

Structured Writing as a Paradigm

by Robert E. Horn

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Introduction

Thomas Kuhn (1962) suggests that "normal science" consists of "research based upon one or more past scientific achievements that some particular community acknowledges for a time as supplying the foundation for its further practice." These achievements were (1) "sufficiently unprecedented to attract an enduring group of adherents away from competing modes of scientific activity," and (2) "sufficiently open-ended to leave all sorts of problems for the redefined group of practitioners to solve." He then states that this is his definition of a paradigm: "Achievements that share these two characteristics I shall henceforth refer to as paradigms." Although Kuhn goes on in the same book to use the word "paradigm" in at least twenty-one distinct meanings (as cataloged by Masterman, 1970), this is the only place where he explicitly defines the term. Others have broadened the meaning of "paradigm" and still others have used the term as a metaphor for "any theory or method or approach, large or small."

If any writing or instructional design approach can be called a paradigm within Kuhn's definition, I will claim that structured writing most certainly qualifies. And if Kuhn's concept of paradigm can be metaphorically extended beyond the sciences to the realm of practical methodology of communication, then structured writing surely qualifies there as well. My approach in this chapter will be to describe what I believe to be the salient characteristics of structured writing and to describe the "past achievements" that supply "the foundation for further practice." Then I will demonstrate briefly how these achievements have been "sufficiently unprecedented to attract an enduring group of adherents away from competing modes of scientific activity" and finally to describe some of the sorts of issues in the research and evaluation that structured writing focuses us on today.

1. What are Some of the Problems that Structured Writing Addresses?

Structured writing has been developed to address many of the perennial problems most people have when working on a complex written communication task. Instructional design certainly qualifies as such a complex task. Some of these perennial problems are:

- How should I organize the mass of subject-matter material?
- How can I keep track of the structure? How can the reader keep track?
- How can I make the structure of the document and the subject matter more obvious?
- How do I analyze the subject so that I am sure that I have covered all of the bases?
- How do I know the coverage is complete? How will the reader understand this scope?
- In large analytic and communication tasks, how do I track multiple inputs, different levels of reader competence and rapidly multiplying and increasingly demanding maintenance requirements?

- If I am working in an organization with a large number of writers, how do I provide the plan for a group of writers and how do I manage the group -- efficiently --so that it will appear to the reader that there is a unity or organization, structure, analysis, style, graphic display and format?
- How do I sequence the final document so that it will present the information to different levels of readers in the most useful manner?
- How do I organize the linkages so that different readers with different backgrounds can get what they want from it easily and quickly?
- What formats are optimum to enable users to make sense of the document as a whole and through the window of the current display?
- How do we make instructional writing optimally effective and efficient?
- These problems are not unique to instructional design. They are addressed one way or another by every person who writes a document. But they are the major issues faced by the paradigm of structured writing. The remainder of this chapter will examine how structured writing helps writers tackle these questions.

2. What are Some of the Presuppositions of Structured Writing?

In this section I will present several of the major presuppositions of structured writing to provide the background that I used to formulate the paradigm of structured writing.

I have used these presuppositions without entering current cognitive science debates as to whether or not we really use some kinds of representations within our minds and brains. Rather, I simply observe that when we communicate, we do use representations.

Presuppositions about Subject Matter. I began with what seemed obvious, namely that, since we communicate with each other using physical mediums we have to represent what we do in sentences and images. Thus, any subject matter consists of all the sentences and images used by human beings to communicate about that subject matter. So, with sentences and images, we have all we need to fully analyze a subject matter. I acknowledge that subject matters exist that can only be learned by intense observation, practice and nonverbal feedback (such as an exotic martial arts). I acknowledge the issues raised by Polanyi in his concept of tacit knowledge, i.e. that certain knowledge is learned by observation of fine motor movements and unvoiced values, which go beyond the sentences that represent a subject matter. But I sidestep them. Structured writing only deals with that which can be written. Practical communication in commerce, science, and technology teaches, documents or communicates something. Therefore, I assume that what is important enough to learn is capable of being rendered in sentences (or diagrams).

I also assumed that the most important regularities to understand in a subject matter are those that exist between sentences. Many of the studies of language begin and end with the study of words and sentences in isolation. Subject matters are tight relationships between many clusters of sentences and images. So, if we are to analyze subject matters properly (i.e. efficiently and effectively) for communication and training, we must understand the relationships between sentences. Why is it that certain sentences should be

"close" to each other in an instructional document in order to convey the subject matter easily to a new learner?

Presuppositions about readers. There were a number of assumptions about the users (or readers). I took it as axiomatic that different readers and learners may want to use a given document in a variety of ways. Readers may use any of the following approaches to a given document: scanning to decide whether to read the communication at all, browsing to find interesting or relevant material, analyzing critically the contents, studying to be able to remember the subject matter, etc. And, in general, it is difficult to predict what learners and readers will do with a given piece of instruction or communication.

Documents often have hundreds or even thousands of users. Each document has a different interest and relevance to each user. Each must therefore serve many people having many purposes. If possible, it is important to optimize among several functions in the same document.

Presuppositions about Writing. When I developed structured writing, I also introduced what turned out to be a fairly radical assumption: *A new paradigm in communication and learning* requires a new basic unit of communication. Revolutions in paradigms in physical theory have in part come about from the different concepts of the most basic particle (the atom as a singular unit, Bohr model of atom as a subvisible solar system, electrons as rings of probability, to the discovery of subatomic particles, etc.).

Revolutions in linguistic theory came about with the invention of grammar as a unit of analysis. The behavioral paradigm in instructional design came after Skinner's invention of the stimulus - response unit. Similarly, the invention of the information block (discussed below) qualifies as a major turning point in the history of the conception of basic units.

Most training is not formal training. It does not take place in the classroom with documents called training manuals. It takes place on the job with whatever documentation is at hand. I have heard that only one-tenth of training is formal classroom training. Nine-tenths never gets accounted for in the financial or other reports of a company as training. Thus, in my list of major assumptions is this one: Anything that is written is potentially instructional. Therefore, in so far as possible: A writer should design each communication to potentially be "instructional" even if its ostensible job may be as a memo or a report or as documentation.

Another focus on the structured writing presuppositions began is giving importance to the scientific research on how much people forget. We forget, as I am sure you remember, most of what we learn within three weeks of learning it. At that time, I noted that we must build "learning - reference systems" in order to deal with these problems. (Horn, et. al., 1969) . Since then we have used the term "reference based training" (Horn, 1989a) to cover this area. Others have invented the delightful term "just in time training" to cover an essential aspect of this training need. And later I specified the domains of memos and reports as another arena in which writing with instructional properties takes place. (Horn, 1977)

With this survey of the assumptions underlying the paradigm, let us take a look at the actual components of the structured writing approach.

3. What Are the Components of the Structured Writing Paradigm?

My early (Horn, 1965) analyses began with the detailed examination of actual sentences, illustrations, and diagrams that appeared in textbooks and training manuals. My investigation involved trying to establish a relatively small set of chunks of information that are (1) similar in that they cluster sentences (and diagrams) that have strong relationships with each other and (2) that frequently occur in various kinds of subject matter. This analysis focused, thus, on the relationship between the sentences in subject matter. The result of this analysis was the invention of the information block as a substitute for the paragraph. The taxonomy that resulted is now known as the information blocks taxonomy for relatively stable subject matter (shown in Figure 1).

Figure 1
Most Frequently Used Block Types
(in domain of relatively stable subject matter)

| | | | |
|----------------------|------------------------|----------------------|------------------|
| Analogy | Description | Notation | Specified Action |
| Block Diagram | Diagram | Objectives | Table |
| Checklist | Example | Outlines | Stage Table |
| Classification List | Expanded Procedure | Parts-Function Table | Synonym |
| Classification Table | Table | Parts Table | Theorem |
| Classification Tree | Fact | | When to Use |
| Comment | Flow Chart | Prerequisites to | |
| Cycle Chart | Flow Diagram | Course | WHIP Chart |
| Decision Table | Formula | Principle | Who Does What |
| Definition | Input-Procedure-Output | Procedure Table | Worksheet |
| | Non-example | Purpose | |
| | | Rule | |

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Definition: Information Blocks

Information blocks are the basic units of subject matter in structured writing analysis. They replace the paragraph as the fundamental unit of analysis and the form of presentation of that analysis. They are composed of one or more sentences and/or diagrams about a limited topic. They usually have no more than nine sentences. They are always identified clearly by a label. Three examples of information blocks are shown in Figure 2. Information blocks are normally part of a larger structure of organization called an information map (see below for explanation of maps). In short, they are a reader-focused unit of basic or core parts of a subject matter.

Example of an Information Block

What do information blocks look like? It is important to notice that different types of blocks vary widely in appearance and construction. For example, below is one of the most simple-looking types of blocks (but one that has standards for construction more stringent than most), a definition block:

Definition. The Master Payroll File is a group of records containing all of the payroll and employee information used by the weekly payroll program.

How is a Block Different from a Paragraph?

Let us examine some of the characteristics of this example of an information block and see how it differs from paragraphs. First, we must note that there is no topic sentence in the information block. Topic sentences are absent or irrelevant in much of structured writing, so much so that they are not taught in a structured writing course.

Second, it is worth observing that there is no "nice to know" but irrelevant information in the information block. Note that the only information it contains is information that is relevant to defining the term Master Payroll File. Paragraphs typically have a lot of nice to know information.

Third, note that the block has a label. One of the mandatory requirements for blocks is that they always have a distinguishing label, chosen according to systematic criteria (Horn, 1989a). Paragraphs have no such requirement, although they may be randomly labeled, depending upon the taste of the writer.

Fourth, All definitions in a given structured document would be consistent with these characteristics. Paragraphs have no requirement for consistency within or between documents. These are some of the main characteristics that distinguish the block from a paragraph.

This first example is a very simple block. While this block is one sentence long, many types of blocks contain several sentences. diagrams, tables or illustrations, depending upon their information type. (See Figure 2) Typical blocks are several sentences in length, and might contain different kinds of tables: Diagrams comprise other kinds of information blocks.

Figure 2
Some Different Kinds of Information Blocks

Information Block Containing a Table

| | | | |
|-----------------|--|---------------------------------|--|
| Decision | IF the book is . . . | THEN send the patron . . . | AND send . . . |
| | available | the book | an invoice to the Billing Unit. |
| | not available - never owned - lost | Form 25 | -- |
| | checked out with no waiting list | Form 66 | a copy of Form 66 to Circulation Desk. |
| | checked out with a waiting list | Form 66 and Waiting List Notice | a copy of Form 66 to Circulation Desk. |

Information Block Containing One Sentence and One Diagram

Diagram

The terminal is held in place in the connector cavity by a locking tang. The attached cable allows you to move and position the terminal.



Information Block with Several Sentences and Several Diagrams

Procedure

| | | |
|---|--|--|
| <p align="center">Step 1</p> <p>Push the cable forward until it will no longer slide.</p> <p align="center">Example :</p> | <p align="center">Step 2</p> <p>Insert the K8889 tool through the hole on the opposite side and gently pull the cable out.</p> <p align="center">Example :</p> | <p align="center">Step 3</p> <p>Inspect the terminal. Replace if necessary and then replace the cable by inserting it into the locking tang.</p> <p align="center">Example :</p> |
|---|--|--|

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How Does Structured Writing Handle Cohesion and Transition?

There is no "transitional" information in the information block, but principles for writing prose encourage or require it. The need for coherence, cohesion, and transition is handled in a completely different manner in structured writing. While this is a huge topic, (Halliday and Hasan, 1976) suffice it to say that much of the burden of coherence is placed on the labeling structure and much of the transition requirement is placed on one type of block, the introduction block, that frequently appears at the beginning of information maps.

The Four Principles

All information blocks are constrained by four principles used to guide structured writing:

The first of these is the **chunking principle**. It derives from George Miller's basic research (Miller, 1957. See also note 2) which suggest that we can hold only 7 plus or minus 2 chunks of information in human short-term memory. Our formulation of the principle states: Group all information into small, manageable units, called information blocks and information maps. Small (in information blocks) is defined as usually not more than 7 plus or minus 2 sentences. While others lately (e.g. Walker, 1988) have recommended modularity (i.e. dividing information into labeled chunks) as a principle of structured writing, I have insisted that information blocks turn out to be "precision modularity" (Horn 1989a, 1993) because of the operation of three other principles with the chunking principle and because I believe we have shown that blocks sorted using our taxonomy (see below) offer much greater efficiency and effectiveness of composition and retrieval.

The second principle we use in helping to define the information block is the **labeling principle**. It says: Label every chunk and group of chunks according to specific criteria. It is beyond the scope of this paper to get into all of these criteria. They consist of guidelines and standards some of which cover all blocks, some of which cover only specific types of blocks or even parts of blocks. I have claimed elsewhere (Horn, 1992a) that it is the precise specification of different kinds of blocks that permits the identification of context and limits for these criteria, thus saving them from being bland and overly abstract, and, thus, largely useless, guidelines.

The third principle used in developing the information block is the **relevance principle**. It says: Include in one chunk only the information that relates to one main point, based upon that information's purpose or function for the reader. In effect it says, if you have information that is nice to know, or contains examples or commentary, the relevance principle demands that you put it some place else and label it appropriately: but do not put it in the definition block.

The fourth principle is the **consistency principle**. It says: For similar subject matters, use similar words, labels, formats, organizations, and sequences.

Answering Some Objections to Blocks

Some have commented that information blocks are not particularly unique or novel. They say, for example, that information blocks are only what paragraphs, when written properly, should be. I have answered many of these claims elsewhere (Horn, 1992a). If extraneous information is excluded from an information block (as it should be, following the relevance principle) the discourse is changed radically. If the materials for cohesiveness and transition in paragraph-oriented writing are put into the labels and if the labeling system is relevant and consistent, the appearance and usefulness of the whole piece of writing is changed tremendously. If the subject matter is divided into appropriate-size of chunks (using the chunking principle and the taxonomy of information blocks), the form of discourse is changed decisively. If all of these changes are made together in the same document, the text usually has much less intertwined prose with multiple threads and allusions. It is a far more usable text to scan, to read and to memorize.

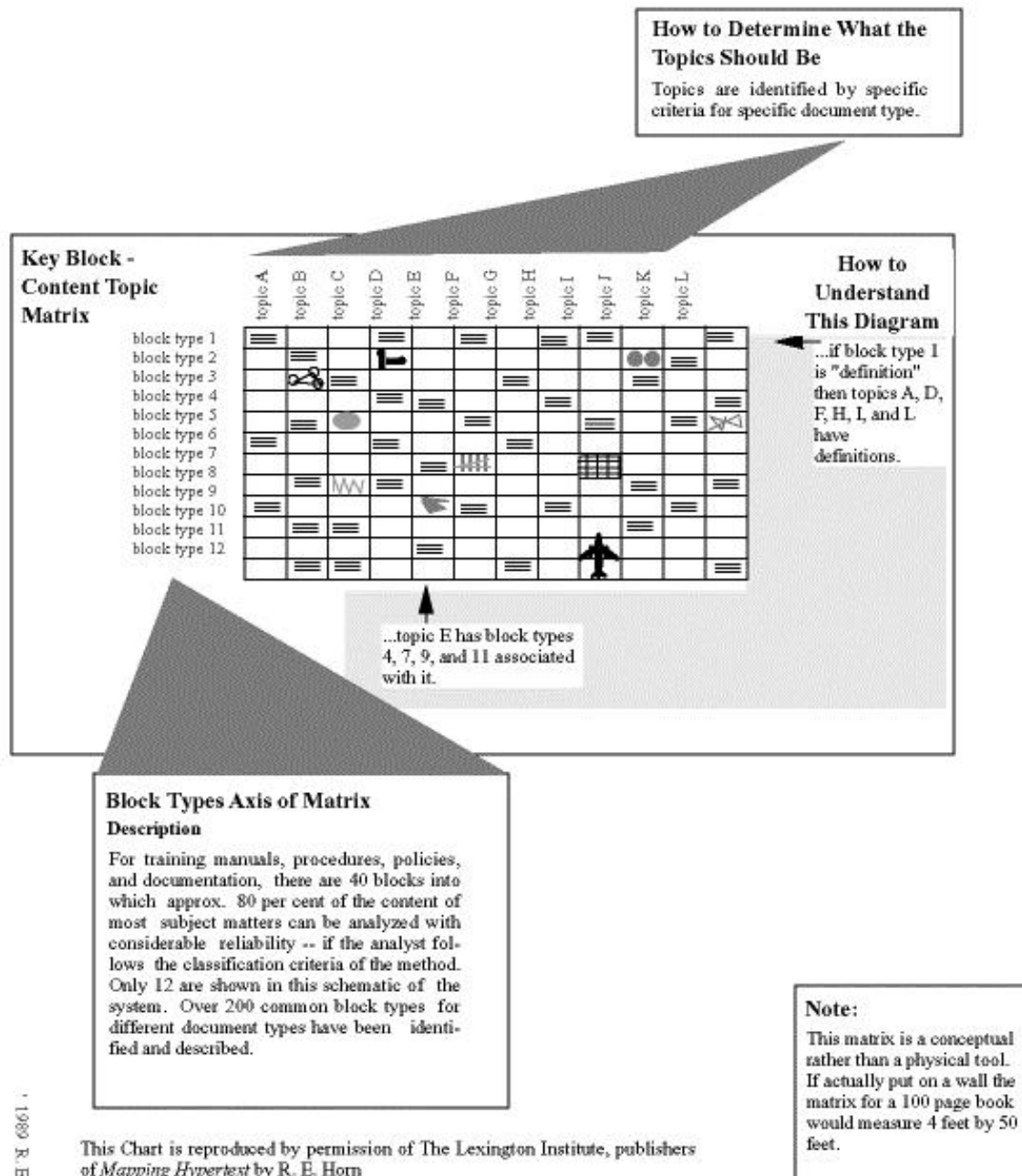
Blocks by Themselves Qualify Structured Writing as a Paradigm.

By itself, the invention of the information block might qualify structured writing as a separate and new paradigm for analysis and writing. But we used these new distinctions to build a powerful analytic tool for gathering information about and specifying the subject matter in instructional or documentation writing. Simply revising the basic unit has radically shifted the rhetoric of exposition in the documents in which structured writing is used.

Topic - Block Matrix of a Subject Matter

To aid analysis of subject matter for instructional and documentation purposes, I conceptualized the subject matter as a topic - block matrix, shown schematically in Figure 3.

Figure 3
Block Type - Content Topic Matrix



The reader will note that the topics from the subject matter are arranged along the top of the matrix. This is done according to a group of guidelines provided as a part of the structured writing system. The block types (see Figure 1 for list) are arranged along the vertical axis. The resulting cells in the matrix represent information blocks into which the

sentences and diagrams from the subject matter are placed. Examination of the blank spaces show the analyst what information may still be not written down and hence perhaps not known. Specific templates have been developed which permit the analysts to know with a high degree of certainty which block should be filled in for a specific topic. An example of this would be a template which would specify these three block types for a concept: definition, example, and (optionally) non-example.

Systematic Labeling

Another key component of structured writing was the development of a system of consistent labeling of parts of a document. Obviously labeling is not unique to structured writing. Many books follow a more or less systematic labeling guideline. But when combined with the new units of communication, the information block and the information map, the systematic labeling becomes a powerful communication device. In a recent article (Horn, 1993) I summarized the benefits of such a systematic approach to labeling. Systematic labeling:

- enables readers to scan content to see what they want to read
- enables readers/learners to find what they are looking for in a consistent, relevant, complete manner;
- enables the analyst/writer to manage the intermediate stages of information gathering and analysis in a more efficient way;
- enables learners to anticipate learning problems by showing the structure of the subject matter to them."

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Definition: Information Maps

Information Maps are a collection of more than one but usually not more than nine information blocks about a limited topic. In general, one can think of an information map as approximately one to two pages in length, but some maps (of certain well-specified types) run several pages in length and some maps are composed of only one information block. Maps both (1) aid the writer in organizing large amounts of information during the analysis phase and (2) help the reader to understand the structure of the subject matter and the document. Maps may be sequenced hierarchically or in other clearly defined ways such as task or prerequisite order. Maps are assembled during the sequencing phase of the writing process, into parts, sections, chapters and documents depending upon communication purpose and reader needs. (For an example, see Figure 4.)

Figure 4
Example of an Information Map

| Comparing 17.1.0 | Regular Data Values, and . . . | Non-Regular Data Values |
|--------------------------------|--|--|
| | | |
| Introduction | Some data have patterns. They progress by fixed increments. | Some data do not show any pattern of intervals between the values. |
| Definition | Data are called regular when the values of a data vector progress from some initial value with some fixed interval to another value, and then optionally from that to still other values by even increments. | Data are called "non-regular" data when they have no systematic pattern of intervals between them. |
| Example One | Time data show frequent regularities. Samples of blood collected from a laboratory animal every hour on the hour might be called SAMPLEHRS and might look this way: SAMPLEHRS = 6, 7, 8, 9, 10 | Most measurement data do not exhibit systematic regularities that are fixed intervals between values, so they are usually non-regular data. Here is an example: LABMEAS = .01, .09, .04, .3 |
| Use This Input Statement | Input with Computed Clause Statement | Standard Input Statement |
| Comment | This statement permits you to input regular data in a very compact form and is much quicker to type than a normal input statement. | This statement should be used for normal data entry. |
| Related Pages | Input with Computed Input Statements, 22 Standard Input Statement, 21 Variables, 19 | |

Discourse Domains

Communication in business takes place in some fairly routinized forms. This fact enables us to identify some major domains of discourse. We begin such an analysis by asking questions about specific domains such as: How does a report of a scientific experiment differ from a sales presentation or a policy manual? They differ in many ways. They differ as to who the authors are, how the authors have come to know the subject matter, what can be assumed about the audience of the communication, what level of detail is used, what content is communicated.

In addition to the "what are the differences" questions, we can ask the "what are the similarities" questions. How are all reports of scientific experiments alike? How are all sales presentations alike? The analysis of these similarities and differences is what is called domain analysis in structured writing. It involves examining the relationships between author and reader of different kinds of documents and the "stances" and points of view that can be seen as a result. This analysis yields specific block types that can be expected in specific kinds of documents. The domain of relatively stable subject matter has already been introduced in this chapter as the one that comprises the subject matter used in training and documentation writing (see also below).

So, in the Information Mapping method, a domain of discourse is defined as the specification of information blocks of a particular class of documents, all of which share the same type of author-reader assumptions and the same stance or point of view towards subject matter.

Some examples of domains of discourse (Horn, 1989a) have been studied extensively. They are:

- the domain of relatively stable subject matter, which is that domain of subject matter which we think we know well enough to teach it in a course or write an introductory training material about it.
- the domain of disputed discourse, which is that subject matter about which we know enough to chart its disagreements.
-

Other domains such as those of business report and memo writing have been studied (Horn, 1977) Still others remain to be carefully identified and mapped.

Information Types

Blocks in the domain of relatively stable subject matter can be sorted into seven basic classifications, which we call the "information types."

The seven information types are:

- Procedure
- Process
- Concept
- Structure
- Classification
- Principle
- Fact

This is a key set of categories for specifying and describing how human beings think, especially about what we have called relatively stable discourse domains. Structured writing guidelines have been developed that permit the information blocks to be assigned to one or more of these information types. An example would be the assignment of definitions and examples to the information type "concept" or the assignment of a flowchart to the information type "procedure." This permits the identification of what has come to be called "key block" information, the information which you must have to fully analyze an individual topic of a subject matter. Key blocks enable writers to anchor their writing firmly and reliably to the centrally important structure of a subject matter. (For further information, see Horn, 1989a, Chapt. 3)

The information types theory is used to help the analyst/writer identify specific information that is needed for each topic. These information-type templates specify the key information blocks needed to ensure completeness and accuracy of the analysis.

Systematic Integration of Graphics

From its conception, the structured writing paradigm recognized the importance of graphics (illustrations, diagrams, photographs) as an integral part of any writing with a practical purpose. This meant that we had to specify exactly where such graphics would communicate better than words by themselves. And this led to the identification of specific blocks within the overall scheme which are required to have some kind of graphic, because the communication was likely to be better than if the same message were conveyed only by words. This is also paradigmatic change. Certainly in the past words and images had been used together. But graphics were regarded either as a "tacked on" afterthought or as decorations, not as a mandatory and integral part of the message. (see Horn, 1993 for a fuller treatment of this point).

Systematic Formatting

Much reading in the Age of Information Overload is actually scanning. We must continually identify that which we don't have to read. We are always looking for the salient parts. This makes the requirement for aiding scanning paramount in the specification of formatting. There have been a variety of formats identified that meet this criteria. Structured writing is most often associated with a single format: that of having the map title at the top and the block labels on the left-hand side of the page. But this is only one of the many possible formats of structured writing that aid scanning (see Horn, 1989 for others). The topic of formatting is also the one that has produced the most confusion about structured writing. Many people have observed only the strongly formatted versions of documents written according to the analytic methods of structured writing and have concluded that "it is only a format." Since the analysis and structuring of the document is part of the process of producing the document, much of the highly disciplined thinking that goes into producing the documents is not immediately visible. But the number of trained writers of structured writing has grown to over 150,000 world-wide, and the discernment that something more than format goes into structured writing has gradually become the norm rather than the exception.

Systematic Life Cycle Approach to Document Development

Documentation and training materials often last a long time. The amount of time from drafting to final discard of a document can be years and sometimes decades. Many business documents are frequently revised and updated. This means that a methodology for writing must have in place a facility for rapid revision and updating as well as cost-effective initial development. The structured writing paradigm has made paradigmatic changes in how documents can be updated and revised. Because the basic units of organization, the information blocks, are easily isolatable from each other (unlike other paradigms of writing and formatting), they can be much more easily removed, changed or replaced. Previous and more literary rhetorics provide a great deal of difficulty to the writer managing the life cycle of the document, because such literary rhetorics have an intricate and highly interwoven approach to organization. Managers involved in preparing foreign language translations also report major efficiencies of translation because of the simplification of rhetorical structure. Needless to say that the structured writing approach propagates rapidly in a business environment in which costs of publication are closely watched.

What Structured Writing Shares with Other Paradigms

Not all of the components of structured writing are novel. Such total novelty is not a requirement for a paradigm. Structured writing shares the use of words and sentences with other forms of writing. Many of the conventions and rhetorical guidelines for good, clear writing of sentences are incorporated without change. Moreover, when serving a purely instructional function, most of the guidelines regarding the design of practice exercises, tests, criteria-based instruction, etc. are used wholesale.

Behavioral research from instructional design, such as Merrill's and Tennyson's (1977) work on teaching concepts, has also been incorporated into the structured writing paradigm. This research serves to strengthen the instructional properties of documents whose initial or primary use is not instructional, but which at some time in the life cycle of the document must provide formal or informal training. Moreover, as another example, much of the collection of research-based design imperatives in Fleming's and Levie's (1978) work on message design supported and strengthened the research foundations of the structured writing paradigm, as have many individual pieces of research since then.

4. What Makes Structured Writing "Structured?"

One of the claims of structured writing is that there exist particular dimensions along which technical or functional writing can be described (if observing it from the point of view of an outside observer) or composed (if attempting to develop some document using it). It seems to me that we can describe several scales of structure or dimensions along which a piece of prose would be placed. Some of these scales are:

The Chunking Scale. This scale might be described by the question "to what degree can the between-sentence units be clearly chunked into separate chunks, each of which serves only one purpose?"

Most ordinary prose paragraphs would be placed on the low end of this scale simply because they mix functions. For example, many paragraphs mix introductory and definitional functions, while highly structured writing keeps them separate. I have itemized and described forty such functions for chunks (which I call information blocks) appearing in the domain of relatively stable subject matter (the domain of text books, procedure and policy manuals, etc.). Dividing subject matter strictly according to this taxonomy of chunks produces highly structured chunking.

Making the structure visible with labels. Does such a highly chunked writing style produce highly structured writing? To some degree it does. But there are other dimensions to consider. One of these has to do with whether or not the reader can actually see the structure by glancing at the page. Three factors contribute significantly to making the structure visible.

One factor is whether or not the chunks are labeled. If the chunks are clearly and functionally labeled the reader will be able to scan the labels and get a gist of the document as a whole. The second factor is actually a group of design elements that include format (where the labels are placed) and type style (such as size and boldness of the labels). A third factor is whether there is a systematic application of labeling -- the application of the consistency principle.

So we have three more possible scales or dimensions of "structuredness" to consider. Clearly most prose falls down badly on these scales, while methods that have a labeling system will be rated as more "structured." And to determine "structuredness" we must use a multi-dimensional approach.

The Between-Chunk Sequencing Structure All of the dimensions of structure discussed so far could be done and we might rate the writing as poorly structured, because the way in which the chunks are put together does not present a clear structure to the reader.

There are many ways to arrange the sequence of chunks in a piece of writing. For example, arranging them hierarchically is one frequently used way. Here again there are at least two distinguishable factors: (1) is the document organized according to some larger organizing scheme, such as the concept of nine different kinds of hypertrails as a basis for the structuring of sequencing (Horn, 1989a) and (2) can the reader see this at a glance? So again we have both the "inner organization" principle and the formatting principle at work.

These and other "dimensions" and their attendant scales might be devised to make a precise determination of structuredness in individual pieces of writing. (See Note 4)

5. Is Structured Writing "Sufficiently Unprecedented" and Has It Attracted an "Enduring Group of Adherents?"

Kuhn suggests that the paradigm must show achievements that were (1) "sufficiently unprecedented to attract an enduring group of adherents away from competing modes of scientific activity."

Structured writing also qualifies as a paradigm in that it was presented all at once as a complete methodology, rather than incremental additions. This is not to say that no improvements or additions have been made. The major structures and components of structured writing have endured over 25 years (Horn, 1993) To review, the components that appeared together all at once are:

- The invention and description of the information block as a new kind of basic unit of communication that permits the use of truly structured writing;
- The precise specification of different kinds of information blocks for specific purposes, and in particular the specification of approximately 40 information blocks that comprehend over 80 percent of the domain of relatively stable subject matter and the specification of other clusters of block types for memos, reports, proposals and other document types;
- The invention of a content analysis approach of question and information types that clusters different information blocks to guide question asking and ensure completeness in the initial analysis of the subject matter;
- The invention and description of an intermediate unit of structured writing, the information map, that permits easy and natural topic clustering;
- The development of a comprehensive and systematic set of criteria for labeling blocks and maps;
- The systematic specification of where graphics should be used and where text would be better;
- The development of easy-to-scan formats that exactly fit with the analysis methodology and categories to aid learning and reference.

We have already described how these different characteristics and components represented dramatic departures from the customary practice at the time structured writing was introduced. Even today the conventional literary approach is still taught in most writing and instructional design courses, although many technical writing courses are adopting some kind of structured approach.

In recent years, the group of adherents to the structured writing paradigm has been growing by approximately 20,000 persons annually (Note 3). The total number of users stands somewhere around 150,000 as this chapter is written. These are primarily people in industry: instructional designers, people who write documentation and reports, managers who write memos and proposals, developers who build online and hypertext applications. Many of these people are taught in the largest companies in the world by a licensing arrangement (Note 3) which qualifies instructors to teach within a company that has made a commitment to training all of the relevant staff in the methodology. A considerable group of researchers has focused attention on the structured writing methodology as well (see next section). Altogether one can confidently note that structured writing has attracted an "enduring group of adherents."

6. Is Structured Writing Sufficiently "Open-Ended" for Research and Practical Application?

Kuhn's definition of paradigm requires that the theory be " sufficiently open-ended to leave all sorts of problems for the redefined group of practitioners to solve." Structured writing qualifies by this criteria in that it has produced a robust, ongoing stream of research and evaluation both in universities and in industry.

One test of this requirement is to ask if there have been major problems solved within the methodology after the initial paradigm was presented. There have been several. In 1977, a major extension of the methodology was made to the crafting of memos and reports. (Horn, 1977) Here the concept of the information block was kept intact, but a new domain was surveyed which resulted in the identification of fifteen basic types of reports and memoranda in industry and the identification of blocks that acted analogously to the key blocks in the domain of relatively stable structured subject matter. The formatting was modified and extended to incorporate requirements of the report and memo contexts. The idea of the map was modified in several ways while keeping its major purpose and the systematic criteria for the labeling of blocks was extended slightly.

A similar major extension was made in 1988 (Bellerive and Horn, 1988) by extending the approach to the preparation of proposals. Most of the major extensions used for reports were reexamined and found appropriate for proposals. A few modifications were made in the basic methodology to adapt it to the proposal context in industry. Similarly in 1989, the approach was applied to writing for computer user documentation (Horn, 1989b).

The structured writing approach has been shown to be analogous to other types of structured methodologies and can incorporate them into its larger dominion. One such area is argumentation analysis (Horn, 1989a, Chapter 7) which enables analysts to examine the form of argumentation presented by an author or speaker at various levels of detail in a diagrammatic way.

Another dimension of open-endedness should also be noted. From the beginning, I made no effort to complete the methodology. I have always said that the taxonomy of 40 information blocks for relatively stable discourse covers eighty percent of the subject matter. Why only try to achieve eighty percent? Why not attempt to identify ninety-nine percent of the information block types? First, eighty percent covers a lot of territory. Since key blocks which identify the core information in a subject matter, fall among this eighty percent, the most fundamental information is guaranteed to be there. Secondly, it would not be cost effective to try to specify all of the rest of the blocks. They tend to be idiosyncratic to particular subject matters and instructional contexts. Rather, I decided to go up a level of abstraction at that point and develop criteria for making new information blocks. What the writer does about the other 20 percent is to devise new block types. I used this open-endedness in my proposals to improve the writing of scientific reports and abstracts (Horn, 1989a, Chapter 8). Others have taken this approach in literally thousands of situations in writing industrial applications. This approach provides a continuous open endedness to the methodology. I might also mention that, in a similar area, writers are encouraged to combine different kinds of maps to suit the document they are creating.

A recent survey (Horn, 1992b) notes fifteen doctoral dissertations that focused on structured writing. One reviewer (Clark, 1993) was "surprised to see that most of the research done on the method has evaluated its effectiveness on learning outcomes, not retrieval speed or accuracy." (That was not surprising to me since the structured writing paradigm grew out of the instructional design context, not the conventional writing context.) Clark continued "Of the ten studies summarized (in detail in Horn 1992b), seven focused on learning and only two on retrieval time. In the learning studies, most compared the effectiveness of (structured writing) with 'conventional' materials on test scores. In two of the studies time was controlled; in the others learners studied as long as they wished." Figure 5 shows the results of the studies summarized in Horn 1992b. Clark concluded "It seems that there is fertile research soil to till with future studies that focus on speed and accuracy of retrieval from large reference documents prepared using various layouts. More cognitively-oriented research that includes protocol analysis while learners read would help to document not only effectiveness but get insight into the reasons for the effectiveness. Certainly reduction of cognitive loading would be one reasonable hypothesis to explore in comparing structured to conventional reference materials."

Figure 5

Results of Major Research Studies on Structured Writing

| | | Measured by Number Right or Errors | Time to Do Task | Supervisor Appraisal |
|------------------------|--|---|--|--|
| Initial Learning | Immediate Recall | Stelnicki: 32% higher scores on facts; 41% higher on concepts Soyster: 13% higher scores Romiszowski: 10% higher scores Burrell: 53 - 59% better on tests Webber: 38% higher scores on the criterion tests | Romiszowski: 10% faster Webber: IM version was 50% faster | |
| | Long Term Recall | Soyster: No difference (attributed to motivation factors by the researcher)* Webber: IM version provided 85% or better accuracy when starting on the job. | | |
| Retrieval | Had Previously Used the Materials | Jonassen & Falk: 33% higher scores with IM | Baker: IM had 12- 21% better reading speed | |
| | Had Never Seen the Materials Before | Schaffer: 54.5% fewer errors with IM | | |
| On-the-Job Application | | | Holding: Supervisors reported 32% de- crease in reading time for persons receiving reports written in IM. 84% of IM users report increase in writing speed after taking course. | Holding: Supervisors reported 100% of those who received training had producti- vity increase. Course was rated: Y very effective 63% Y effective 30% Y somewhat effective 7% |

Key:
IM = Information Mapping's method
Names are names of principal
investigators on specific research
studies.

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Many companies have now trained thousands of people in the structured writing methodology. More studies are needed to examine the impact of implementing the method throughout an entire organization. One such study (Holding, 1985) studied the impact of training 180 managers in structured writing seminars at Pacific Telephone. She looked at both the results on the writers and the readers (by interviewing their supervisors). On the writer side, there were decreases in writing time and increases in clarity, as well as improvement in analytical and organizing skills; which is not surprising given the extreme focus on analysis and organization in structured writing courses. All of

the supervisors surveyed stated that the amount of time it takes to read a document, using the method taught in the structured writing course, decreased. The mean decrease in the amount of time was 32 percent. Other advantages the supervisors reported included faster approval (of reports and memos) due to the methods used in the course (83%). The supervisors and writers agreed that writers wrote their required letters and memos before deadlines. Further research along these lines would prove useful to other implementers.

The structured writing field has generally had to rely on research from cognitive psychology, educational research, and other fields for the close examination of its components and writing guidelines. There is a rich vein of potential research in this area as well. I have noted elsewhere (Horn, 1992a) that, while research in naturalistic settings such as jobs, classrooms and laboratories are important those settings may be the "wrong place to attempt to measure certain effects." I urged the field to devote more research time in the next phase of research to isolating variables. It would, for example, be helpful to know how much of the dimensions of "structure" contribute to the overall effects.

There is virtually unanimous agreement that much of what we read will be stored on computers in the next ten years. That conversion to online access and reading is proceeding steadily and is expected to accelerate. The availability of hypertext functions provides many opportunities for just-in-time instruction, but also provides managers with a panoply of problems (see Horn, 1989a, Chapter 2 for a survey of these problems). I have claimed that structured writing will help solve a good many for these problems (Horn, 1989a, Chapter 5).

It would seem that structured writing easily meets Kuhn's criterion of being "sufficiently open-ended to leave all sorts of problems for the redefined group of practitioners to solve" while at the same time providing practical solutions to today's busy instructional design practitioners.

#Notes

1. The primary source of training in structured writing is Information Mapping Inc. (Address: Information Mapping, Inc., 300 Third Avenue, Waltham, MA 02154; phone: (617-890-7003))
2. Originally I took Miller's dictum of 7 plus or minus 2 quite literally. Subsequent research on chunking has indicated that the ideas must be retained but in using them as a basis for structured writing guidelines, to consider them on a more metaphorical basis.
3. The estimate includes only those taught structured writing by Information Mapping, Inc. the major company teaching the methodology through its seminar division and its international licensees in the U. S., Japan, Australia, New Zealand, Mexico, and Europe.
- 4 In Information Mapping's method of structured writing, I generally set the standard toward the most highly structured end of the various dimensions and scales I have suggested in this article.

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