00	24.50	10.00	24.50	4.00	1.00
7.00	3.50	9.00	13.50	9.00	13.50	6.00	2.00
8.00	6.00			9.00	13.50		
8.00	6.00			10.00	24.50		
9.00	13.50			8.00	6.00		
10.00	24.50			9.00	13.50		
10.00	24.50						
Sum=	133.00	Sum=	111.50	Sum=	147.00	Sum=	43.50
Median=	13.50	Median=	24.50	Median=	13.50	Median=	13.50
Mean=	13.30	Mean=	22.30	Mean=	16.33	Mean=	8.70

KRUSKAL-WALLIS

$\chi 2$ (3, N = 29) = 7.921, p = 0.048 [asymp]

$\eta 2$ = 0.28289

POST HOC COMPARISONS

Group	n	Mean rank	Sum of ranks	Mann Whitney U	Exact signif
1	10	6.55	65.50		
2	5	10.90	54.50	10.50	0.075
1	10	8.90	89.00		
3	9	11.22	101.00	34.000	0.400
1	10	8.85	88.50		
4	5	6.30	31.50	16.500	0.310
2	5	9.70	48.50		
3	9	6.28	56.50	11.500	0.147
2	5	7.70	38.50		
4	5	3.30	16.50	1.500	0.016
3	9	8.83	79.50		
4	5	5.10	25.50	10.500	0.112

Pangea item 3: Descriptive statistics for ranked scores and nonparametric analyses for cohesive and non-cohesive versions

Item 3: "Relationships among ideas in this article are [very unclear, 1] <--> [very clear, 5]"

DESCRIPTIVE STATISTICS FOR RANKED SCORES

Group 1 NS / CO n=10		Group 2 NNS / CO n=5		Group 3 NS / NC n=9		Group 4 NNS / NC n=5	
Score	Rank	Score	Rank	Score	Rank	Score	Rank
7.00	5.00	10.00	25.50	9.00	18.00	6.00	2.50
7.00	5.00	10.00	25.50	10.00	25.50	7.00	5.00
8.00	10.50	9.00	18.00	9.00	18.00	10.00	25.50
8.00	10.50	10.00	25.50	8.00	10.50	3.00	1.00
6.00	2.50	10.00	25.50	9.00	18.00	8.00	10.50
8.00	10.50			8.00	10.50		
9.00	18.00			10.00	25.50		
8.00	10.50			9.00	18.00		
9.00	18.00			8.00	10.50		
10.00	25.50						
Sum=	116.00	Sum=	120.00	Sum=	154.50	Sum=	44.50
Median=	10.50	Median=	25.50	Median=	18.00	Median=	5.00
Mean=	11.60	Mean=	24.00	Mean=	17.17	Mean=	8.90

KRUSKAL-WALLIS

$\chi 2$ (3, N = 29) = 10.947, p = 0.012 [asymp]

$\eta 2$ = 0.39096

POST HOC COMPARISONS

Group	n	Mean rank	Sum of ranks	Mann Whitney U	Exact signif
1	10	5.90	59.00		
2	5	12.20	61.00	4.000	0.008
1	10	7.90	79.00		
3	9	12.33	111.00	24.000	0.095
1	10	8.80	88.00		
4	5	6.40	32.00	17.000	0.371
2	5	10.40	52.00		
3	9	5.89	53.00	8.000	0.060
2	5	7.40	37.00		
4	5	3.60	18.00	3.000	0.056
3	9	8.94	80.50		
4	5	4.90	24.50	9.500	0.083

Pangea item 4: Descriptive statistics for ranked scores and nonparametric analyses for cohesive and non-cohesive versions

Item 4: "Ideas in this article are [very poorly connected, 1] <--> [very well connected, 5]"

DESCRIPTIVE STATISTICS FOR RANKED SCORES

Group 1 NS / CO n=10		Group 2 NNS / CO n=5		Group 3 NS / NC n=9		Group 4 NNS / NC n=5	
Score	Rank	Score	Rank	Score	Rank	Score	Rank
4.00	2.00	7.00	6.50	9.00	19.00	9.00	19.00
9.00	19.00	9.00	19.00	7.00	6.50	9.00	19.00
8.00	12.00	10.00	26.50	9.00	19.00	10.00	26.50
8.00	12.00	10.00	26.50	8.00	12.00	3.00	1.00
7.00	6.50	7.00	6.50	9.00	19.00	5.00	3.00
7.00	6.50			9.00	19.00		
8.00	12.00			10.00	26.50		
9.00	19.00			7.00	6.50		
10.00	26.50			8.00	12.00		
10.00	26.50						
Sum=	142.00	Sum=	85.00	Sum=	139.50	Sum=	68.50
Median=	12.00	Median=	19.00	Median=	19.00	Median=	19.00
Mean=	14.20	Mean=	17.00	Mean=	15.50	Mean=	13.70

KRUSKAL-WALLIS

$\chi 2$ (3, N = 29) = 0.540, p = 0.910 [asymp]

Pangea item 5: Descriptive statistics for ranked scores and nonparametric analyses for cohesive and non-cohesive versions

Item 5: "Sections within this article are [very poorly connected, 1] <--> [very well connected, 5]"

DESCRIPTIVE STATISTICS FOR RANKED SCORES

Group 1 NS / CO n=10		Group 2 NNS / CO n=5		Group 3 NS / NC n=9		Group 4 NNS / NC n=5	
Score	Rank	Score	Rank	Score	Rank	Score	Rank
6.00	3.00	7.00	7.50	10.00	27.00	8.00	14.00
9.00	20.50	8.00	14.00	7.00	7.50	7.00	7.50
7.00	7.50	9.00	20.50	9.00	20.50	10.00	27.00
8.00	14.00	10.00	27.00	9.00	20.50	5.00	2.00
7.00	7.50	7.00	7.50	9.00	20.50	4.00	1.00
8.00	14.00			9.00	20.50		
9.00	20.50			7.00	7.50		
8.00	14.00			7.00	7.50		
10.00	27.00			9.00	20.50		
10.00	27.00						
Sum=	155.00	Sum=	76.50	Sum=	152.00	Sum=	51.50
Median=	14.00	Median=	14.00	Median=	20.50	Median=	7.50
Mean=	15.50	Mean=	15.30	Mean=	16.89	Mean=	10.30

KRUSKAL-WALLIS

$\chi 2$ (3, N = 29) = 2.115, p = 0.549 [asymp]

Pangea item 6: Descriptive statistics for ranked scores and nonparametric analyses for cohesive and non-cohesive versions

Item 6a: "Under which main topic do you put the info in lines 9-15?"

DESCRIPTIVE STATISTICS FOR RANKED SCORES

Group 1 NS / CO n=10		Group 2 NNS / CO n=5		Group 3 NS / NC n=9		Group 4 NNS / NC n=5	
Score	Rank	Score	Rank	Score	Rank	Score	Rank
1.00	19.50	1.00	19.50	1.00	19.50	0.00	5.00
1.00	19.50	1.00	19.50	1.00	19.50	1.00	19.50
0.00	5.00	0.00	5.00	1.00	19.50	0.00	5.00
1.00	19.50	0.00	5.00	1.00	19.50	0.00	5.00
1.00	19.50	1.00	19.50	1.00	19.50	1.00	19.50
1.00	19.50			1.00	19.50		
1.00	19.50			1.00	19.50		
1.00	19.50			0.00	5.00		
0.00	5.00			0.00	5.00		
1.00	19.50						
Sum=	166.00	Sum=	68.50	Sum=	146.50	Sum=	54.00
Median=	19.50	Median=	19.50	Median=	19.50	Median=	5.00
Mean=	16.60	Mean=	13.70	Mean=	16.28	Mean=	10.80

KRUSKAL-WALLIS

$\chi 2$ (3, N = 29) = 2.938, p = 0.401 [asymp]

Pangea item 7a: Descriptive statistics for ranked scores and nonparametric analyses for cohesive and non-cohesive versions

Item 7a: "What are [the desirable characteristics of strawbale buildings]?"

DESCRIPTIVE STATISTICS FOR RANKED SCORES

Group 1 NS / CO n=10		Group 2 NNS / CO n=5		Group 3 NS / NC n=9		Group 4 NNS / NC n=5	
Score	Rank	Score	Rank	Score	Rank	Score	Rank
0.50	11.00	1.00	22.50	0.25	4.00	0.25	4.00
1.00	22.50	1.00	22.50	0.50	11.00	0.25	4.00
1.00	22.50	1.00	22.50	0.50	11.00	0.50	11.00
1.00	22.50	1.00	22.50	0.50	11.00	0.25	4.00
0.75	15.00	1.00	22.50	0.50	11.00	0.25	4.00
1.00	22.50			0.50	11.00		
1.00	22.50			0.25	4.00		
1.00	22.50			0.25	4.00		
1.00	22.50			1.00	22.50		
1.00	22.50						
Sum=	206.00	Sum=	112.50	Sum=	89.50	Sum=	27.00
Median=	22.50	Median=	22.50	Median=	11.00	Median=	4.00
Mean=	20.60	Mean=	22.50	Mean=	9.94	Mean=	5.40

KRUSKAL-WALLIS

$\chi 2$ (3, N = 29) = 20.612, p = 0.000 [asymp]

$\eta 2$ = 0.7361

POST HOC COMPARISONS

Group	n	Mean rank	Sum of ranks	Mann Whitney U	Exact signif
1	10	7.50	75.00		
2	5	9.00	45.00	20.000	0.594
1	10	13.65	136.50		
3	9	5.94	53.50	8.500	0.001
1	10	10.45	104.50		
4	5	3.10	15.50	0.500	0.001
2	5	11.50	57.50		
3	9	5.28	47.50	2.500	0.004
2	5	8.00	40.00		
4	5	3.00	15.00	0.000	0.008
3	9	8.72	78.50		
4	5	5.30	26.50	11.500	0.147

Pangea item 8a: Descriptive statistics for ranked scores and nonparametric analyses for cohesive and non-cohesive versions

Item 8a: "Which agency would probably study the issues in lines xx-xx?"

DESCRIPTIVE STATISTICS FOR RANKED SCORES

Group 1 NS / CO n=10		Group 2 NNS / CO n=5		Group 3 NS / NC n=9		Group 4 NNS / NC n=5	
Score	Rank	Score	Rank	Score	Rank	Score	Rank
1.00	17.00	1.00	17.00	1.00	17.00	0.00	1.50
1.00	17.00	1.00	17.00	1.00	17.00	0.50	3.50
1.00	17.00	1.00	17.00	0.50	3.50	1.00	17.00
1.00	17.00	1.00	17.00	1.00	17.00	1.00	17.00
1.00	17.00	1.00	17.00	1.00	17.00	1.00	17.00
1.00	17.00			1.00	17.00		
1.00	17.00			1.00	17.00		
0.00	1.50			1.00	17.00		
1.00	17.00			1.00	17.00		
1.00	17.00						
Sum=	154.50	Sum=	85.00	Sum=	139.50	Sum=	56.00
Median=	17.00	Median=	17.00	Median=	17.00	Median=	17.00
Mean=	15.45	Mean=	17.00	Mean=	15.50	Mean=	11.20

KRUSKAL-WALLIS

$\chi 2$ (3, N = 29) = 3.705, p = 0.295 [asymp]

Pangea item 9a: Descriptive statistics for ranked scores and nonparametric analyses for cohesive and non-cohesive versions

Item 9a: "Which [building] materials are sometimes unnecessary in strawbale?"

DESCRIPTIVE STATISTICS FOR RANKED SCORES

Group 1 NS / CO n=10		Group 2 NNS / CO n=5		Group 3 NS / NC n=9		Group 4 NNS / NC n=5	
Score	Rank	Score	Rank	Score	Rank	Score	Rank
0.00	10.50	0.25	22.00	0.00	10.50	0.00	10.50
0.25	22.00	1.00	28.00	0.00	10.50	0.00	10.50
1.00	28.00	0.00	10.50	0.00	10.50	0.25	22.00
1.00	28.00	0.00	10.50	0.00	10.50	0.00	10.50
0.75	25.50	0.50	24.00	0.00	10.50	0.00	10.50
0.00	10.50			0.00	10.50		
0.75	25.50			0.00	10.50		
0.00	10.50			0.00	10.50		
0.00	10.50			0.00	10.50		
0.00	10.50						
Sum=	181.50	Sum=	95.00	Sum=	94.50	Sum=	64.00
Median=	16.25	Median=	22.00	Median=	10.50	Median=	10.50
Mean=	18.15	Mean=	19.00	Mean=	10.50	Mean=	12.80

KRUSKAL-WALLIS

$\chi 2$ (3, N = 29) = 7.937, p = 0.047 [asymp]

$\eta 2$ = 0.28346

POST HOC COMPARISONS

Group	n	Mean rank	Sum of ranks	Mann Whitney U	Exact signif
1	10	7.95	79.50		
2	5	8.10	40.50	24.500	0.953
1	10	12.25	122.50		
3	9	7.50	67.50	22.500	0.065
1	10	8.95	89.50		
4	5	6.10	30.50	15.500	0.254
2	5	10.20	51.00		
3	9	6.00	54.00	9.000	0.083
2	5	6.70	33.50		
4	5	4.30	21.50	6.500	0.222
3	9	7.00	63.00		
4	5	8.40	42.00	18.000	0.606

Pangea item 10a: Descriptive statistics for ranked scores and nonparametric analyses for cohesive and non-cohesive versions

Item 10a: "How do you compare strawbale "breathing" with ventilation in conventional buildings?"

DESCRIPTIVE STATISTICS FOR RANKED SCORES

Group 1 NS / CO n=10		Group 2 NNS / CO n=5		Group 3 NS / NC n=9		Group 4 NNS / NC n=5	
Score	Rank	Score	Rank	Score	Rank	Score	Rank
1.00	21.00	1.00	21.00	1.00	21.00	1.00	21.00
0.00	6.50	0.00	6.50	0.00	6.50	0.00	6.50
1.00	21.00	0.00	6.50	1.00	21.00	1.00	21.00
0.00	6.50	0.00	6.50	1.00	21.00	1.00	21.00
1.00	21.00	1.00	21.00	0.00	6.50	0.00	6.50
0.00	6.50			1.00	21.00		
1.00	21.00			1.00	21.00		
1.00	21.00			1.00	21.00		
0.00	6.50			1.00	21.00		
0.00	6.50						
Sum=	137.50	Sum=	61.50	Sum=	160.00	Sum=	76.00
Median=	13.75	Median=	6.50	Median=	21.00	Median=	21.00
Mean=	13.75	Mean=	12.30	Mean=	17.78	Mean=	15.20

KRUSKAL-WALLIS

$\chi 2$ (3, N = 29) = 2.304, p = 0.512 [asymp]

APPENDIX K

CHERRYLEAF RANKED SCORES AND ANALYSES

Cherryleaf item 1: Descriptive statistics for ranked scores and nonparametric analyses for cohesive and non-cohesive versions

Item 1: "Overall, I understand this article [with great difficulty, 1] <--> [very easily, 5]"

DESCRIPTIVE STATISTICS FOR RANKED SCORES

Group 5 NS / CO n=11		Group 6 NNS / CO n=4		Group 7 NS / NC n=10		Group 8 NNS / NC n=5	
Score	Rank	Score	Rank	Score	Rank	Score	Rank
7.00	8.50	8.00	14.50	6.00	5.00	8.00	14.5
9.00	23.50	8.00	14.50	6.00	5.00	9.00	23.5
5.00	2.50	10.00	29.50	9.00	23.50	5.00	2.5
8.00	14.50	9.00	23.50	9.00	23.50	9.00	23.5
10.00	29.50			7.00	8.50	8.00	14.5
9.00	23.50			8.00	14.50		
8.00	14.50			9.00	23.50		
9.00	23.50			7.00	8.50		
6.00	5.00			8.00	14.50		
4.00	1.00			7.00	8.50		
9.00	23.50						
Sum=	169.50	Sum=	82.00	Sum=	135.00	Sum=	78.50
Median=	14.50	Median=	19.00	Median=	11.50	Median=	14.50
Mean=	15.41	Mean=	20.50	Mean=	13.50	Mean=	15.70

KRUSKAL-WALLIS

$\chi 2$ (3, N = 30) = 1.924, p = 0.588 [asymp]

Cherryleaf item 2: Descriptive statistics for ranked scores and nonparametric analyses for cohesive and non-cohesive versions

Item 2: "I can follow the development of important points in this article [with great difficulty, 1] <--> [very easily, 5]"

DESCRIPTIVE STATISTICS FOR RANKED SCORES

Group 5 NS / CO n=11		Group 6 NNS / CO n=4		Group 7 NS / NC n=10		Group 8 NNS / NC n=5	
Score	Rank	Score	Rank	Score	Rank	Score	Rank
7.00	11.00	6.00	6.00	4.00	3.00	8.00	15.00
6.00	6.00	8.00	15.00	7.00	11.00	10.00	29.00
7.00	11.00	9.00	22.00	8.00	15.00	6.00	6.00
7.00	11.00	10.00	29.00	9.00	22.00	9.00	22.00
10.00	29.00			6.00	6.00	9.00	22.00
9.00	22.00			9.00	22.00		
9.00	22.00			9.00	22.00		
9.00	22.00			6.00	6.00		
3.00	1.50			9.00	22.00		
3.00	1.50			7.00	11.00		
9.00	22.00						
Sum=	159.00	Sum=	72.00	Sum=	140.00	Sum=	94.00
Median=	11.00	Median=	18.50	Median=	13.00	Median=	22.00
Mean=	14.45	Mean=	18.00	Mean=	14.00	Mean=	18.80

KRUSKAL-WALLIS

$\chi 2$ (3, N = 30) = 1.564, p = 0.668 [asymp]

Cherryleaf item 3: Descriptive statistics for ranked scores and nonparametric analyses for cohesive and non-cohesive versions

Item 3: "Relationships among ideas in this article are [very unclear, 1] <--> [very clear, 5]"

DESCRIPTIVE STATISTICS FOR RANKED SCORES

Group 5 NS / CO n=11		Group 6 NNS / CO n=4		Group 7 NS / NC n=10		Group 8 NNS / NC n=5	
Score	Rank	Score	Rank	Score	Rank	Score	Rank
4.00	3.00	9.00	24.00	5.00	4.00	8.00	17.00
6.00	6.00	9.00	24.00	6.00	6.00	8.00	17.00
9.00	24.00	9.00	24.00	8.00	17.00	7.00	10.00
7.00	10.00	10.00	28.50	7.00	10.00	8.00	17.00
10.00	28.50			6.00	6.00	7.00	10.00
8.00	17.00			10.00	28.50		
8.00	17.00			9.00	24.00		
8.00	17.00			3.00	2.00		
7.00	10.00			10.00	28.50		
2.00	1.00			8.00	17.00		
8.00	17.00						
Sum=	150.50	Sum=	100.50	Sum=	143.00	Sum=	71.00
Median=	17.00	Median=	24.00	Median=	13.50	Median=	17.00
Mean=	13.68	Mean=	25.13	Mean=	14.30	Mean=	14.20

KRUSKAL-WALLIS

$\chi 2$ (3, N = 30) = 5.769, p = 0.123 [asymp]

Cherryleaf item 4: Descriptive statistics for ranked scores and nonparametric analyses for cohesive and non-cohesive versions

Item 4: "Ideas in this article are [very poorly connected, 1] <--> [very well connected, 5]"

DESCRIPTIVE STATISTICS FOR RANKED SCORES

Group 5 NS / CO n=11		Group 6 NNS / CO n=4		Group 7 NS / NC n=10		Group 8 NNS / NC n=5	
Score	Rank	Score	Rank	Score	Rank	Score	Rank
4.00	4.50	8.00	17.50	3.00	1.50	9.00	25.00
6.00	8.50	9.00	25.00	7.00	12.00	9.00	25.00
7.00	12.00	9.00	25.00	7.00	12.00	8.00	17.50
8.00	17.50	9.00	25.00	6.00	8.50	8.00	17.50
9.00	25.00			4.00	4.50	8.00	17.50
10.00	30.00			9.00	25.00		
7.00	12.00			9.00	25.00		
9.00	25.00			3.00	1.50		
4.00	4.50			5.00	7.00		
4.00	4.50			8.00	17.50		
7.00	12.00						
Sum=	155.50	Sum=	92.50	Sum=	114.50	Sum=	102.50
Median=	12.00	Median=	25.00	Median=	10.25	Median=	17.50
Mean=	14.14	Mean=	23.13	Mean=	11.45	Mean=	20.50

KRUSKAL-WALLIS

$\chi 2$ (3, N = 30) = 7.298, p = 0.063 [asymp]

Cherryleaf item 5: Descriptive statistics for ranked scores and nonparametric analyses for cohesive and non-cohesive versions

Item 5: "Sections within this article are [very poorly connected, 1] <--> [very well connected, 5]"

DESCRIPTIVE STATISTICS FOR RANKED SCORES

Group 5 NS / CO n=11		Group 6 NNS / CO n=4		Group 7 NS / NC n=10		Group 8 NNS / NC n=5	
Score	Rank	Score	Rank	Score	Rank	Score	Rank
5.00	8.50	8.00	22.50	4.00	5.00	9.00	26.50
7.00	17.50	9.00	26.50	4.00	5.00	7.00	17.50
7.00	17.50	8.00	22.50	7.00	17.50	4.00	5.00
6.00	12.00	9.00	26.50	6.00	12.00	8.00	22.50
10.00	29.50			3.00	1.50	6.00	12.00
10.00	29.50			5.00	8.50		
6.00	12.00			9.00	26.50		
8.00	22.50			4.00	5.00		
3.00	1.50			6.00	12.00		
4.00	5.00			7.00	17.50		
7.00	17.50						
Sum=	173.00	Sum=	98.00	Sum=	110.50	Sum=	83.50
Median=	17.50	Median=	24.50	Median=	10.25	Median=	17.50
Mean=	15.73	Mean=	24.50	Mean=	11.05	Mean=	16.70

KRUSKAL-WALLIS

$\chi 2$ (3, N = 30) = 6.988, p = 0.072 [asymp]

Cherryleaf item 6a: Descriptive statistics for ranked scores and nonparametric analyses for cohesive and non-cohesive versions

Item 6a: "On which line number do you find the start of this topic?"

DESCRIPTIVE STATISTICS FOR RANKED SCORES

Group 5 NS / CO n=11		Group 6 NNS / CO n=4		Group 7 NS / NC n=10		Group 8 NNS / NC n=5	
Score	Rank	Score	Rank	Score	Rank	Score	Rank
1.00	17.50	1.00	17.50	1.00	17.50	0.00	2.50
1.00	17.50	1.00	17.50	1.00	17.50	1.00	17.50
1.00	17.50	1.00	17.50	1.00	17.50	1.00	17.50
1.00	17.50	1.00	17.50	0.00	2.50	1.00	17.50
1.00	17.50			1.00	17.50	1.00	17.50
1.00	17.50			1.00	17.50		
1.00	17.50			1.00	17.50		
1.00	17.50			0.00	2.50		
1.00	17.50			1.00	17.50		
1.00	17.50			0.00	2.50		
1.00	17.50						
Sum=	192.50	Sum=	70.00	Sum=	130.00	Sum=	72.50
Median=	17.50	Median=	17.50	Median=	17.50	Median=	17.50
Mean=	17.50	Mean=	17.50	Mean=	13.00	Mean=	14.50

KRUSKAL-WALLIS

$\chi 2$ (3, N = 30) = 4.740, p = 0.192 [asymp]

Cherryleaf item 7a: Descriptive statistics for ranked scores and nonparametric analyses for cohesive and non-cohesive versions

Item 7a: "What is the recommended order of basic steps to follow in planning a proposal?"

DESCRIPTIVE STATISTICS FOR RANKED SCORES

Group 5 NS / CO n=11		Group 6 NNS / CO n=4		Group 7 NS / NC n=10		Group 8 NNS / NC n=5	
Score	Rank	Score	Rank	Score	Rank	Score	Rank
0.67	21.00	0.34	10.50	0.00	3.50	0.34	10.50
1.00	29.00	0.67	21.00	0.00	3.50	0.00	3.50
0.34	10.50	0.67	21.00	0.67	21.00	0.67	21.00
1.00	29.00	0.67	21.00	0.00	3.50	0.67	21.00
0.67	21.00			0.00	3.50	0.67	21.00
0.67	21.00			0.00	3.50		
0.67	21.00			0.34	10.50		
0.67	21.00			0.34	10.50		
1.00	29.00			0.34	10.50		
0.67	21.00			0.34	10.50		
0.34	10.50						
Sum=	234.00	Sum=	73.50	Sum=	80.50	Sum=	77.00
Median=	21.00	Median=	21.00	Median=	7.00	Median=	21.00
Mean=	21.27	Mean=	18.38	Mean=	8.05	Mean=	15.40

KRUSKAL-WALLIS

$\chi 2$ (3, N = 30) = 13.1816, p = 0.003 [asymp]
$\eta 2$ = 0.4764

POST HOC COMPARISONS

Group	n	Mean rank	Sum of ranks	Mann Whitney U	Exact signif
5	11	8.55	94.00		
6	4	6.50	26.00	16.000	0.489
5	11	15.18	167.00		
7	10	6.40	64.00	9.000	0.001
5	11	9.55	105.00		
8	5	6.20	31.00	16.000	0.221
6	4	11.38	45.50		
7	10	5.95	59.50	4.500	0.024
6	4	5.50	22.00		
8	5	4.60	23.00	8.000	0.730
7	10	6.70	67.00		
8	5	10.60	53.00	12.000	0.129

Cherryleaf item 8a: Descriptive statistics for ranked scores and nonparametric analyses for cohesive and non-cohesive versions

Item 8a: "Which main topic is related to [the unfamiliar word] gerund?"

DESCRIPTIVE STATISTICS FOR RANKED SCORES

Group 5 NS / CO n=11		Group 6 NNS / CO n=4		Group 7 NS / NC n=10		Group 8 NNS / NC n=5	
Score	Rank	Score	Rank	Score	Rank	Score	Rank
0.00	7.50	1.00	22.50	0.00	7.50	0.00	7.50
0.00	7.50	0.00	7.50	1.00	22.50	0.00	7.50
0.00	7.50	1.00	22.50	0.00	7.50	1.00	22.50
1.00	22.50	1.00	22.50	0.00	7.50	1.00	22.50
1.00	22.50			0.00	7.50	0.00	7.50
1.00	22.50			1.00	22.50		
1.00	22.50			1.00	22.50		
1.00	22.50			0.00	7.50		
1.00	22.50			0.00	7.50		
1.00	22.50			0.00	7.50		
1	22.5						
Sum=	202.50	Sum=	75.00	Sum=	120.00	Sum=	67.50
Median=	22.50	Median=	22.50	Median=	7.50	Median=	7.50
Mean=	18.41	Mean=	18.75	Mean=	12.00	Mean=	13.50

KRUSKAL-WALLIS

$\chi 2$ (3, N = 30) = 4.796, p = 0.187 [asymp]

Cherryleaf item 9a: Descriptive statistics for ranked scores and nonparametric analyses for cohesive and non-cohesive versions

Item 9a: "For a list of proposal problems, do you click on Previous or Next?"

DESCRIPTIVE STATISTICS FOR RANKED SCORES

Group 5 NS / CO n=11		Group 6 NNS / CO n=4		Group 7 NS / NC n=10		Group 8 NNS / NC n=5	
Score	Rank	Score	Rank	Score	Rank	Score	Rank
0.00	7.50	1.00	22.50	0.00	7.50	0.00	7.50
0.00	7.50	1.00	22.50	1.00	22.50	0.00	7.50
1.00	22.50	0.00	7.50	1.00	22.50	0.00	7.50
1.00	22.50	1.00	22.50	0.00	7.50	0.00	7.50
0.00	7.50			1.00	22.50	1.00	22.50
1.00	22.50			1.00	22.50		
0.00	7.50			1.00	22.50		
1.00	22.50			1.00	22.50		
0.00	7.50			0.00	7.50		
1.00	22.50			1.00	22.50		
0.00	7.50						
Sum=	157.50	Sum=	75.00	Sum=	180.00	Sum=	52.50
Median=	7.50	Median=	22.50	Median=	22.50	Median=	7.50
Mean=	14.32	Mean=	18.75	Mean=	18.00	Mean=	10.50

KRUSKAL-WALLIS

$\chi 2$ (3, N = 30) = 4.231, p = 0.238 [asymp]

Cherryleaf item 10a: Descriptive statistics for ranked scores and nonparametric analyses for cohesive and non-cohesive versions

Item 10a: "In the last block, do you expect to read new info or info that has already appeared?"

DESCRIPTIVE STATISTICS FOR RANKED SCORES

Group 5 NS / CO n=11		Group 6 NNS / CO n=4		Group 7 NS / NC n=10		Group 8 NNS / NC n=5	
Score	Rank	Score	Rank	Score	Rank	Score	Rank
1.00	19.50	1.00	19.50	0.00	4.50	1.00	19.50
1.00	19.50	1.00	19.50	0.00	4.50	1.00	19.50
1.00	19.50	1.00	19.50	1.00	19.50	1.00	19.50
1.00	19.50	1.00	19.50	1.00	19.50	0.00	4.50
1.00	19.50			0.00	4.50	0.00	4.50
1.00	19.50			0.00	4.50		
1.00	19.50			0.00	4.50		
1.00	19.50			1.00	19.50		
0.00	4.50			1.00	19.50		
1.00	19.50			1.00	19.50		
1.00	19.50						
Sum=	199.50	Sum=	78.00	Sum=	120.00	Sum=	67.50
Median=	19.50	Median=	19.50	Median=	12.00	Median=	19.50
Mean=	18.14	Mean=	19.50	Mean=	12.00	Mean=	13.50

KRUSKAL-WALLIS

$\chi 2$ (3, N = 30) = 6.216, p = 0.102 [asymp]

VITA

Lyn Featherston Gattis

Candidate for the Degree of

Doctor of Philosophy

Dissertation: INFLUENCE OF COMPOSING STRATEGY ON THE COMPREHENSIBILITY OF TECHNICAL DOCUMENTS IN ENGLISH

Major Field: English

Biographical:

Education: Received Bachelor of Arts degree in English from the University of Arkansas, Fayetteville, Arkansas, in May 1973. Received Master of Arts degree in English from the University of Oklahoma, Norman, Oklahoma, in December 1995. Completed the requirements for the Doctor of Philosophy degree with a major in English at Oklahoma State University, Stillwater, Oklahoma, in July, 2006.

Experience: Employed by Oklahoma State University, Department of English, as a teaching assistant, 2002 to 2005, and tutoring assistant, 2001 to 2002. Employed by the University of Arkansas as communications manager for the Mack-Blackwell Transportation Center and in other positions, 1994 to 2001. Employed by SEARCH, Inc., Norman, Oklahoma, as technical editor, 1991 to 1994.

Professional Memberships: Society for Technical Communication, Association of Teachers of Technical Writing, Institute of Electrical and Electronics Engineers, Modern Language Association.

Name: Lyn F. Gattis Date of Degree: July, 2006

Institution: Oklahoma State University Location: Stillwater, Oklahoma

Title of Study: INFLUENCE OF COMPOSING STRATEGY ON THE COMPREHENSIBILITY OF TECHNICAL DOCUMENTS IN ENGLISH

Pages in Study: 262 Candidate for the Degree of Doctor of Philosophy

Major Field: English

Scope and Method of Study: This study investigated whether readers comprehend English single-sourced texts with cohesive devices differently from single-sourced texts without cohesive devices, and whether native and non-native English readers also comprehend the texts differently. Participants in the study were graduate students at Oklahoma State University and the University of Arkansas, Fayetteville, including 40 native readers and 19 East Asian readers. Test instruments were two authentic single-sourced English texts, adjusted to emphasize or minimize between-paragraph cohesive ties. Each participant read a cohesive version of one text and a non-cohesive version of the other text. For each text, participants answered five global Likert-scale questions on the text's comprehensibility, used information from the text to complete five task items, and identified the cohesive devices they had used to connect pieces of information. Likert-scale ratings and task scores were analyzed with a series of Kruskal-Wallis tests, followed by Mann Whitney U tests on significant results, corrected with the Bonferroni method. Cohesive devices named by participants were tallied and categorized.

Findings and Conclusions: On one Likert-scale item, non-native readers reported relationships among ideas in one of the cohesive texts to be significantly clearer than did native readers. On one task item, two groups of cohesive readers completed the task with significantly greater accuracy than did the corresponding two groups of non-cohesive readers. Of the semantic cohesive devices named, participants named more lexical cues than any other type; of the structural devices named, participants named bolded heading and subheadings most frequently. Within-paragraph lexical repetition may reinforce the effectiveness of between-paragraph cohesive devices. For readers of English single-sourced technical documents, textual cohesiveness may contribute more to reader comprehension than do adjustments for different linguistic backgrounds.

ADVISOR'S APPROVAL: _____Thomas L. Warren_____