DOCUMENT RESUME

ED 240 608 CS 208 180

AUTHOR Hayes, John R.; Flower, Linda S.
TITLE A Cognitive Model of the Writing Process in Adults. Final Report.
INSTITUTION Carnegie-Mellon Univ., Pittsburgh, Pa.
SPONS AGENCY National Inst. of Education (ED), Washington, DC.
PUB DATE 11 Oct 83
GRANT NIE-F-78-0195
NOTE 92p.; Figures and tables may be marginally legible.
PUB TYPE Reports - Research/Technical (143)

EDRS PRICE MF01/PC04 Plus Postage.
DESCRIPTORS Academic Aptitude; *Cognitive Processes; College Students; Expository Writing; Higher Education; Models; Planning; *Research Methodology; Writing Improvement; *Writing Processes; *Writing Research; *Writing Skills
IDENTIFIERS *Protocol Analysis

ABSTRACT

A research project was undertaken to (1) identify the major cognitive processes involved in expository writing, (2) test a model of the organization of those processes, and (3) identify teachable aids that could be used by poor and average adult writers to improve their writing skills. Subjects were expert and novice student writers at Carnegie-Mellon University in Pittsburgh, Pennsylvania. The research method employed was that of protocol analysis, with each student being asked to think aloud as he or she performed writing tasks. The resulting tapes were analyzed to discover the cognitive processes involved in writing and to develop a model of composition. The findings suggest the following: (1) there are important differences in the ways expert and novice writers handle the writing process, (2) many of the strategies employed by expert writers are teachable, and (3) one of the most promising areas for improving students' writing is in the art of planning. (Charts, tables of data, and excerpts from student protocols are appended.) (FL)

Final Report
on Grant NIE-F-78-0195
A Cognitive Model of the Writing Process in Adults

John R. Hayes and Linda S. Flower

Carnegie-Mellon University

Pittsburgh, PA 15213

11 October 1983

ABSTRACT

The ability to write effectively is important for achievement in post-secondary education and in professional life. Yet the ability to use writing as a practical and intellectual skill has eluded many adults. The three main objectives of this research project on adult writing were to identify the major cognitive processes involved in expository writing; to test a model of the organization of these processes; and to identify teachable aids which could be used by poor and average adult writers to improve their writing skills.

Subjects for the project were competent and non-competent writers at Carnegie-Mellon University. The research method employed was that of protocol analysis; each student was asked to think aloud as he performed writing tasks. These protocols enabled the principal investigators to better understand the cognitive processes involved in writing and to develop a model of composition.

This research on the composing process has a number of implications for teaching including these three important observations: 1.) There are important differences in how expert and novice writers handle the process of writing; 2.) Many of the strategies employed by experienced writers are teachable; and 3.) One of the most promising areas for improving students' writing is in the neglected art of planning. Teaching students to plan what and what to say and to learn while they write can offer them a very useful skill.

Table of Contents

1. Introduction 1
    1.1. Strategic Decisions 1
    1.2. The Task Environment 6
    1.3. The Writer's Long-Term Memory 6
2. A Model of the Writing Process 6
    2.1. The Writing Process 7
    2.2. Planning: Generating 7
    2.3. Planning: Organizing 8
    2.4. Planning: Goal Setting 9
        2.4.1. Translating 9
        2.4.2. Reviewing 10
        2.4.3. The Monitor 12
    2.5. Testing the Model 13
    2.6. Protocol Sections 15
    2.7. HYPOTHESIS 1: The Form of the Written Materials 16
    2.8. HYPOTHESIS 2: Classifying "Content" Statements 17
    2.9. HYPOTHESIS 3: Measuring Retrieval Chains 20
    2.10. Conclusions 21
3. The Dynamics of Composing 22
    3.1. Introduction 22
    3.2 Knowledge 23
    3.3. Written Speech 24
4 Cognition of Discovery 26
    4.1. Studying Cognitive Processes 27
    4.2. A Model of the Rhetorical Problem 28
    4.3. Differencees Among Writers 28
5 A Taxonomy of Writing Plans 31
    5.1. Plans To Do 31
    5.2 Plans To Say 32
    5.3 Composing Plans 32
6. The Pregnant Pause 35
    6.1. Evidence for an Episode Structure 37
7. Evaluating How Writers Generate Ideas 39
    7.1. Results 42
8 Formulating Sentences in Writing 43
    8.1 The Relation Between Planning and Sentence Construction 44
    8.2 What Happens When Sentences Are Written? 47
    8.3 Differences Between Experts and Non-experts 49
9. Implications for Teaching 51
    9.1 Implication 1 51
    9.2. Implication 2 53
    9.3 Implication 3 54
    9.4 Teaching Planning Versus Doing it 57
    9.5 A Plan To Do 59
    9.6 A Plan To Say 60
    9.7 A Plan To Discover 61

1. Introduction

During the last three years of research supported by NIE, we have applied protocol analysis and other methods of cognitive science to the analysis of written composition. In conducting our research we have made a number of strategic decisions about what is interesting and about how best to proceed. These decisions are the incarnation of our scientific biases.

1.1. Strategic Decisions

Our approach proceeds from five strategic decisions which we made about how to conduct our research. Briefly these decisions were:

1. to focus on the act of writing;
2. to try for a process model of writing,
3. to model individual writers;
4. to work wholistically or "top down"; and
5. to divide the writing task into parts for easier analysis.

As we will see below, these decisions are genuine ones in the sense that we could reasonably have made other choices. Alternative approaches to the study of writing proceed from different decisions on these same issues.

1. Our first and most important decision was to focus on the act of writing -- that is, to attend to whatever it is that writers do when they produce a text. Thus, we viewed writing primarily as a process rather than as a product We felt that by far the richest source of information about writing would be to observe step by step how the writer had actually created the essay. However, we did not intend to ignore the product. Wherever possible, we looked to the writer's essay for evidence to confirm or elaborate the more direct observations of process

To observe writers in action we have employed process training methods borrowed

from cognitive psychology. In our studies, a typical experiment proceeds as follows: subjects appear at the experimental session knowing that they will be assigned a topic on which to write an essay and that the whole procedure will take about an hour. Further, they know that they will be asked to "think aloud" while writing. The subject is seated in a quiet office with a desk, pencil, and paper, and the tape recorder is turned on. The experimenter then gives the subject an envelope containing the writing assignment -- that is, the topic and the intended audience. The subject then busily sets to work writing and commenting roughly as follows: "Well, open up the magic envelope. OK. Whew! This is a killer. Write about abortion pro and con for Catholic Weekly. Ok, boy! How am I going to handle this?", etc. This continues for about an hour until the subject says something like, "Well, that's it. Good bye, tape recorder [click]." The data of the study consist of a verbatim transcript of the tape recording (with all the "um's" and pauses and expletives undeleted) together with the essay and all of the notes the writer has generated along the way. The transcript is called a protocol. These materials are then examined in considerable detail for evidence which may reveal something of the processes by which the writer has created the essay. In general, the data are very rich in such evidence. Subjects typically give many hints about their plans and goals, e.g., "I'll just jot down ideas as they come to me", about strategies for dealing with the audience, e.g., "I'll write this as if I were one of them", about criteria for editing and evaluation, e.g., "For 10-year-olds, we better keep this simple", and so on. The analysis of this data is called protocol analysis.

2. To understand the writing act, we certainly need to identify the processes involved -- but this is not enough. We also need to know how these processes are organized to produce a text. That is, we need to know how the processes are sequenced, how one process is terminated and how the one which follows is chosen, how errors are detected, etc. Further, we want to know how simultaneous processes interact. When

writers construct sentences, we want to know how they handle such multiple constraints as the requirement for correct grammar, appropriate tone, accuracy of meaning, and smooth transition. In short, we want a model which specifies the processes involved in writing and accurately describes their organization and interaction.

A model is a metaphor for a process: it's a way to describe something, such as the composing process, which refuses to sit still for a portrait. People build models in order to understand how a dynamic system works, and to describe the functional relationships among its parts. In addition, if a model is to really help us understand more, it should speak to some of the critical questions in the field of writing and rhetoric. It should help us see things in a way we didn't see them before

Our second strategic decision was to direct our research toward the construction of such a model Ideally, the model should be capable of telling us how writers go about producing a text when they are given a writing assignment. It should tell us what processes are involved, in what order they occur, and at what points the writer will experience difficulty. At present, of course, we must be satisfied with a model which is much less complete that the ideal The ideal defines where we would like to go, but, alas!, not where we are now.

3. It is apparent that not all writers write in the same way. For example, some writers plan their essays from beginning to end before they write a single word of text, while others never seem to look beyond the next sentence. Further, some writers seem to write with their readers constantly in mind, checking frequently to be sure that they have taken the reader's knowledge and attitudes into account. Others appear serenely unaware that an audience could fail to understand what they, in good faith, have intended to say.

In modeling, we can deal with such differences in either of two ways. We can choose to construct a model of the "average" writer and delay until some more propitious

time the description of differences among writers. This approach has the merit of simplicity. Further, if things work out well, a model of an average writer might be useful in characterizing individual differences. Thus, models for individual writers might prove to be minor variants of the average model. However, this approach may have the disadvantage that averages sometimes suffer from -- the average may be representative of no one. Thus, we sincerely hope that no one has the average number of children -- two and a half -- nor would we want anyone to have to eat an average course at dinner, which might be a compromise between appetizer and dessert such as oysters with chocolate sauce.

An alternative approach is to construct models which are intended to describe individuals rather than averages of groups. The disadvantage of this approach is that it may be expensive In the worst case, each individual may require a separate model. With better luck, models of individual writers will turn out to be variants of a small number of model types. The advantage of this approach is that it is more likely than a model of the average to capture the behavior of actual (rather than idealized) writers

Our third strategic decision, then, was to model the behavior of individual writers rather than the average behavior of groups of writers.

4. In studying writing, we might well have started with processes which psychologists and psycholinguistics have already identified as fundamental ones -- processes such as short-term memory, grammatical categorization, and lexical marking We might then have attempted to synthesize more complex processes using these fundamental processes as building blocks. This synthetic or bottom up approach is a very familiar one in science and has frequently been used with great success. Geometry and Newtonian physics are perhaps the best known examples

However, research often proceeds in the opposite direction, that is, wholistically, or from the top down Chemistry provides a good example of top down research. Chemical

research often starts with a complex compound and then looks for the elementary components and their relations. The top down approach is the one we have chosen to apply in our writing research. We have started from the top with the complete writing act and have attempted to analyze it first into a few relatively complex subprocesses. As the analysis proceeds, the complex subprocesses are analyzed further into progressively simpler subprocesses Ultimately, we hope that this top down analysis will make contact with the fundamental processes which psychologists and psycholinguistics have already identified. Thus, the top down and bottom up approaches may be viewed as complementary.

The advantage of the bottom up approach is that it is rooted in fundamental processes. The advantage of the top down approach is that its results are almost certain to be relevant to real writing situations.

5. Our final strategic decision was to divide the writing task into three parts (see Figure 2 1):

1. The task environment -- that is, the world outside the writer's skin.
2 The writer's long-term memory; and
3 The writing processes -- that is, the writer excluding the writer's long-term memory.

We chose this division because it is an especially convenient one for psychological analysis and modelling. Transfers of information between the task environment and the writer are usually marked clearly by overt acts of reading or writing Further, information retrieval from long-term memory is frequently detectable by examining the verbal protocol Thus, the boundaries we have chosen divide the writing task into parts whose interactions are relatively easy to observe

Bitzer's analysis of the rhetorical situation (1968) focuses on the importance of the task environment Lowes' classic study of Coleridge (1927) focuses on the importance of

the writer's long-term memory. Our own research has focused on the writing processes

1.2. The Task Environment

The task environment includes everything outside the writer's skin that influences the performance of the task. It includes the writing assignment, that is, a description of the topic and the intended audience, and it may include information relevant to the writer's motivation. For example, the teacher's stern expression when he presents an assignment may tell the writer that the assignment must be taken very seriously. Britton et al. (1975) have emphasized the importance of such motivational factors. Once writing has begun, the task environment also includes the text which the writer has produced so far. This text is a very important part of the task environment because the writer refers to it repeatedly during the process of composition.

1.3. The Writer's Long-Term Memory

We assume that writers have knowledge about many topics, e.g., auto mechanics and American history, and about many audiences, e.g., children and Catholics, stored in long-term memory. They may also have generalized writing plans, perhaps in the form of a story grammar (Rumelhart, 1975) or a formula such as the journalist's questions, "who, what, where, when, why?".

2. A Model of the Writing Process

The unique features of the model are

1. It identifies not only subprocesses of the composing process, but also the organization of those subprocesses
2. Minor variations in its simple control structure (shown in Figure 2.6) allow it to describe individual differences in composing styles

Although the model is provisional, it provides a first approximate description of normal composition that can guide research and afford a valuable starting point in the

search for more refined models.

2.1. The Writing Process

We propose that writing consists of three major processes: PLANNING, TRANSLATING, and REVIEWING. The PLANNING process consists of GENERATING, ORGANIZING, and GOAL-SETTING subprocesses. The function of the PLANNING process is to take information from the task environment and from long-term memory and to use it to set goals and to establish a writing plan to guide the production of a text that will meet those goals. The plan may be drawn in part from long-term memory or may be formed anew within the PLANNING process The TRANSLATING process acts under the guidance of the writing plan to produce language corresponding to information in the writer's memory. The function of the REVIEWING process, which consists of READING and EDITING subprocesses, is to improve the quality of the text produced by the TRANSLATING process. It does this by detecting and correcting weaknesses in the text with respect to language conventions and accuracy of meaning, and by evaluating the extent to which the text accomplishes the writer's goals. The structures of the various processes are shown in Figures 2 2 through 2.6.

2.2. Planning: Generating

The function of the GENERATING process is to retrieve information relevant to the writing task from long-term memory We assume that this process derives its first memory probe from information about the topic and the audience presented in the task environment Because each retrieved item is used as the new memory probe, items are retrieved from memory in associative chains In order to focus search on relevant material, the retrieval chain is broken whenever an item is retrieved that is not useful to the writing task Search is then restarted with a new memory probe derived from the task environment or from useful material already retrieved

Some criterion for terminating search chains is essential to prevent the process from getting lost in associative reverie. The criterion that we have chosen, i.e., one irrelevant item, may have to be relaxed somewhat to simulate human performance accurately. We believe, though, that it won't have to be relaxed much beyond one item. The most persistent memory searches we have observed in writing protocols never extended more than three retrievals beyond useful material.

Insert Figures 2.1 and 2.2 about here

When an item is retrieved, the GENERATING process may produce a note. Characteristically, these notes are single words or sentence fragments, although they may sometimes be complete sentences. The form of these notes will be used later to identify occurrences of the GENERATING process.

2.3. Planning: Organizing

The function of the ORGANIZING process is to select the most useful of the materials retrieved by the GENERATING process and to organize them into a writing plan. The plan may be structured either temporally (e.g., "First, I'll say A, then B.") or hierarchically (e.g., "Under topic #1, I should discuss A, B, and C.") or both.

Organizing is done by the elementary operators shown in Figure 2.3. The first four of these operators act on single topics, or pairs of topics, e.g., the second operator decides which of two topics to discuss first. The last operator, "Identify a category," may act to classify a large number of topics that were generated separately under the same heading.

Insert Figure 2.3 about here

Notes generated by the ORGANIZING process often have an organizational form

That is, they are systematically indented, or numbered, or alphabetized, or possibly all of these. This organizational form will be used later to identify occurrences of the ORGANIZING process.

2.4. Planning: Goal Setting

Some of the materials retrieved by the GENERATING process are not topics to be written about but rather are criteria by which to judge the text. Often such criteria appear in the protocol when the writer is considering the audience or features of the text. At such times the writer may say, "Better keep it simple," or, "I need to write a transition here." The GOAL SETTING process identifies and stores such criteria for later use in EDITING.

2.4 1. Translating

The function of the TRANSLATING process is to take material from memory under the guidance of the writing plan and to transform it into acceptable written English sentences. We assume that material in memory is stored as propositions but not necessarily as language. By a proposition, we understand a structure such as

[(Concept A) (Relation B) (Concept C)]
or
[(Concept D) (Attribute E)], etc.

where concepts, relations, and attributes are memory structures, perhaps complex networks or images, for which the writer may or may not have names.

To illustrate the operation of the TRANSLATING process (see Figure 2.4), we have invented a scenario of a student writing an essay on Henri Rousseau.

1. Get next part of writing plan. "I've covered the early years, now I've got to say how he got into painting."

2. Plan next sentence: Retrieve propositions
   Proposition A: [(Rousseau) (showed) (some early promise)]
   Proposition B: [(Rousseau) (did) (very little painting until 40)]
   Sentence plan: (Proposition A) but (Proposition B)

3. Express next proposition part: "Rousseau ... Rousseau, what? Rousseau displayed ... Although Rousseau displayed some early pr - ise ..., etc."

Insert Figure 2.4 about here

Writing done during the TRANSLATING process shows two features:

1. Characteristically, it is in the form of complete sentences, and

2. It is often associated with a protocol segment that contains an interrogative reflecting search for the next sentence part, e.g., "Rousseau did what?" or, "How do I want to put this?"

These features will be used later to identify occurrences of the TRANSLATING process.

2.4.2. Reviewing

The function of the reviewing process is to improve the quality of the written text. It consists, as Figure 2.5 shows, of two subprocesses: READING and EDITING.

Insert Figure 2.5 about here

Reviewing: Editing. The EDITING process examines any material that the writer puts into words, whether by reading, writing, or speaking. Its purpose is to detect and correct violations in writing conventions and inaccuracies of meaning and to evaluate materials with respect to the writing goals. These evaluations may be reflected in questions such as, "Will this argument be convincing?" and, "Have I covered all parts of the plan?"

We assume that the EDITING process has the form of a production system.[1] The conditions of the productions have two parts. The first part specifies the kind of language to which the editing production applies, e.g., formal sentences, notes, etc. The second is a fault detector for such problems as grammatical errors, incorrect words, and missing context. When the conditions of a production are met, e.g., a grammatical error is found in a formal sentence, the action that is triggered is a procedure for fixing the fault.

Consider the following production:

[(formal sentence) (first letter of sentence lower case)
----------> change first letter to upper case]

If the writer is producing formal sentences, this production will detect and correct errors in initial capitalization. However, if the writer is only producing notes, the conditions of the production will not be met and capitalization will be ignored.

Although the action in the preceding production is simple, in some cases the action may invoke the whole writing process recursively. For example, in one writing protocol, the writer's first draft contained the first sentence of the final draft immediately followed

---

[1] A production system is an ordered sequence of condition-action rules. The left side of each rule shows the condition or stimulus, and the right side shows the action to be taken if the condition is met. The conditions are tested in order, starting with the first rule. The order of the productions is important. Consider the production system for putting a horse in a barn.

Conditions		Actions
(horse out of barn) and (barn door closed)	-->	(open barn door)
(horse out of barn)	-->	(put horse in barn)
(barn door open)	-->	(close barn door)

Changing the order of these productions could have very serious consequences for the horse!

by the seventh sentence of the final draft. In editing the first draft, the writer recognized that the reader would not have sufficient context to understand the relation between these two sentences. To correct this fault, the writer constructed a small explanatory essay to insert between the sentences. Thus, in this case, the fixing procedure invoked the whole writing process.

We assume that the EDITING process is triggered automatically whenever the conditions of an editing production are satisfied and that it will interrupt any other ongoing process

---

Insert Figure 2.6 about here

We distinguish between REVIEWING and EDITING as two distinct modes of behavior. On the one hand, EDITING is triggered automatically and may occur in brief episodes interrupting other processes. REVIEWING, on the other hand, is not a spur-of-the-moment activity but rather one in which the writer decides to devote a period of time to systematic examination and improvement of the text. It occurs typically when the writer has finished a translation process rather than as an interruption to that process

2.4.3. The Monitor

The relations among the processes are defined by the simple production system shown in Figure 2.7. The structure of the monitor was chosen to reflect three observations about composition processes

---

Insert Figure 2.7 about here

---

1. The EDITING and GENERATING processes may interrupt other processes. Thus, the first two production rules triggering EDITING and GENERATING processes take priority over goal setting rules

2. The writer's intuitions and the persistence of his or her actions suggest that

writing processes are controlled by goals. Thus, if writers report that they are trying to organize material, they will persistently return to ORGANIZING processes even when those processes are interrupted by EDITING and GENERATING (productions 3 through 6 define the writer's goals).

3. Individual differences in goal setting reflect important individual differences in writing style. Figure 2.8 shows four alternative configurations for the goal setting productions. Each configuration corresponds to a characteristically different way of producing an essay. Configuration 1, for example, corresponds to a style in which the writer tries to produce a perfect first sentence and then to follow the perfect first sentence with a perfect second sentence and so on. The work of planning, translating, and reviewing each sentence is completed before the writer proceeds to the next sentence. With Configuration 2, thoughts are written down as they occur to the writer and he reviews them later. With Configuration 3, the writer tries to generate a perfect first draft. Configuration 4 yields a breadth-first composing process. A draft is planned and then written out in full before any review takes place. Lowenthal and Wason (1977) have described writing styles among academics that correspond to Configurations 3 and 4.

Insert Figure 2.8 about here

Rules 7 through 10 in Figure 2.7 have the effect of executing the current goal when the goal activity is not being interrupted by rule 1 or rule 2.

As a final observation about the model, notice that the GENERATING process operates differently when the goal is GENERATING than when it is not. When the goal is GENERATING, the GENERATING process is persistent. That is, each attempt to generate is followed by another attempt to generate. When the goal is not GENERATING, each attempt to generate is followed by a return to the process specified by the current goal (the one which GENERATING interrupted).

2.5. Testing the Model

We compare our model with a writing protocol in which the writer gave especially clear indications of ongoing writing processes and of the transitions between processes (The writer's style suggests that he sets his goals in the same way as the monitor with Configuration 4 -- see Figure 2.8) This relatively unambiguous protocol provides a

rigorous test of the model's adequacy.

The protocol consisted of 14 pages of verbal transcript (the thinking aloud part of the protocol), five pages of notes, and a page of completed essay. We divided the verbal transcript into a sequence of segments, each containing a simple comment or statement. We have analyzed the first 458 segments of the transcript, or about half of it.

The segments are of three general types:

1. Metacomments--comments that writers make about the writing process itself, e.g., "I'll just make a list of topics now," "I'm going to write out a draft," "Better go back and read it over."

2. Task-oriented or "content" statements--statements that reflect the application of writing processes to the current task, e.g., "That's not the right word" reflects an editing process. "I'll use that topic last" reflects an organizing process, etc.

3 Interjections--such as "Ok, "Well, let's see," "all right," "umm," "ah," etc

Consider the sequences of segments. Well,/I'll just make a list of topics now./Energy conservation./pollution./unemployment. The first segment is an interjection; the second, a metacomment, and the rest are task-oriented statements. (Interjections were not analyzed in this study.)

Writing protocols are complex, and writers are often incomplete or ambiguous when they describe what they are doing. As a result, in analyzing a protocol, we frequently have to make judgments about the writer's meaning. The presence of such judgments may lead one to question the objectivity of the analyses Because we are testing our model by comparing it to a protocol, we have to be especially careful to establish the objectivity of our analysis. To do this, we have taken the following steps

1. Whenever objective evidence was available, we used it. Thus, reading and writing processes were identified by matching the verbal protocol word for word with the writer's notes and text (the objective evidence).

2. Whenever possible, processes were identified by using converging lines of evidence, e.g., the form of the written material on the one hand, and the writer's comments about what he is doing on the other.

3. The most important analyses were replicated by independent judges.

2.6. Protocol Sections

The writer's metacomments suggest that the protocol can be divided quite cleanly into three sections. In the first section, including segments 1 through 116, the writer's goal is to generate; in the second, including segments 117 through 270, it is to organize, and in the third, including segments 271 through 458, it is to translate. Here are the metacomments that led us to this conclusion:

Segment 2: "And what I'll do now is to simply jot down random thoughts.."

Segment 5: "Topics as they occur randomly are.."

Segment 48: "Organizing nothing as yet."

Segment 69: "Other things to think about in this random search are."

Segment 117: "Now I think it's time to go back and read over the material and elaborate on its organization."

Segment 161: "Now this isn't the overall organization. This is just the organization of a subpart."

Segment 237: "There's an organization."

Segment 239: "Let's try and write something."

Segment 243: "Oh, no We need more organizing"

Segment 269: "I can imagine the possibility of an alternate plan..."

Segment 271: "But let's build on this plan and see what happens with it."

If these assumptions about goals are correct, it follows from the model that the most frequent process in the first section will be GENERATING interrrupted occasionally by EDITING, in the second, ORGANIZING interrupted by GENERATING and EDITING, and in the third, TRANSLATING interrupted by GENERATING and EDITING. Further, we can make three predictions about the protocol:

1. The form of the written material should vary from section to section corresponding to changes in process from section to section. Thus, in the first section, we expect the generating process to produce many single words, detached phrases, and incomplete sentences. In the second section, we expect the organizing process to produce material that is systematically indented, alphabetized, or numbered. In the third section, we expect the translating process to produce many complete sentences and some material associated in the verbal protocol with interrogatives suggesting search for sentence continuation.

2. The content statements in the protocol should reflect the distribution of processes just predicted, and

3. The generating process should be more persistent in section 1 than in sections 2 and 3.

2.7. HYPOTHESIS 1: The Form of the Written Materials

To test the first hypothesis, we wanted to determine if items written during the first section had a form consistent with the GENERATING process; items written during the second section, with the ORGANIZING process, and the items written during the third section, with the TRANSLATING process. For this purpose we identified all of the items written in the three protocol sections : 26 in the first section; 24 in the second; and 12 in the third. An item was a word, phrase, or sentence that was identifiable in the verbal protocol as being written during a single segment or several contiguous segments It was, in effect, a short burst of writing.

Three raters were given the written material and verbal protocol and were asked independently to make the following judgments about each written item

1. Does it have good form, i e , is it a complete, grammatical sentence?

2 Is it part of a systematically indented, alphabetized, or numbered structure, i e , does it appear to be part of an outline or structured plan of some sort?

3. Is it associated in the verbal protocol with an interrogative suggesting search for sentence completion?

Table 2 1 shows that there was excellent agreement among the raters in making these judgments. For each of the properties, Table 2 2 shows the proportion of items

written during each section that were judged to have that property. An item was scored as having a property if two or more of the judges agreed that it did.

Insert Tables 2.1 and 2.2 about here

Items written during section 1 sometimes had good form but most usually had none of the three properties. Items written during section 2 typically showed the second property (indentation, etc.) but neither of the other properties. Two-thirds of the items written during section 3 were of good form and many were associated in the protocol with interrogatives. No items written in any other section were associated with an interrogative. These results are quite consistent with the view that GENERATING is the dominant process in section 1, ORGANIZING in section 2, and TRANSLATING in section 3, and thus provide strong support for Hypothesis 1.

2.8. HYPOTHESIS 2: Classifying "Content" Statements

Our second hypothesis is that the content statements in the protocol will reflect differences in distribution of processes in the three protocol sections. As with our first hypothesis, we are looking for evidence that the writing processes we have postulated turn up where they ought to, e.g., GENERATING should appear prominently when the writer says that his goal is to generate ideas, etc. In addition, we are looking for evidence that the EDITING and GENERATING processes interrupt the other processes as we have postulated. Again, the expected distribution of writing processes is, in the first section, GENERATING interrupted by EDITING, in the second, ORGANIZING interrupted by EDITING and GENERATING, and in the third, TRANSLATING interrupted by EDITING and GENERATING.

To test this hypothesis, each of the authors independently classified each segment in two ways.

In classification 1, each segment was judged as belonging to one of the following four categories: (a) interjections, (b) metacomments; (c) content statements; and (d) a combination of metacomments and content statements.

In classification 2, the authors made judgments as to which of the writing processes was most likely to have given rise to the segment. Four alternative writing processes were considered: GENERATING, ORGANIZING, TRANSLATING, and EDITING.

Because the protocol sections were identified by examining the writer's metacomments, we wanted to test Hypothesis 2 using only segments that were purely content statements with no component of metacomment. Therefore, in the following analysis, we have considered only those segments that both authors classified as pure content statements. Out of a total of 458 segments, 170 were identified as pure content statements, approximately 130 as interjections, 18 previously identified as "reads" were not judged, and the remainder were judged by one author or the other as being metacomments in part or whole.

The authors agreed in attributing writing processes in 144 or 84.7% of the 170 content statements. Table 2.3 shows that, despite some differences, the authors agree that the content statements in section 1 can be attributed mostly to GENERATING; in section 2, to ORGANIZING: and in section 3, to TRANSLATING. They also agree that approximately 10 to 15% of the segments in each section can be attributed to EDITING and that approximately 10 to 15% of segments in sections 2 and 3 can be attributed to GENERATING The most important disagreement is that one author attributes some segments in sections 1 and 2 to TRANSLATING whereas the other does not.

Insert Table 2 3 about here

Figure 2 9, which shows the processes author 2 attributed to the sequence of metacomments and content statements, illustrates two features of the protocol:

1. Interruptions of other processes by EDITING and GENERATING are frequent and widely distributed.

2. Even though in segment 117, the writer announced, "Now it's time to go back and read over the material and elaborate on its organization," apparently he doesn't do very much organizing until segment 153. The reason for this is that the writer is indeed reading (10 "reads" occurred in this interval), and the reading triggered some GENERATING and EDITING interrupts.

Because we made the judgments of process in the context of the whole protocol, one must be concerned that this context could have influenced our judgment. For example, we might have attributed a segment to GENERATING rather than to TRANSLATING if the segment occurred early in the protocol.

To determine if consistent judgments of process could be made without context, we conducted the following study. We selected 41 content statements from the protocol and typed them on cards. The cards were then shuffled and presented for judgment independently to two coders (not the authors). Coder 1 agreed with one of us in 67% of judgments and Coder 2, in 77% of judgments. Most of the disagreements (16 out of 22) involved judgments of EDITING. Many segments that the author attributed to EDITING the coders attributed to GENERATING. EDITING may be especially difficult to identify out of context because "edits" often present a comment on the previous segment or represent a change in a previous segment It is difficult, for example, to see that segment 87, "I guess all elements are low level," indicates editing for redundancy unless one also sees segment 86, "even low level elements of writing." If we consider only segments that the author attributed to GENERATING ORGANIZING, or TRANSLATING, we find that both coders agree with the author in 86% of cases. These high levels of agreement are very encouraging and suggest that even if judgments were made without context, our conclusions concerning Hypothesis 2 would be substantially the same Overall, then, our results strongly support Hypothesis 2

Insert Figure 2.9 about here

2.9. HYPOTHESIS 3: Measuring Retrieval Chains

Our third hypothesis is that the GENERATING process will be more persistent during section 1 of the protocol, when the goal is to generate, than during sections 2 and 3, when it is not. To test this hypothesis, one of the authors identified all of the content ideas generated during the protocol. (A single idea might be the topic of several protocol segments but was nonetheless counted as one idea.) A total of 48 separate ideas was identified. The two authors then independently judged whether each idea had been cued by the previous idea or not. Because the authors' judgments agreed in 96% of cases, we simply present the average of their results.

In section 1, 32 ideas occurred in chains of average length 6.4, whereas in sections 2 and 3, 16 ideas occurred in chains of average length 2.0. As the model predicted, the GENERATING process was much more persistent during the first section of the protocol than during the second two. The fact that the average chain length in sections 2 and 3 was two rather than one as the model requires suggests that our criteria for terminating search should be relaxed a bit.

The sequence in which ideas were retrieved in section 1 was strongly determined by associative connections to appear in the final essay. We might expect this unless, of course, an active ORGANIZING process intervenes between GENERATING and TRANSLATING as the model postulates.

Figure 2.10 shows the writer's outline for the essay as a structure of ideas in tree form. The numbers in the figure indicate the order in which the ideas were generated. Clearly, the retrieval order is very different from the outline order.

Insert Figure 2.10 about here

2.10. Conclusions

We believe that the evidence provides very encouraging support for our model. All three of the model's predictions were strongly confirmed. We should note, however, that although these results are encouraging, they are quite limited in scope. First, although the model was derived through informal analysis of many protocols, it has been tested formally with only one protocol. Second, although the model is quite complex, only a few of its properties have been tested. We have tested some properties of the major writing processes, but we have not, for example, tested the model's predictions about individual differences nor about the structure of the editing processes We plan to conduct much more extensive testing of the model in the near future.

Whether or not it is supported by the data, one may still ask, "Is there really anything new about the model? Haven't English teachers been talking about processes such as planning, organizing, and editing for a long time?" Indeed, English teachers have been talking about such processes for a long time. Nonetheless, there is a great deal that is new about the model. First, the model is rather specific about the nature of the individual processes (see Figures 2.2 - 2.6). Second, and more important, the model specifies the organization of these processes In particular, it specifies an organization that is goal directed and recursive, that allows for process interrupts, and that can account for individual differences.

We should caution the reader not to interpret our model as a stage model. We are not saying that writing proceeds in order through successive stages of PLANNING, TRANSLATING, and REVIEWING. It may do so, and, indeed, in the part of the protocol examined in this paper, writing did proceed generally in successive stages. However, this

is not the only sort of writing behavior we have observed, nor is it the only sort allowed by the model. The model is recursive and allows for a complex intermixing of stages. As we noted previously, the whole writing process, including PLANNING, TRANSLATING, and REVIEWING, may appear as a part of an EDITING subprocess. Because EDITING can interrupt any other process, these processes can appear within any other process.

Further, we should note that we do not intend to imply that all writers use all of the processes we have described. Our model is a model of competent writers. Some writers, though, perhaps to their disadvantage, may fail to use some of the processes. We have, for example, observed a writer who failed to organize. This writer, however, could not be viewed as competent.

We believe that our model, if it is approximately correct, can serve as a guide to the diagnosis of writing difficulties. We hope that, whether it is right or wrong, it can serve as "a target to shoot at," and hence a guide to further research on writing.

3. The Dynamics of Composing

3.1. Introduction

In this section we attempt to use our proposed model of the writing process to describe writers in action. In other words, we would like to account, from the writer's point of view, for the dynamics of composing. We make two major points. The first is that the act of writing is best described as the act of juggling a number of simultaneous constraints. This is in contrast to seeing it as a series of discrete stages or steps that add up to a finished product. Second, we suggest that one of the most effective strategies for handling this large number of constraints is Planning. Plans allow writers to reduce "cognitive strain," that is, to reduce the number of demands being made on conscious attention. (They also create a nested set of goals that allow a number of constraints to be satisfied at once.)

In general, the constraints an adult writer must shoulder seem to fall into three major groups of increasing inclusiveness: the second is the more inclusive linguistic conventions of written texts; and the third is the encompassing constraints of the rhetorical problem itself. Writing is like trying to work within government regulations from various agencies: Whatever the writer chooses to say must, in principle, eventually conform to all of the constraints imposed from all of these areas. Let us look at each of these kinds of constraints in more detail.

3.2. Knowledge

Generally speaking, Knowledge is a resource, not a constraint. However, it becomes a constraint on the process when it is not in an acceptable form. In general, expository writing calls for relatively organized, conceptually integrated knowledge. When confronting a new or a complex issue, writers must often move from a rich array of unorganized, perhaps even contradictory perceptions, memories, and propositions to an integrated notion of just what it is they think about the topic. Some writers obviously go much further down this road than others, but much of the work of writing can be the task of transforming incoherent thought and loosely related pockets of information into a highly conceptualized and precisely related knowledge network.

In the following protocol, we se a subject responding to the demand for sufficiently integrated knowledge. She has probably never had to talk, much less write, about her subject before, so her writing process is strongly constrained by the need to formulate just what it is she thinks or knows. We see her retrieving information from memory, drawing inferences, and relating her various ideas We have deleted portions of the protocol that are irrelevant to this discussion, they will be shown later. There are a number of important things to notice here. If we try to diagram the writer's developing knowledge structure as a map, we find that the topography keeps changing. The writer doesn't start with a well-formed thesis that she can just develop. Instead, she must

juggle her ideas around trying to decide just how they are related. "Grades" is an interesting floater. Notice how it moves about on her knowledge map.

The arrows in Figure 3.2 indicate a general causal relationship between two ideas. If that relationship becomes further specified, the line then receives a label as in episode 3. Initially both Grades and Pressure are linked independently to Motivation (lines 1-4 in the protocol). Then Grades become identified with Pressure and subordinated to a new notion, Personal Satisfaction. In episode 3, line 9 in the protocol, Personal Satisfaction is reasserted as a cause of Motivation and the relationship between the two is further defined with the label major. In episodes 4 and 5, lines 15-28 in the protocol, the writer sets up a number of trial relationships in which Grades are still a subordinate element. When, however, we skip to the final draft, we find a knowledge map in which Grades and Personal Satisfaction have come to stand as independent parallel causes and each relationship has been further specified by the labels major and initial.

Insert Figures 3.1 and 3.2 about here

Retrieving knowledge and creating an adequate conceptual structure of "what you think" can be a demanding task. Sir Phillip Sidney's poetic advice to A trophel, "Look into they heart and write," is often a useful heuristic, but it doesn't guarantee that you will find a ready-made conceptual structure there.

3.3 Written Speech

If we refer to the Wendy protocol at line 11 in Figure 3.3, we can see her trying to accommodate a second, even more demanding constraint. In addition to clarifying what she thinks, she is now trying to express that knowledge map within the linguistic and discourse conventions of written prose. Notice too how quickly she has jumped to the added task of producing text. nine lines of analysis and she is ready to set it in type.

Insert Figure 3.3 about here

There are many ways in which language, which enables us to express complex thought, also constrains our attempt to do it. For the inexperienced or remedial writer, the rules of grammar and conventions of usage and syntax may make an enormous demand on time and attention. But even the more experienced writer must encounter the inevitable truculence of language itself, which seems to resist our attempts to form a set of continuous sentences with forward and backward reference. A sentence that is grammatically acceptable may twist the meaning, repeat a word too soon, or have terrible rhythm. In generating a given sentence, the writer needs to meet all of these constraints more or less at once

The following example illustrates the difference between knowing something and trying to turn that knowledge into a piece of writing. Wendy has established a knowledge map in which Motivation and Grades are related in three distinct ways. She is now trying to turn that set of thoughts into an acceptable sentence. Where we enter the protocol, she is working on the sentences that will become sentences 2, 4, and 6 in the final text.

The excerpts shown in Figure 3.4, from Wendy's final essay and from the protocol, illustrate two interesting points:

1. Complex thoughts don't automatically flower into appropriately parallel complex sentences. Although Moliere's Bourgeois Gentleman was surprised to discover that he had been speaking "prose" all his life, doing so is no mean task The success that sentence-combining exercises claim for improving overall writing skill (O'Hare, 1973) is probably due to their ability to reduce the effect of this linguistic constraint. By making sentence production processes somewhat more automatic, the writer has time to concentrate on other important constraints.

2 In addition to producing a verbal rendition of thought, our writer must also work within the conventions of written speech, particularly those conventions that distinguish oral speech from writing and make writing a specialized form of discourse. Even from this brief protocol passage, we can infer that the

writer probably has a set of rules or adages about paper writing that say:

* Be specific.

* Repeat ideas for emphasis.

* Refer back for coherence.

* Don't repeat words/phrases in close proximity.

* Use "correct" (?) wording.

Insert Figure 3.4 about here

---

4. Cognition of Discovery

Even though the teacher gives several students the same assignment, The writers themselves create the problem they solve. Because people only solve the problems they give themselves, the act of representing the problem has a dramatic impact on performance. People simply rewrite an assignment or a situation to make it commensurate with their own skills, habits, or fears (Britton et. al., 1978). Although writing texts generally ignore this part of the writing process, (Larson, 1978) our work suggests that it may be one of the most critical steps the average writer takes.

The first part of this section, then, will describe our method for studying the cognitive process by which people represent the rhetorical problem. Then we will present a model of the rehetorical problem itself, that is, a description of the major elements writers could consider in building such an image Finally, we will use this model of the possible as a basis for comparing what good and poor writers actually do.

4.1. Studying Cognitive Processes

The research question we posed for ourselves was this: if discovery is an act of making meaning, not finding it, in response to a self-defined problem or goal, how does this problem get defined? Specifically, we wanted to answer three questions:

1. What aspects of a rhetorical problem do people actively represent to themselves? For example, do writers actually spend much time analyzing their audience, and if so, how do they do it?

2. If writers do spend time developing a full representation of their problem, does it help them generate new ideas?

3. And finally, are there any significant differences in the way good and poor writers go about this task?

In order to describe the problem definition process itself, we collected thinking-aloud protocols from both expert and novice writers A protocol is a detailed record of a subject's behavior. Our protocols include a transcript of a tape recording made by writers instructed to verbalize their thinking process as they write, as well as all written material the writer produced A typical protocol from a one-hour session will include four to five pages of notes and writing and 15 pages of typed transcript. The novice writers were college students who had gone to the Communication Skills Center for general writing problems such as coherence and organization. The expert writers were teachers of writing and rhetoric who had received year-long NEH fellowships to study writing. Each writer was given the following problem "write about your job for the readers of Seventeen magazine, 13-14 year-old girls," and was asked to compose out loud into a tape recorder as he or she worked. They were told to verbalize everything that went through their minds, including stray thoughts and crazy ideas, but not to try to analyze their thought process, just to express it.

4.2. A Model of the Rhetorical Problem

From these protocols, we pulled together a composite picture or model of the rhetorical problem itself. This composite is shown in Figure 4.1, with examples drawn from our writers' protocols. It is based on what the group of writers did and shows the basic elements of a writing problem which a given writer could actively consider in the process of composing, if he or she chose to. For example, the writer in the following excerpt is actively creating an image of himself or his persona, an image of what effect he might have on his reader, and an initial representation of a meaning or idea he might choose to develop, as the words in brackets indicate.

> Ah, in fact, that might be a useful thing to focus on, how a professor differs from...how a teacher differs from a professor, (meaning), and I see myself as a teacher, (persona), that might help them, my audience, to reconsider their notion of what an English teacher does. (effect on audience)

Insert Figure 4.1 about here

Taken as a whole, the rhetorical problem breaks into two major units. The first is the rhetorical situation. This situation, which is the writer's given, includes the audience and assignment. The second unit is the set of goals the writer himself creates. The four dominant kinds of goals we observed involved affecting the reader, creating a persona or voice, building a meaning, and producing a formal text.

4.3. Differencees Among Writers

This six-part model of the rhetorical problem attempts to describe the major kinds of givens and goals writers could represent to themselves as they compose. As a model for comparison it allowed us to see patterns in what our good and poor writers actually did. The differences, which were striking, were these:

1. Good writers respond to all aspects of the rhetorical problem. As they compose

they build a unique representation not only of their audience and assignment, but also of their goals involving the audience, their own persona, and the text. By contrast, the problem representations of the poor writers were concerned primarily with the features and conventions of a written text, such as number of pages or magazine format. For example, Figure 4.2 shows a vivid contrast between an expert and novice when we compare the way two writers represented their rhetorical problem in the first 60 lines of a protocol. The numbers are based on categorizing pharses and sentences within the protocol.

Insert Figure 4.2 about here

As you can see, the expert made reference to his audience or assignment 18 times in the first seven to eight minutes of composing, whereas the novice considered the rhetorical situation less than half that often. The most striking difference of course, is in their tendency to represent or create goals for dealing with the audience. Finally, the column marked "Total" shows our expert writer simply spending more time than the novice in thinking about and commenting on the rhetorical problem, as opposed to spending that time generating text

2. In building their problem representation, good writers create a particularly rich network of goals for affecting their reader Furthermore, these goals, based on affecting a reader, also helped the writer generate new ideas In an earlier study we discovered that our experienced writers (a different group this time) generated up to 60 per cent of their new ideas in response to the larger rhetorical problem (that is, in response to the assignment, their audience, or their own goals) Only 30 per cent were in response to the topic alone For example, a writer would say "I'll want an introduction that pulls you in," instead of merely reciting facts about the topic, such as "As an engineer the first thing to do is ..." In the poor writers the results were almost reversed. 70 per cent of their new

ideas were statements about the topic alone without concern for the larger rhetorical problem (Flower and Hayes, 1979). All of this suggests that setting up goals to affect a reader is not only a reasonable act, but a powerful strategy for generating new ideas and exploring even a topic as personal as "my job."

As you might easily predict, plans for affecting a reader also give the final paper a more effective rhetorical focus. For example, one of the novice writers, whose only goals for affecting the audience were to "explain (his) job simply so it would appeal to a broad range of intellect," ended up writing a detailed technical analysis of steam turbulence in an electrical generator. The topic was of considerable importance to him as a future research engineer, but hardly well focused for the readers of Seventeen.

3. Good writers represent the problem not only in more breadth, but in depth. As they write, they continue to develop their image of the reader, the situation, and their own goals with increasing detail and specificies. We saw this in the writer who came back to revise and elaborate her image of her fashion-consuming reader. By contrast, poor writers often remain throughout the entire composing period with the flat, undeveloped, conventional representation of the problem with which they started

The main conclusion of our study is this: good writers are simply solving a different problem than poor writers Given the fluency we can expect from native speakers, this raises an important question Would the performance of poor writers change if they too had a richer sense of what they were trying to do as they wrote, or if they had more of the goals for affecting the reader which were so stimulating to the good writers? People only solve the problems they represent to themselves. Our guess is that the poor writers we studied possess verbal and rhetorical skills which they fail to use because of their underdeveloped image of their rhetorical problem. Because they have narrowed a rhetorical act to a paper-writing problem, their representation of the problem doesn't call on abilities they may well have.

5. A Taxonomy of Writing Plans

We know that writers generate an enormous number and variety of plans as they compose; the problem is how to categorize these plans in a useful way. Our hypothesis is that writers draw on three major kinds of plans which are hierarchically related to one another.

5.1. Plans To Do

To begin with, writers generate plans for dealing with their rhetorical problem. These rhetorical plans are called plans To Do something in or by language. These are essentially plans for performing a speech act--for responding in some way to that rhetorical problem, which includes the writer, the reader, and a purpose. A plan To Do something in writing might be as unique and specific as "Write a note for the icebox door to keep the family our of the plums Use a stern parental voice that begins with firm reasonableness and ends with a veiled threat" At the other extreme a rhetorical plan could be as conventional and limited as "write another essay for Freshman Compositions class." As you might expect when writers fail to plan or depend on limited, stereotypic plans, they are likely to spend very little time actively considering audience or purpose when they write They are more likely to produce "Writer-Based prose," which takes on the structure of the writer's own thought process and the style of an interior monologue (Flower, 1979).

A rhetorical plan To Do something can not only improve the quality of a paper, it can also make it easier to write When people treat writing as a speech act, they are more likely to draw on many of the well-learned strategies adults use everyday for arguing, explaining, or describing, but which many seem to ignore when they are writing for a class A rhetorical plan offers the writer a pole star for the choppy sea of trying to compose

5.2. Plans To Say

In order to carry out a plan **To Do** something, writers often generate two kinds of subplans. The first of these is the familiar and rudimentary plan that all schoolchildren have had drilled into them in the form of outlining: a plan for what you want **To Say** A plan **To Say** something is essentially a content plan--a simplified or abstract version of the information you want to convey. It can take a variety of forms, ranging from scribbled notes and sketches on an envelope to an impressive sentence outline complete with Roman numerals and two subpoints under every point. A plan **To Say** is essentially a scale model of the final product. Perhaps that is why it has been so widely and rigorously taught, often to the exclusion of any other kind of planning.

5.3. Composing Plans

There is, however, another kind of planning writers do that is based not on the product of writing, but on the process. This third kind of plan we call a **Composing Plan.**

Some **Composing Plans** help people generate knowledge. In classical rhetoric, such formalized plans go under the name of invention. One can choose from highly systematic and analytical plans, such as the particle, wave, field analysis of tagmemics, to Aristotle's topics or Gordon's synthetics. Or one could choose from more enigmatic and inspirational plans, such as Sheridan Baker's (1969) advice on "picking an argument" or the meditation techniques used in Pre-Writing, on down to the time-honored methods of poetic inspiration "Look into your heart and write." If you wish your students to have more self-conscious control over the process of generating ideas, there are many ways to teach it.

The category of **Composing Plans** also includes a large set of ad hoc plans people use to guide themselves through the process of writing For example, when the w. r in the Wendy protocol ran into trouble, she told herself to "write a bunch of ideas down and connect them later." Some of our subjects appear to be at the mercy of inspiration as

they compose, or slaves to their own growing text. Others are able not only to monitor their composing process, but to choose alternative ways to proceed. At the base of our work with heuristic strategies for writers (Flower and Hayes, 1977) is an attempt to learn more about these unexplored alternative strategies within the art of composing itself.

Let us close with an excerpt from a protocol that illustrates a writer working under a top-level plan **To Do** something, which in turn creates a nested set of goals and subgoals. As the protocol develops, we see how the writer's forward progress is the result of a recursive, nonlinear process guided by a variety of plans. As an illuminating contrast to this Subject, we studied another writer whom we shall call "Free write." As he composed, Freewrite's top-level plan appeared to be "Write whatever comes to mind" His guiding plan was essentially a plan **To Say**, with only a rudimentary set of composing rules tacked on (e.g., use correct grammar, use correct spelling if you know it, and paragraph occasionally) His protocol showed almost no discernible attention given to audience or purpose, and the final product, as you might guess, read rather like a audience or purpose, and the final product, as you might guess, read rather like a transcript of free association, even though the writer considered it quite adequate.

Insert Figure 5.2 about here

We return then to the writer working under a top-level plan **To Do** This schematic version of a protocol covers the beginning of the composing session The plans To Do and To Compose are generally comments the writer makes to himself, whereas the plans **To Say** are frequently notes jotted on paper Notice how the first three moves essentially define the rhetorical problem.

> By move 4, the writer has sketched out the rhetorical problem (his purpose, audience, and his own role) and set up a composing plan (just jot things down). When he begins to explore his knowledge at move 4, it is under the simultaneous control of these two plans

Move 5, a decision to keep on generating ideas, is a reaffirmation and development of the initial composing plan in Move 2.

By move 7, the information the writer has generated leads him to form a new plan that is both a Composing plan for the final paper and a plan **To Do** something--to make a point for the reader.

Move 9 is probably the most illuminating point of the protocol because the writer encounters a mismatch between his Knowledge (things he could say about Memory Is) and his goal vis-a-vis the reader. His action demonstrates the distinction between Knowledge and Goals in writing. His high-level plan **To Do**, based on his purpose and reader, lets him consider two subplans (make the subject itself important or focus on its underlying principle) and in turn two pockets of knowledge. In the process of working by plan our writer considers two radically different things he could say. Clearly his writing process is not simply the straightforward act of expressing what he knows. Instead it is a hierarchically organized, recursive process in which knowledge and text are generated under the direction of both the rhetorical plan **To Do** something and a Composing plan for how to do it in writing.

This fragment of protocol was the beginning of the Subject's writing session. At the end of the session, 40 minutes later, there was an unexpected code The writer discovered that his initial objective of "justifying Memory I" had been entirely forgotten in the course of composing a different line of argument. He now sees that Memory I (and the ideas generated in our excerpt) could be an example in this larger argument. In the following brief section, he sets up a new plan (which is both a rhetorical and a composing plan) and begins to compose text.

This excerpt illustrates what is probably one of the critical differences we have seen between the processes of good and weak writers. Weak writers in this situation would probably continue to crunch out text under the direction of a plan To Say what they knew or a plan To Compose their information into "acceptable" text. Good writers, by contrast, not only make initial high-level plans **To Do** something, but continue to return to and develop those plans as they write

---

Insert Figure 5 3 about here

---

6. The Pregnant Pause

An important aspect of most writers composing plans is the heuristic of fractionation (Hayes, 1981). Fractionation is the process of breaking a problem into parts and solving it by solving its component parts. the power of this heuristic for reducing the impact of problem constraints and memory limitations is widely recognized. The writer's use of fractionation to solve writing problems is revealed in the structure of the thinking aloud protocols. Typically, writing protocols are divided into easily perceived segments or "composing episodes" which are with few exceptions devoted to the statement and solution of a relatively well defined part of the total writing problem.

Composing episodes are units in the process of the writer, rather than his or her written product. We initially noticed that writers appeared to work in units of concentration or periods of sustained focus, and, more importantly, found that the boundaries between these composing episodes could be agreed upon by independent readers. In the protocols of three subjects analyzed in detail (the tape of one expert writer was no longer available) these episodes ranged in length from 1 to 33 lines of typescript, lasting from 7 seconds to 12 minutes, with an average length of 1 minute 45 seconds and an average of 10 clauses per episode (see Table 6 1).

Insert Table 6 1 about here

In our analysis we will occasionally separate episodes into "major" episodes, which are clearly autonomous episodes with strong boundaries, and "minor" episodes, which have weaker boundaries or stronger connections to adjacent episodes. Sets of these minor episodes typically cluster together to form a functional unit--they work as sub-episodes within the more clearly bounded unit of a major episode The following example will clarify this distinction. It comes from the very beginning of an expert protocol and shows two brief major episodes (74 and 47 seconds) and the beginning of one longer

major episode (13 minute) composed of three minor episodes. The bo ndaries between major episodes are indicated by double slash marks; those between minor episodes by a single mark.

There a number of features worth mention here. First, if this writer's performance were merely observed, it would appear to be a long 160 seconds of pausing, broken only by the act of shutting the door and ended by the transcription of the first sentence. The protocol, however, reveals a substantial and complex body of planning. Even during verbalizing, pauses still occur and those of 2 seconds or more are noted with superscript numbers. The coding of the protocol reflects our model (Hayes and Flower, 1980, Flower and Hayes, in press. a) and distinguishes between the processes of Planning, Translating (producing written text). and Reviewing Here text produced by the writer is underlined once, reading is underscored twice.

Note that the first episode ends with a metacomment--a familiar enough ploy for diverting attention from the task at hand. Episode two begins with a renewed attack on the assignment, which told subjects to work as if they were free-lance writers. The third episode breaks into smaller internal units or minor episodes. Like many of the episodes focused on the act of Translating or producing prose, it is relatively long and broken into minor episodes by brief evaluative comments and attention to side issues; yet the thread of composition is not lost. Such episodes seem directed by an overall plan that can sustain changes in topic and can cross paragraph boundaries. In this case, notice how adroitly the fragment of text produced in Episode 3 responds to the audience analysis, implicit goals, and plans which preceded it. As we will try to show in the rest of this paper, these episodes are goal-directed planning units in which writers work.

6.1. Evidence for an Episode Structure

Our analysis of the content of "pregnant pauses" will rest on two assertions we have attempted to verify:

1. That the "composing episodes" are real; that is, that they represent meaningful and verifiable units of concentration in which writers normally work.
2. That by looking at the boundaries which occur between episodes we are in fact looking at many of the longer, "pregnant" pauses noted by overvational research.

Although these episode patterns had intuitive validity to readers of the protocols, we looked for converging evidence to support their reality and the reliability of our boundary judgments. One content free indication of a boundary comes in the form of signal words such as "all right," "let's see," and "okay." In three of our four writers these signal words clustered significantly ($p < .001$) around episode boundaries (i.e., appearing in either the immediately preceeding or succeeding clauses). The fourth writer simply didn't use signal words. Such expressions seem to indicate a sense of opening or closure as in "okay, now..." or "that's okay." Or they worked as filler in the writer's transition from one episode to the next. (Although many boundaries are sharply defined points, some are one to three clause transitional units containing false closures, false starts, and metacomments.)

Most of the evidence for episodes and their boundaries, however, depends on the internal logic of the protocol itself. As Table 6.2 shows, when judges study the protocol carefully and know it well, they achieve high reliability in judging boundaries. These "knowledgeable" judges were merely instructed to look for units of concentration in the writer's process and to mark a boundary when they saw the writer shifting focus, changing a train of thought, or setting up a new plan. These judgements did show a threshold effect (as verified by the Gutman scaling technique)--some judges simply had broader criteria for selecting boundaries and noted more of them. However, even with

these differences, out of a total of 248 boundaries selected by our four knowledgeable judges. two or more judges agreed on 70% of these boundaries. A random selection predicted by a multinomial probability test would have yielded only a 20% agreement.

Insert Table 6.2 about here

For comparison, the protocols were then judged by four more readers whom we called "intuitive judges" because they had not studied the protocols and were given no instructions beyond "Use your intiution to mark what you see as meaningful episodes in the process of the writer's thought." As a control they were given a set of markers slightly greater than the number of major and minor episodes noted by the knowledgeable judges As one might expect, the intuitive judges created many more idiosyncratic boundaries (i.e., those chosen by only one judge). Nevertheless, of the 290 boundaries they marked, two or more judges agreed on 50% of the boundaries. They showed even stronger agreement on the "official" boundaries (i.e, those selected by two or more knowledgeable judges). Two or more of the intuitive judges selected over 90% of these boundaries (whereas, a probability test would predict only 13%) and three or more judges agreed on 73% (compared to the even smaller probability prediction of only .5% agreement) Finally, we asked a group of twenty-two writing researchers attending a seminar on protocol analysis to make intuitive judgments on yet another protocol and found that eight readers or more agreed on 70% of all the boundaries chosen by the group (here probability would predict such agreement on only 00000118% of the boundaries). We think these results are remarkably strong.

The goal of this initial analysis was not to create a well-specified definition of episodes, but simply to gather prima face evidence that they do indeed exist as complex, yet strongly visible units within the composing process. We can sum up the findings in this way You can't expect every reader to agree on all the boundaries; yet major

episode boundaries have a high intuitive discernibly. The selection of minor or sub-episode boundaries will be more idiosyncratic since readers respond to a wide range of events such as precess shifts between planning, translating, and editing; shifts in topic; and the intrusion of metacomments. However, knowledgeable readers--that is, people who carefully study the content and logic of the entire protocol--will come to high agreement in choosing episodes. The importance of "knowing" the protocol also reveals a key fact about episodes. Episodes are not like paragraphs of a text, organized around a central topic which a casual reader can easily follow. Instead, episodes seem to be organized around goals, so that one episode could include various topics and various processes from planning to editing--all tied together by their relevance to the writer's current plan or goal. Readers who know the protocol well are more aware of this overall structure.

7. Evaluating How Writers Generate Ideas

An important part of the planning process as it is described in our model is idea generation. In this section, we present data which helps us to describe idea generation more fully.

This study started with the hypothesis that an important difference between good and poor writers lies, not simply in their ability to express ideas in written speech, but in the very strategies they use to generate those ideas in the first place. We had observed that poor writers, in their attempt to find a focus or thesis for a paper, often seemed tied to the topic, while more experienced writers appeared to be responding to a larger rhetorical problem--a problem which included the reader and their own goals (Flower and Hayes, 1980).

If this hypothesis were true it would mean a number of things. First, if poor writers are obsessively focused on the topic to the exclusion of the larger rhetorical problem, it could help explain why they often are more likely to violate conventions of the

appropriate when they write, but not when they speak. In face-to-face conversation only ancient mariners are likely to ignore the rhetorical situation. Secondly, it the rhetorical situation itself helps stimulate plans and ideas, it could explain why so many poor writers, including the ones in our experiment, often seem to "run out of ideas." Finally, if a significant difference between good and poor writers is the strategy they use to generate ideas, this would suggest that evaluating or editing the final product gua product is unlikely to produce dramatic change. A more effective teaching technique would focus on the writing process itself.

To test this hypothesis we collected, on tape, verbal protocols of nine writers composing aloud. Four were people on the university staff who liked to write, who had done writing, and who were considered by their peers to be "good" writers In contrast to this group of "good" or experienced writers, we studied a group of "poor" writers who had come or been sent to the Communications Skills Center for general problems with organization and coherence. Two of these "poor" writers were graduate students, two undergraduate, none had difficulty with basic grammar or sentence structure

Each subject wrote on an assignment about which they would have topic information, but which created significant audience constraints They were told to work for approximately an hour and to verbalize everything that went through their minds as they wrote We analyzed these transcripts in two steps first, by isolating each new idea that was generated during the session (see Table 7.1). A new idea was defined as any complete grammatical unit, including complex statements with dependent clauses However, if such a complex statement was generated in two attempts separated by long pauses or intervening material, it was coded as two ideas. Our goal was to code as one unit those ideas which were being retrieved from memory as a unit, and to code as new all new attempts to expand or develop an idea Changes which affected merely the wording or sentence structure were judged on the basis of our model of the writing

process to belong to the process of "translating," not "generating," and were not counted (Hayes and Flower, 1980).

Insert Table 7.1 about here

Our second step was to discover where each of these new ideas came from. Therefore we categorized each new idea in one of three ways, as a response to either:

1. the larger rhetorical problem, including the topic,
2. the topic alone,
3. a current element in memory.

The basic purpose of this categorization was simple. Within a given body of ideas, we wanted to see what per cent of those ideas were generated as a response merely to the topic alone (or to a current element in memory) or alternatively, as a response to not only the topic, but to the larger rhetorical situation as well.

We used the following taxonomy to decide into which category a new idea should be placed:

1. An idea was categorized as a response to the rhetorical problem if it indicated one of the following: a concern with the writer's Purpose or Goal; an indication of the writer's sense of Audience; or a concern with the writer's sense of Self or Persona. A writer,s concern with purpose or Goals took two major forms either as a statement of purpose (e.g., "I need something here that pulls you in") or as a recognition of some of the formal features of written text Statements such as, "I'll use this as an introduction," indicated that the writer was seeing her ideas in the larger context of writing a paper or article Ideas which responded to the audience were sometimes direct ("Make this friendlier; it's for a young audience") or implicit (e.g., "I'll list the names of the most fascinating drinks"). Writers generated ideas in response to their projected Self or Persona with comments such as, "I'll appear like an idiot." Finally, some statements combined a number of these elements, such as "This may not be the best term for ten-year-olds, but it maintains the rhythm." Any idea which showed some response to the larger rhetorical problem, then, was placed in the first category

2 The second category was reserved for new ideas which were judged as

simply information generated in response to the topic alone, such as "A waitress has a number of duties, first. . . ." Often these ideas appeared to be the result of a straight memory search of what the writer remembered about the topic.

3. The final category was necessary to account for new ideas which appeared to be connected by some association to a recent thought or current item in memory, but which were not relevant to the rhetorical problem or to the topic. Both good and poor writers appear to go off on these short trains of association; the difference is in how frequently they do it.

As we expected, it is difficult to get complete agreement from judges on the absolute number of new ideas, since different judges are likely to have different thresholds for distinguishing new ideas from mere rewordings of old ones. Therefore, as a check on our method we conducted the following test using a set of 73 ideas which were judged as new ideas by all four judges in the experiment. The critical judgments in this study are the categorizations: is a given idea a response to the rhetorical problem or merely to the topic or a current element? And can judges agree on making those categorizations? In a universe of 73 ideas which all four judges had selected as new ideas, there was complete categorization agreement on 52 ideas or 71%. Three judges agreed on 69 responses or 94.5%. There was a two or three-way split on only four ideas This percentage of agreement confirmed our sense that such categorization is reliable

7.1. Results

The results of this analysis were striking, especially since our subjects did not represent the extremes of either good or poor writers and there was not attempt to account for or control individual differences. Nevertheless, as Table 7.1 shows, the poor writers as a group generated on 28% of their new ideas in response to the rhetorical problem, the other 72% were in response to the topic and/or a current element in memory. For the good writers this 30/70 distribution was nearly reversed Good writers generated 60% of their new ideas in response to the rhetorical problem in some way; only 40% of their ideas were a response to the topic or current element alone.

As you can see in Table 7.1, there is a significant spread among the poor writers, but as a group they remained distinct from the good writers. On the basis of a Pitman randomization test, these results were significant at the .01 level; that is, the probability that this difference between the groups would have arisen by chance is less than 1 in 100 (Siegel, 1956).

8. Formulating Sentences in Writing

In the previous several sections, we have examined the planning process, the first major process in our writing model in considerable detail. In this section, we turn to the second major process, Translation

How do people actually write sentences? When asked ourselves this question, we found that there was a great deal we didn't know We knew, of course, that writers' plans are very important, but we weren't sure of the extent to which the writers' plans determined the details of the sentences written nor of the extent to which the experience of composing sentences modified the writers' plans We didn't know if sentences are composed as a whole or if they are assembled from separately composed parts Further, we didn't know if there were differences in the processes experts and non-experts use to compose sentences

This paper explores all three of these questions. In the first section, we will discuss the relation of planning and sentence composition. In the second section, we will present data on the processes by which writers compose sentences We will propose a model to account for the data In the third section, we will describe differences in the way experts and non-experts compose sentences

In conducting this research, we were guided by our model of written composition (Hayes and Flower, 1980) In this model (see Figure 2.1 Section 2), we proposed three major writing processes. PLANNING, TRANSLATING, and REVIEWING The function of the PLANNING process is to set goals and to establish a writing plan which will guide the

production of text. The TRANSLATING process acts under the guidance of the writing plan to produce written text. The function of the REVIEWING process is to improve the quality of the text.

Below, we will present observations of people writing formal sentences, and use these observations to develop a detailed model of the TRANSLATION process and its relation to PLANNING.

8.1. The Relation Between Planning and Sentence Construction

We observed writers as they wrote essays on topics such as "My Job" and "Abortion: Pro and Con" for teenage audiences. The writers were asked to "think aloud" while writing. The resulting protocols were tape recorded and transcribed Our subjects were six expert writers chosen for their professional involvement in writing and six subjects who were competent adult writers, but not professionals.

For some writers, planning prior to writing is very sketchy, apparently consisting of little more than the choice of a general topic or perhaps a decision to write in simple language. Others plan more extensively--developing lists of subtopics to be discussed in a particular order--before any sentences are written.

Plans influence the way in which sentences are written. The order in which topics are discussed in the final essay is typically closely related to the order in which they are listed in the notes the writer made during planning.

The left hand column of Figure 8.1 shows the plan for organizing the essay by one of the expert writers as revealed by his protocol and by his notes written before he began to construct formal sentences. The right hand column shows the sequence of topics and subtopics in this completed essay.

Insert Figure 8 1 about here

For this writer, the relation between plan and essay was very close.

One output of the PLANNING process is typically a sequence of brief written notes of two kinds:

1. topic designations, e.g., "religious reasons," "misery of being an unwanted child," and

2. instructions to the writer, e.g., "introduction," "snapper line."

These two kinds of notes seem to serve rather different functions Topic designations serve to remind the writer to include information about a particular subject matter. Often it appears that the writer has this information preorganized for presentation in long-term memory. Instructions to the writer, on the other hand, remind the author to accomplish some rhetorical goal such as providing an appropriate beginning or end to the essay. Often they are content free or direct the writer to organize information at some later time For example, an instruction such as "summary" will typically lead the writer to organize content for a summary only after the essay has been written.

When the writer begins to generate formal sentences, these brief notes will be greatly expanded For the writer whose plan and essay are described in Figure 8 1, each plan element gave rise on the average to 2 5 sentences and about 55 words. In word count, the topics in the outline were expanded about eight-fold on the average when they appeared in the finished essay Expansion varied from a low in which a 29 word note was transformed into 39 words of text to much more extensive expansions in which, for example, "snapper line" became a 53 word conclusion and the single word "age" gave rise to 58 words of text.

As we noted above, our writers usually did not make outlines as complete as this writer did As a result, the amount of expansion from outline to essay for most writers is greater than we observe here.

For none of the writers we observed was the order of topics in the essay exactly

the same as the order of topics in the plan. Many changes in plans occurred while the writer was composing sentences. The writer whose plans are outlined in Figure 8.1 decided after writing section 2a(2) of the essay, "economic reasons," that section 2b of the plan, "current con-position," was "repetitious" and eliminated it. After writing section 2a(3), he decided that section 2c was unnecessary. Later he decided that topic 4b in the plan was really two topics and wrote it as such in the essay.

Clearly, then, the writer's plans influence the construction of sentences. Constructing sentences, however, can also influence plans. Just how a plan will work out isn't always clear until the writer tries to execute it. When he tries to put the plans into words, he may well discover weaknesses and redundancies which were not obvious and perhaps could not be obvious earlier.

The process of writing sentences can lead to more than just a change in the writing plan. It can also provide the occasion for writers to change their understanding of the topic. In the protocol segment shown in Figure 8.2, the writer is trying to compose a sentence about writing difficulties.

Insert Figure 8.2 about here

At first the writer seems to feel that the important problem is impulsiveness. By the time the sentence is completed, however, he decided that the real problem is lack of planning

Our main point here is that even when writers do make complete plans, there is still plenty of work to do to construct formal sentences. We know this because

1 The plan will almost certainly be modified during TRANSLATION.

2 The plan will be expanded ten fold or more to produce the sentence And

3 Some elements in the plan are instructions to the writer such as introduction" or "snapper line" which require the writer to add content at the

time of writing sentences.

We can summarize the relation between the PLANNING and TRANSLATING process as follows:

1. The order of topics in the writing plan is closely related to the order of topics in the essay. The PLANNING process clearly exerts some control over the TRANSLATING process.

2. When writing formal sentences, the writer greatly expands the topics designated quite briefly in the plan. The TRANSLATING process, then, takes the plan as input and builds on it.

3. Writing sentences can lead the writer to modify the writing plan. The TRANSLATION process, then, can exert some reciprocal control over PLANNING.

8.2. What Happens When Sentences Are Written?

The top part of Figure 8.3 is a protocol segment in which the subject was composing and writing down the sentence shown at the bottom. This segment shows all of the important features of sentence generation that we have observed in our sample of writers. First and most important, the subject constructs sentences by proposing and evaluating sentence parts.

Insert Figure 8.3 about here

Items 1, 4, 6, 9, 12, and 17 are proposed sentence parts. Items 10, 13, and 15 indicate evaluations. In addition, the protocol segment reveals three other processes: interrogation, goal setting, and rereading. Items 2 and 8 are interrogations. It is very common for subjects while they are writing to ask themselves questions such as, "What do I want to say?", "What do I mean?", "What did he do?", or simply, "What?" We assume that these interrogations reflect memory search processes in which the writer is trying to find information to be used in constructing the sentence.

Items 3 and 5 are instances of goal setting in which the writer specifies some

properties desired in the sentence without producing them.

Items 11, 14, and 16 are instances of reading.

The average size of proposed sentence parts for our 12 subjects was 9.29 words, and the average number proposed was 2.78 parts per sentence. Of the words proposed in the form of sentence parts, just over three-quarters (.76) were included in the final sentence Thus the process of proposing sentence parts appears to be a fairly efficient one

Of all the protocol segments which correspond to sentence construction:

* 18% contain one or more interrogatives

* 66% involve rereading of previously currently being written, and

* 8% involve rereading of previously written sentences

Rereading of the current sentence, then, is much more common during the TRANSLATING process than rereading of sentences composed earlier.

Figure 8.4 shows a model of the TRANSLATION process which accounts for many of the observed behaviors. The model assumes that in constructing sentences, the writer will try to follow a sequence of plan elements formed earlier. If a plan element is evaluated negatively, or if for some reason there is no plan element, then the writer will initiate PLANNING. In both PLANNING and EVALUATING, the writer may and often does make use of information derived by reading the context of the sentence to be produced

---

Insert Figure 8.4 about here

Once a plan element is selected, the writer will attempt to express it by writing one or more sentences This will be done by proposing and evaluating sentence parts If the writer had difficulty in proposing a part, then she/he may reread the context of the sentence ("to get a running start") or may ask a clarifying question such as, "What did he

really do?" or, "What am I trying to say?"

If a proposed part is evaluated positively, it is added to the current sentence buffer. We assume that parts are added to the sentence buffer from left to right and that at any time the buffer contains the first or left hand part of a sentence. We believe that it rarely or never contains a sentence part which is detached from the beginning of the sentence.

A sentence part may evaluated negatively because it fails to match the intended plan. For example, the proposed part may state something either more general or something more specific than the writer intended. If the writer continues to have difficulty in finding a part to add to the current sentence buffer, she/he may start over by clearing the sentence buffer.

When a sentence is completed, the writer must decide if the current plan element has been completed. If not, she/he will compose more sentences until the plan element is completed. If so, the writer will look for a new plan element.

8.3. Differences Between Experts and Non-experts

Generally, the protocols of the expert writers resemble those of the competent writers. Both groups construct sentences by proposing and evaluating sentence parts, and both groups engage in interrogation, goal setting, and rereading of the current sentence. There are, however, two consistent differences between experts and novices. Experts write longer essays and experts propose longer sentence parts. Table 8.1 shows the essay length and sentence part length for the experts and non-experts. Both differences are significant beyond the .05 level by the Mann-Whitney test.

Insert Table 8.1 about here

An independent rater measured sentence part lengths for two of the subjects--S4 and S7--and obtained average part lengths of 12.23 words for S4 and 7.30 words for S7.

The four experts who proposed long sentence parts (Subjects 1, 2, 3, and 4) wrote essays which were ranked first, second, third and fourth by panel of judges who judged all 12 essays. The experts who proposed short sentence parts (Subjects 5 and 6) wrote essays which were ranked 9th and 10th in quality by these same judges. There is some reason, then, to believe that the average length of the sentence parts which a writer proposes when he is constructing sentences is related to the writer's skill in writing. What mechanism could be responsible for such a relation?

Simon and Chase (1973), studying skill in chess, concluded that the advantage which chess experts have over novices depends on a enormous amount of pattern knowledge which they acquire during thousands of hours spent in analyzing chess games. The fact that experts have more and larger patterns than those available to novices allows the expert to think of chess games in larger units than novices can use. Perhaps thousands of hours spent constructing sentences enables the expert writer to work in larger units than those with less experience.

In contrast to the fluency shown by experts, the sentence constructing processes of poor writers may be interrupted frequently by difficulties with low level processes. Figure 8 5 illustrates this sort of difficulty in a student who had been referred to a writing clinic. Spelling, orthography, and even the simple matter of handling a pencil occupy so much of the writer s attention that he has considerable difficulty keeping track of his sentence. Our competent and expert writers rarely have difficulties with low level processes

---

Insert Figure 8 5 about here

In poor writers, then, fluency is strongly influenced by mastery (or lack of mastery) of low level skills. In competent and expert writers, we propose that fluency depends on the acquisition of large quantities of sentence pattern knowledge.

9. Implications for Teaching

Our research on the composing process has a number of implications for teaching. It suggests some important additions to what we teach: we need to teach students to understand and analyze their own thinking process just as they now do their writing products. And we need to reconsider how we teach, when the content of such teaching is not content specific knowledge but process skills. Teaching heuristics and thinking strategies--trying to affect performance--calls for new techniques. In summing up the implications of our research for teaching, we would emphasize three important observations supported by our work.

1. There are important differences in how expert and novice writers handle the process of writing.

2 Many of the heuristics or strategies experienced writers employ are eminently teachable.

3 One of the most promising areas for improving students' writing is in the neglected art of planning.

9.1. Implication 1

There are important differences in how expert and novice writers handle the process of writing This difference was particularly evident in a study of how writers defined their own rhetorical problem--what elements of the task they attend to and how rich and complex a representation they built

1. Good writers respond to all aspects of the rhetorical problem. As they compose they build a unique representation not only of their audience and assignment, but also of their goals involving the audience, their own persona, and the text. By contrast, the problem representations of the poor writers were concerned primarily with the features and conventions of a written text, such as number of pages or magazine format

2 In building their problem representation, good writers create a particularly rich network of goals for affecting their reade Furthermore, these goals, based on affecting

a reader, also helped the writer generate new ideas. In an earlier study we discovered that our experienced writers (a different group this time) generated up to 60 per cent of their new ideas in response to the larger rhetorical problem. Only 30 per cent were in response to the topic alone. For example, a writer would say, "I'll want an introduction that pulls you in," instead of merely reciting facts about the topic, such as "As an engineer the first thing to do is . . . ." In the poor writers the results were almost reversed 70 per cent of their new ideas were statements about the topic alone without concern for the larger rhetorical problem. All of this suggests that setting up goals to affect a reader is not only a reasonable act, but a powerful strategy for generating new ideas and exploring even a topic as personal as "my job."

As you might easily predict, plans for affecting a reader also give the final paper a more effective rhetorical focus For example, one of the novice writers, whose only goals for affecting the audience were to "explain [his] job simply so it would appeal to a broad range of intellect," ended up writing a detailed technical analysis of steam turbulence in an electrical generator. The topic was of considerable importance to him as a future research engineer, but hardly well focused for the readers of Seventeen

3 Good writers represent the problem not only in more breadth, but in depth As they write, they continue to develop their image of the reader, the situation, and their own goals with increasing detail and specificity We saw this in the writer who came back to revise and elaborate her image of her fashion-consuming reader By contrast, poor writers often remain throughout the entire composing period with the flat, undeveloped, conventional representation of the problem with which they started

The main conclusion of our study is this good writers are simply solving a different problem than poor writers Given the fluency we can expect from native speakers, this raises an important question Would the performance of poor writers change if they too had a richer sense of what they were trying to do as they wrote, or if

they had more of the goals for affecting the reader, which were so stimulating to the good writers? People only solve the problems they represent to themselves. Our guess is that the poor writers we studied possess verbal and rhetorical skills which they fail to use because of their underdeveloped image of their rhetorical problem. By narrowing a rhetorical act to a paper-writing problem, their representation of the problem doesn't call on abilities they may well have.

The second implication we see in our own study is that the ability to explore a rhetorical problem is eminently teachable. Unlike a metaphoric "discovery," problem-finding is not a totally mysterious or magical act. Writers discover what they want to do by insistently, energetically exploring the entire problem before them and building for themselves a unique image of the problem they want to solve A part of creative thinking is just plain thinking

Exploring a topic alone isn't enough As Donald Murray put it, "writers wait for signals" which tell them it is time to write, which "give a sense of closure, a way of handling a diffuse and overwhelming subject." Many of the "signals" Murray described, such as having found a point of view, a voice, or a gene, parallel our description of the goals and plans we saw good writers making If we can teach students to explore and define their own problems, even within the constraints of an assignment, we can help them to create inspiration instead of wait for it

9 2. Implication 2

The process of writing is not a simple, step-by-step process However, many of the heuristics or strategies which aid experienced writers are eminently teachable Three implications for teaching heuristics stand out:

1 Heuristics do not offer a step-by-step formula for how to write. They are available, and powerful, but optional techniques for solving problems along the way Although it makes sense, in general, to plan before you generate and to generate ideas before juggling them for a reader, these processes can often

be collapsed together in a writer's thinking. Furthermore, as our subjects show, the entire process of plan, generate, and construct may be reiterated time and again at all levels of the process, from the act of articulating a key phrase to producing a sentence, paragraph, or entire paper. Problem solving asks the writer to trade in his/her set of rules for How to Write (Gather, Outline, and Write), which never worked too well anyway, for a set of Alternative Ways to Reach Your Goal When You Write.

2. A second basic fact about teaching heuristics is that people must experience a new thinking technique to learn it. Brainstorming, for example, is an acquired skill and may go against the grain for writers geared to producing usable prose on a first sitting. Students will not blithely relinquish their habitual composing techniques, no matter how inefficient, at the sight of a new idea. To make a new heuristic an available option it must be presented as a classroom experience which ensures that the writer actually learns how to use and apply a new technique. Even the inexperienced writer is never a tabula rasa. he comes equipped with many well-engrained, if counter-productive habits. It is one thing to teach students a new formula, another to actually change behavior. But writing, like problem-solving thinking in general, is a performance art. Unless we deal with writing as a form of thinking, we have simply taught the student the ropes of another classroom genre-the composition paper.

3. Finally, a problem-solving approach to writing works for many writers because it allows for the disorderly dynamics of serious thinking and encourages an analytical and experimental attitude in the writer. Heuristics ask the student to see writing as a communication problem they are setting out to solve with all the strategies they can muster. In practice, perhaps the most remarkable result of using heuristics is that early in the course students develop a conviction that writing is an important skill they can in fact master. Obviously, such a conviction is not always one hundred per cent warranted, but in replacing the mystique of talent and the fear of failing with the possibility of an attainable goal, problem solving helps writers draw more fully on the abilities they do have.

9 3. Implication 3

Finally, in teaching strategies for the writing process, one of the most promising areas is in teaching the often neglected are of planning.

In a recent talk, Richard L. Larson took English teachers to task for the way we do and don't teach writers to plan. According to his informal survey of current textbooks, our instruction in planning is limited to teaching a few old war horses and is focused quite decidedly on the written product, not the writing process. If students followed only

our teaching (and apparently it's a good thing they don't), the only kind of planning they would do would be limited to 1) making and outline, 2) choosing a method of development and 3) deciding on transitions. In reality, as Professor Larson points out, writers also need to plan what they want to do in a piece of writing and where they want to leave the reader.

That statement seems an uncontestable piece of common sense. And yet, would we agree with it? Is the common sense support of planning in conflict with the equally reasonable assumption that writing is a process of discovery? Many of us would argue that writers find where they are going on the way to getting there. And furthermore, that planning, especially the lockstep of an outline, can force a writer to leave the wandering path of discovery in favor of marching down a straight and narrow-minded path to the end of the theme. According to the discovery method, planning may indeed help you get there sooner, but the destination you reach may not be worth the trip.

We could state the dilemma in this way. The act of producing a rhetorically effective, purposeful piece of writing depends on highly goal-directed thinking, on making plans. On the other hand, the equally important act of making meaning where none existed, of turning our experience into ideas, is a discovery procedure fostered by the freedom to explore by-ways and follow unmarked paths that no plan could foresee.

The practical problem for us as teachers is how to resolve this conflict, can we give students the power of planning without denying the experience of discovery? Textbooks, insofar as they reflect teaching methods, often fall into one of these two camps, emphasizing either hardline traditional methods of planning (outlines, methods of development, etc.) or discovery procedures such as pre-writing or free writing. This suggests that writing can be either an act of honest and creative self-exploration, or it can be an act of planned, rhetorically effective problem-solving. But, we seem to be saying, it can't be both.

In contrast to this apparent dichotomy in teaching, research in composing process suggests that good writers do both. In my own work with John R. Hayes studying the thinking processes of writers, we see writers make plans to explore a topic, to discover conflicts, to figure out what they really mean, and at the same time make plans to produce written discourse and to deal with a reader. One of the important problems writers face, but teachers teach, is how to map these various plans onto one another and to coordinate exploration and communication to serve a common goal.

I suggest we often fail to teach this interaction for precisely the reasons Professor Larson mentioned--our definitions of planning are limited and limiting. Let me qualify that statement. when we ourselves write, our working definition of planning might be quite broad and flexible, it probably includes all those things that go on when one is driving to work or standing in the shower But what we teach under the name of plans may still be outlines, methods of development, and transitions

The purpose of this paper is to briefly describe the kinds of planning writers do which combine the power of goal-directed thinking with the richness of a discovery process We will look at three kinds of plans. plans To Do Something by writing, plans To Say Something in writing, and plans To Discover Something through the act of writing itself But first let's take a brief look at the nature and power of plans

Contrary to the tradition of monumental sentence outlines glittering with Roman numerals and two points beneath every sub-point, good plans are often only sketches in the mind Plans help us write in three ways

1. Plans let people reduce large messy problems (such as "be interesting") down to their <u>essentials</u> Architects do this when they create and revise sketches instead of experimenting in steel and concrete Writers do it when they choose a focus, jot down notes on envelopes, draw pictures with arrows, or write outlines A plan, then, is a scaled down version of our solution to a problem, a model which abstracts the essentials from a problem and allows us to mentally manipulate those essentials first

2 This reveals a very important fact about plans Since a plan allows us to test

out a solution in the way an artist uses a sketch, a good plan must be detailed enough to test, but cheap enough to throw away. That is why those elaborate early outlines often fail to produce good writing or help the writer. They are so expensive to create, they are less a plan than a shackle. They lock writers into a premature solution before they have even entered the problem. A good plan, then, is a sketch which sets up goals and alternatives which, in turn, keep the writer focused on the essentials of the problem, not the details of a particular solution.

3. Plans, at least some plans, have another characteristic. They give writers a set of steps or procedures for getting from where they are to where they want to be. We say that good plans of this sort are operational; they help us act. One way to see if a plan is operational is to put it in the form of a goal statement. Then see if it suggests how to proceed; if it offers built-in "how-to" cues for how to achieve the goal. Compare these two goals, one with "how-to" cues, one without: (1) I want to be rich and famous, versus (2) I want to study probability, statistics, and writing so I can get rich quick at Las Vegas and become famous writing a bestseller on how I did it. A writer might make a goal such as "be persuasive" more operational by saying, "I want to argue forcefully both sides of this controversy to show the reader that I have pinpointed the crucial issues, but also to pave the way for my own ideas." Plans or goals without "how-to" cues are often highly abstract, for example, "I want to discuss team sports..impress my reader.. get an A in this course." Such plans may not offer the writer much help at all.

4. The third strength of plans is really a result of the first two. Because plans abstract a problem to its essentials and suggest ways to go about working on it, they help writers turn an overwhelming situation--write that terrific paper--into a manageable set of sub-problems By discovering and concentrating on major sub-problems, such as the purpose of the paper, writers can handle each part better and reduce the anxiety of facing an unmanageable whole. As you might expect, good writers not only work on such sub-problems but have a variety of strategies for integrating the parts into a whole For example, writers can delay consideration of a lower level concern such as spelling, grammar, or even organization until they have worked out what they might want to say. But at the same time, they continue to consolidate and reorganize what has gone before as their ideas develop

9.4. Teaching Planning Versus Doing It

Teaching has a lot in common with planning. We break a complex process down into parts and teach people how to use the parts But inevitably, we leave the work of integrating those parts into a whole up to the student The process of writing is too complex to give anything like a recipe for it. But at the same time we must not confuse

the parts we teach with the process itself. This is particularly important with planning. At the end of this paper I will offer three kinds of planning that we can teach as independent planning exercises. In reality, of course, good writers use and integrate all three kinds of plans which we as teachers must separate to teach. The question is, how do good writers do that?

In trying to develop a model of such cognitive processes in writing, John R. Hayes and I have used the method of protocol analysis to see what writers are actually doing as they compose. In this research we ask writers to compose out loud, verbalizing everything that goes through their minds as they are writing The transcript of this tape recording, which is called a verbal protocol, along with the writers' notes and manuscript provides an extraordinarily rich record of the thinking processes that underlie the act of composing. When we look at the planning processes writers use, two things stand out

1 Plans do not emerge fully blown at the beginning of a writing session. They are often generated in response to the writer's purpose, topic, or audience Plans begin as sketches that get changed and fleshed out as the writer explores the problem.

2 The planning process (that is, for the writers who do make plans, and some don't) continues throughout the writing process. We may place planning at the beginning of a textbook and encourage it at the beginning of writing, but it is not a formal exercise like outline making. It is a thinking activity, almost a frame of mind, that characterizes the entire writing process of good writers. So, even though we may teach the kinds of planning outlined below as independent activities, we need to also make clear how they fit into the larger act of writing

With that in mind let me describe three planning techniques which try to bridge research and teaching by translating what good writers do into teachable techniques that help people write.

9.5. A Plan To Do

One of the most important but most untaught kinds of plans writers make are rhetorical plans or plans **To Do Something** by writing. People write for a reason, and the clearer they are about their goals the more likely they are to get there. In trying to decide what they want **To Do** by writing, writers must define the rhetorical problem they are facing: what do they think they are going to accomplish with whom, and how do they think they are going to do it? Teaching students to do such rhetorical planning, and creating realistic assignments that require it, remind us that writing is a purposeful act and not an exercise in style alone. Furthermore, rhetorical planning is an important way good writers narrow down their search from all the possible things they could say about a topic to the important things they want to say. Rhetorical planning simply makes it easier to write well

Here is an example from a writer who tried to map his plan for what he wanted **To Do** by writing a letter to his Congressman. As you can see, it would have been easy to simply write a list of facts about himself. Planning can escalate the problem The writer must create and organize new concepts, not just "print out" what he knows Such planning sets new standards, and makes it possible to achieve them.

My purpose in writing is to convince the Congressman that I am the best candidate for a legislative aid.

How do I convince him that I'm the best applicant?

Show him that I am a person of purpose and determination

have set career goals — have set ways to achieve them

college — law school

Convince him that I possess the skills that he would consider valuable and hopefully better than other candidates'

analytical and communication skills — govt. experience — leadership roles

Another kind of Plan **To Do** writers often make is called an Impact Statement much

like the environmental impact statement a dam builder has to make, describing the effect his dam will have on the land, wildlife, water and so on. An Impact Statement is focused on the reader. For instance, the writer asks herself

> In a few words, try to describe what I want to happen; what impact do I hope to have? What do I want my reader to feel, or think, or maybe even do after reading my paper? If my goal is to make an engineer, say someone like my college roommate, understand why people read poetry and maybe even come to enjoy it, how am I going to do this?

Clearly a review of the history of poetry won't do the trick. An Impact Statement lets the writer plan with the reader in mind.

96. A Plan To Say

Once a writer has at least a start on what he or she wants To Do, it makes sense to try to plan what To Say. Here we are on the old familiar ground of outlines, but with one distinction. Early in the writing process plans To Say might well be only sketches, notes with arrows and stars. As models to be tested and changed and refined, they need to be cheap enough to throw away. The later, more formal kinds of plans are really aids to constructing tight, coherent text rather than generating possible ideas.

The following plan was done by a writer who liked to visualize his relationships. Notice how it generates a set of things the writer could say in a personal profile, but keeps those things within the context of what he wants to do by writing. Again compare the result of this plan to the things he could have said had he chosen to simply describe "My Job at Goodrich"

Facts	Concepts
Worker for Goodrich-	
responsible for projects	responsible
developed 6 improvements	innovative
all engineering involved	

applied general theory to real problems

developed cost effective solution

experienced

adaptable and flexible

Worked for D'Alecy

successfully developed program

sharpened analytical skills

learned to shape complex results to a model.

9.7. A Plan To Discover

For some writers the best plan is to begin by writing immediately. And this brings us back to the question at the beginning of this paper. how can we preserve and in fact foster the freedom to explore?

One way is by helping writers to build plans To Discover. When good writers "just start to write" they are in fact calling on a rather sophisticated set of composing plans This procedure should not be confused with undirected free-association sometimes encouraged as "free writing" They are not simply writing down what comes to mind Instead, they are setting up conditions for discovery We could imagine them working under a set of plans or private mental instructions such as these

* don t try to be perfect it, just write and see where it leads
  - don't worry about spelling, punctuation, etc
  - follow an idea out until it gets cold, then go on to a hot one
  - don't worry about coherence and precise connections yet
* then after a period, go back, not to revise your text, but to see what you've turned up

- what ideas look more promising, interesting

- how does this all fit together

- what implications, new ideas could I draw from this

In other words, when people write **To Discover**, they are working under a creative and sophisticated plan which helps them handle the act of discovery better by consciously fostering it. They are telling themselves how to carry out their own composing process.

It is not surprising that many students confuse this process with simply sitting down and producing a paper from the top sentence down. It would look much the same from the outside. But it is what's going on inside that makes all the difference. A writer who has learned to plan has gained a degree of control over his or her own writing process

Teaching stuoents how they can make plans **To Do**, **To Say**, or **To Discover** can offer them a genuinely useful skill. However, there is a difference between the complex planning process writers really use, and the specific parts of it we isolate to teach. All teaching techniques should probably carry a "product warning", mine would be this: techniques in a textbook look neat and orderly, but the process of writing isn't. Good writers don't follow recipes or sit down and do planning exercises as they write. For example, they may well be doing all three kinds of planning described here at the same time. What they do possess, though, are a set of options and powerful techniques, such as planning, which they can use when they need them whether it is to help them to get started, to get out of a block, or to just carry on. Knowing such techniques lets writers control their own writing process more and gives them the freedom to choose alternatives as they write.

References

Baker, S. The practical stylist. New York: Thomas Crowell, 1969.

Bitzer, L. The rhetorical situation. Philosophy and Rhetoric, 1968, 1, 1-14.

Britton, J., Burgess, T., Martin, M., McLeod, A., & Rosen, H. The development of writing abilities (11-18). London: Macmillan, 1975.

Flower, L. Writer-based prose: A cognitive basis for problems in writing. College English, September 1979 [a], 41, 19-37.

Flower, L. Writer based prose: A cognitive basis for problems in writing. Manuscript in preparation, 1979 [b].

Flower, L., & Hayes, J.R. The dynamics of composing: Making plans and juggling constraints. In L. Gregg & E. Steinberg (Eds.), Cognitive processes in writing: An interdisciplinary approach. Hillsdale, NJ: Lawrence Erlbaum Associates, 1980.

Flower, L., & Hayes, J.R. A cognitive process theory of writing. College Composition and Communication, 1981, 32, 365-387.

Flower, L., & Hayes, J.R. Problem-solving strategies and the writing process. College English, 1979[a], 39, 449-461.

Flower, L., & Hayes, J.R. Process-based evaluation of writing: Changing the performance, not the product. American Educational Research Association Convention, San Francisco, April 1979 [b].

Hayes, J.R., & Flower, L. Identifying the organization of writing processes. In L. Gregg & E. Steinberg (Eds.), Cognitive processes in writing: An interdisciplinary approach. Hillsdale, NJ: Lawrence Erlbaum Associates, 1980.

Larson, R.L. The rhetorical act of planning a piece of discourse. Beaver College Conference on Evaluation of Writing, Glenside, PA, October 1978.

Lowenthal, D., & Wason, P. Academics and their writing. Times Literary Supplement, June 1977, Vol. 24.

Lowes, J.L. The road to Xanadu. Boston: Houghton Mifflin, 1927.

O'Hare, F. Sentence-combining. Improving student writing without formal grammar instruction. Urbana, IL: National Council of Teachers of English, 1973.

Rumelhart, D. Notes on a schema for stories. In D. Bobrow & A. Collins (Eds.), Representation and understanding. New York: Academic Press, 1975.

Simon, H.A., & Chase, W.G. Skill in chess. American Scientist, 1973, 61, 394-403.

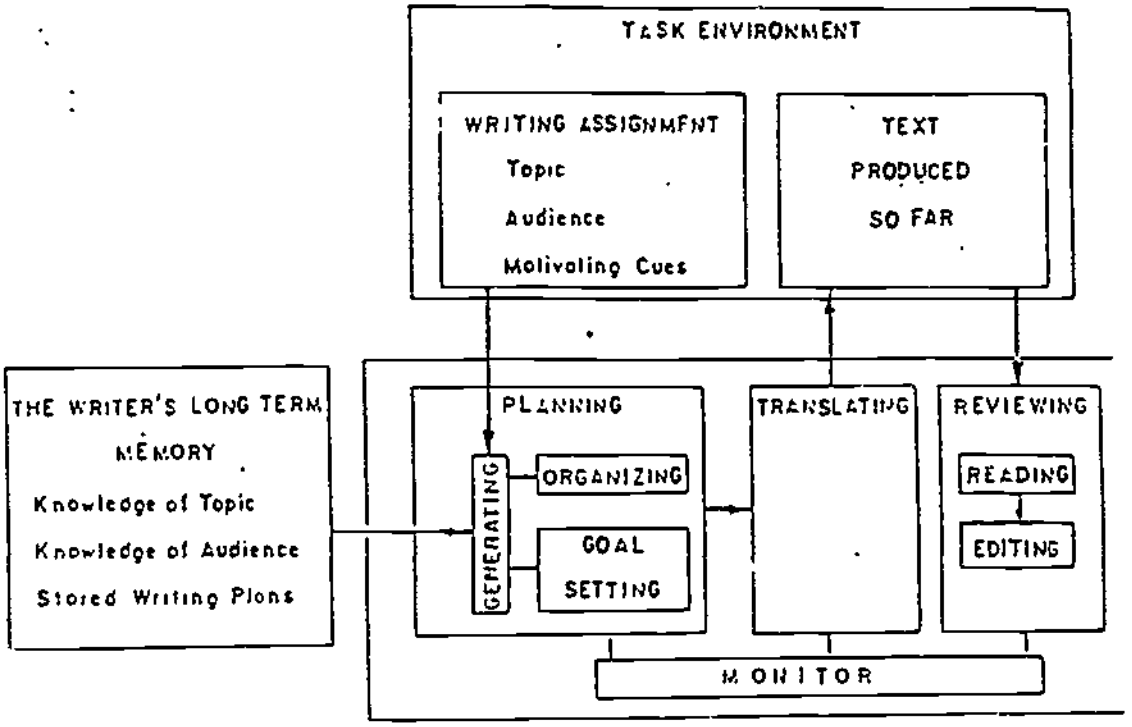


Figure 2.1 Structure of the Writing Model.

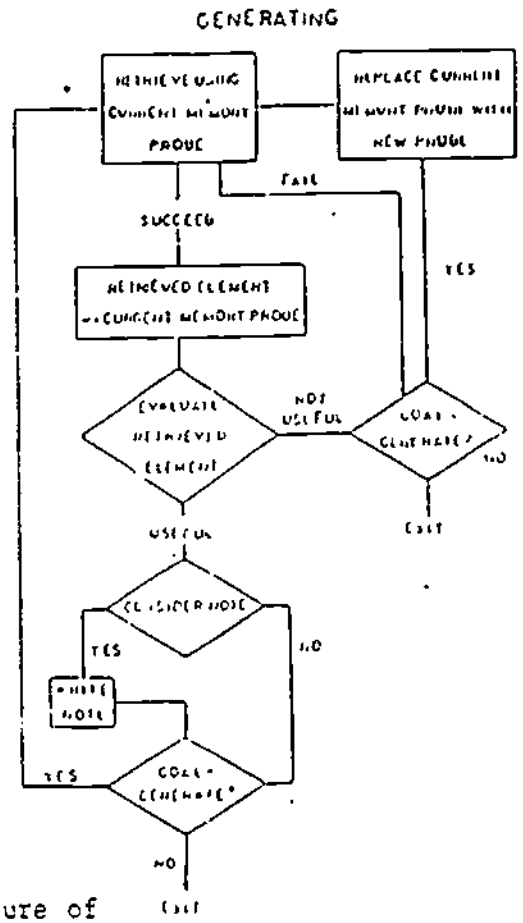


Figure 2.2 The structure of the Generating process.

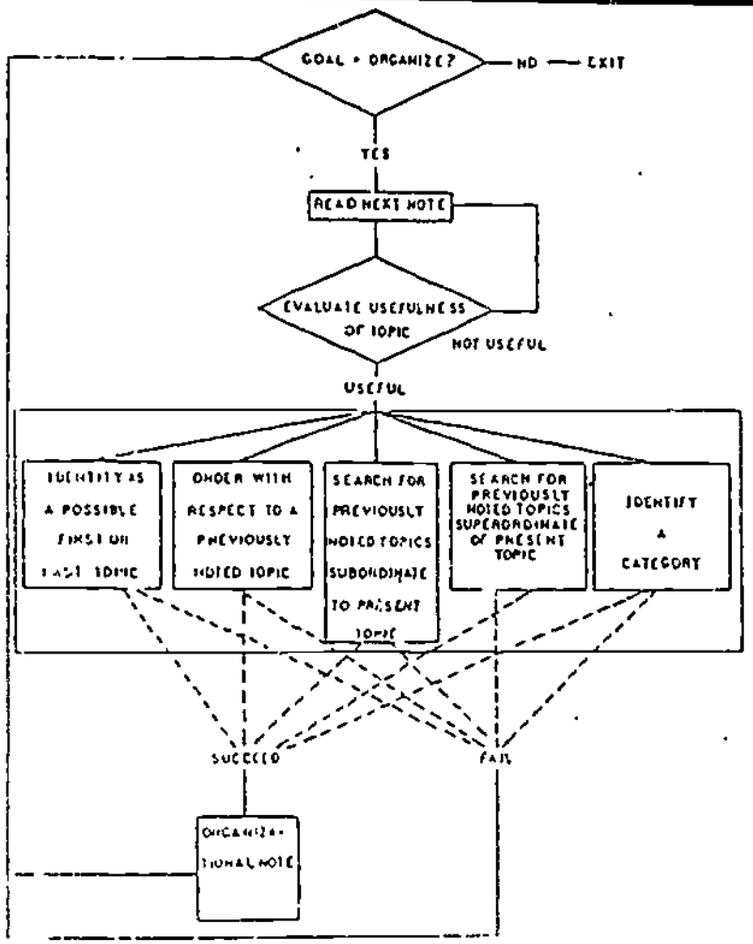
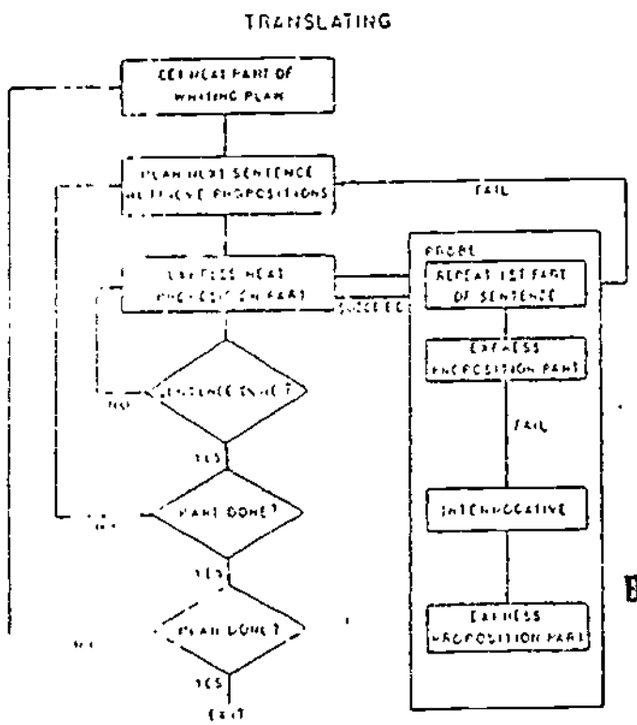


Figure 2.3 The structure of the Organizing Process.



BEST COPY AVAILABLE

Figure 2.4 The structure of the Translating process.

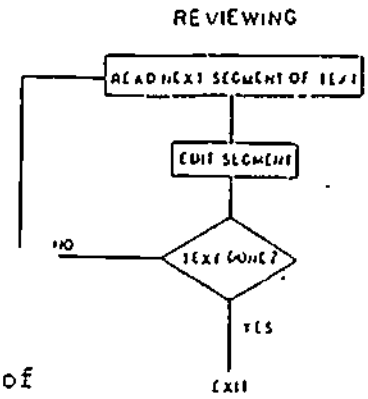


Figure 2.5 The structure of the Reviewing process.

EDITING

EDIT FOR STANDARD LANGUAGE CONVENTIONS

[(formal or note)(spelling fault)]	⇒ fix spelling fault]
[(formal)(grammar fault)]	⇒ fix grammar fault]
[(formal)(repetition of word)]	⇒ search for alternative]
etc.	

EDIT FOR ACCURACY OF MEANING

[(formal or note)(wrong word)]	⇒ fix word]
[(formal or note)(ambiguous word)]	⇒ remove ambiguity]
etc	

EVALUATE FOR READER UNDERSTANDING

[(formal)(unusual or technical word)]	⇒ find more common word]
[(formal)(missing context)]	⇒ supply context]
etc	

EVALUATE FOR READER ACCEPTANCE

[(formal)(material offensive to reader)]	⇒ soften]
[(formal)(tone inconsistent)]	⇒ make uniform]
etc	

Figure 2.6 The structure of the Editing process showing alternative modes of editing.

1 (Generated language in STM → edit)
2 (New information in STM → generate)
3 - 6 Goal setting productions (These vary from writer to writer, see Fig. 1.12)
7 (goal = generate) → generate)
8 (goal = organize) → organize)
9 (goal = translate) → translate)
10 (goal = review) → review)

Figure 2.7 Monitor.

Configuration 1 (Depth first)

3. | New element from translate → (goal = review)|
4. | New element from organize → (goal = translate)|
5. | New element from generate → (goal = organize)|
6. | Not enough material → (goal = generate)|

Configuration 2 (Get it down as you think of it, then review)

3 | New element from generate → (goal = organize)|
4. | New element from organize → (goal = translate)|
5. | Not enough material → (goal = generate)|
6. | Enough material → (goal = review)|

Configuration 3 (Perfect first draft)

3. | Not enough material → (goal = generate)|
4 | Enough material, plan not complete → (goal = organize)|
5 | New element from translate → (goal = review)|
6 | Plan complete → (goal = translate)|

Configuration 4 (Breadth first)

3. | Not enough material → (goal = generate)|
4. | Enough material, plan not complete → (goal = organize)|
5. | Plan complete → (goal = translate)|
6. | Translation complete → (goal = review)|

Figure 2.8 Alternate configuration for the monitor.

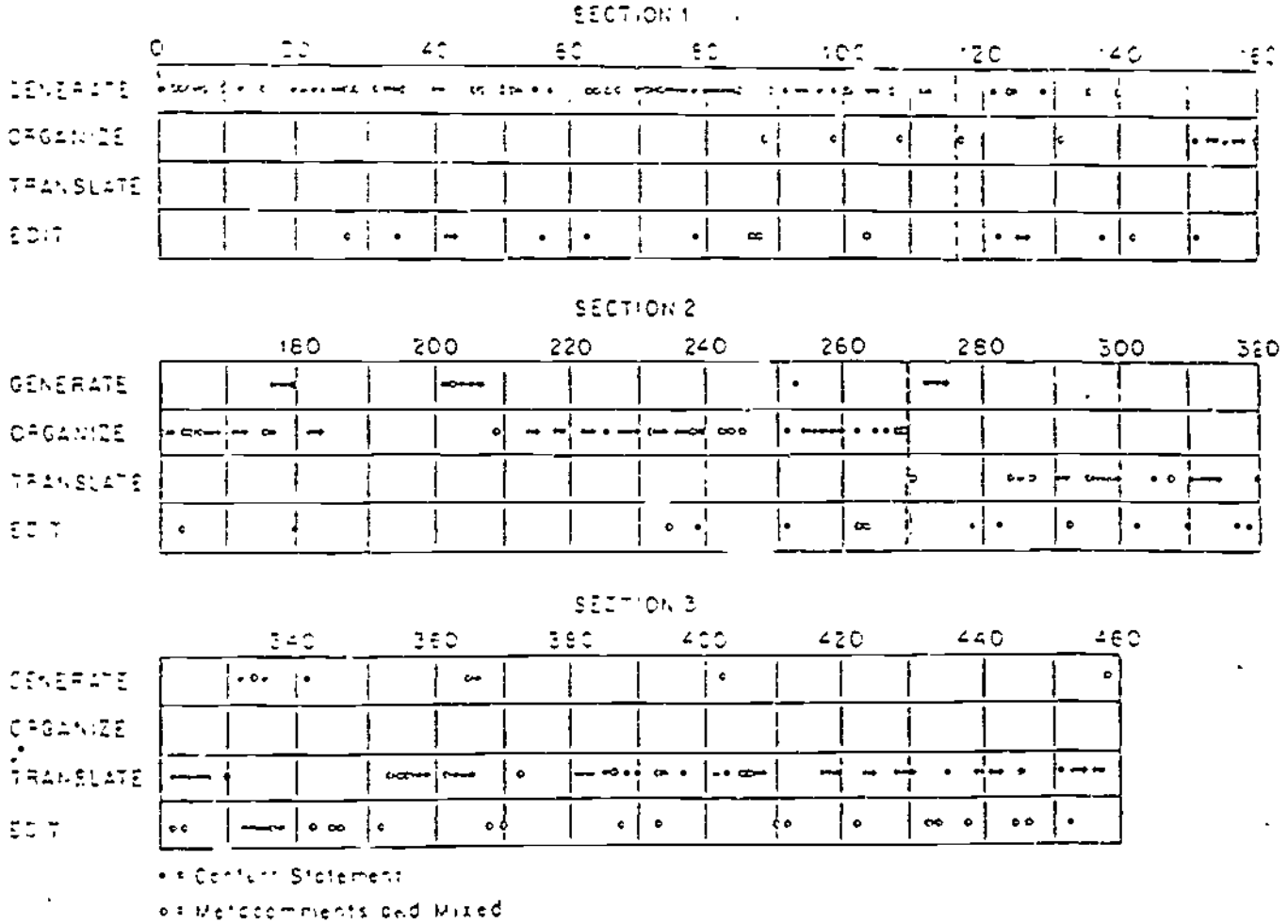


Figure 2.9 Processes attributed to segments by Author 2.

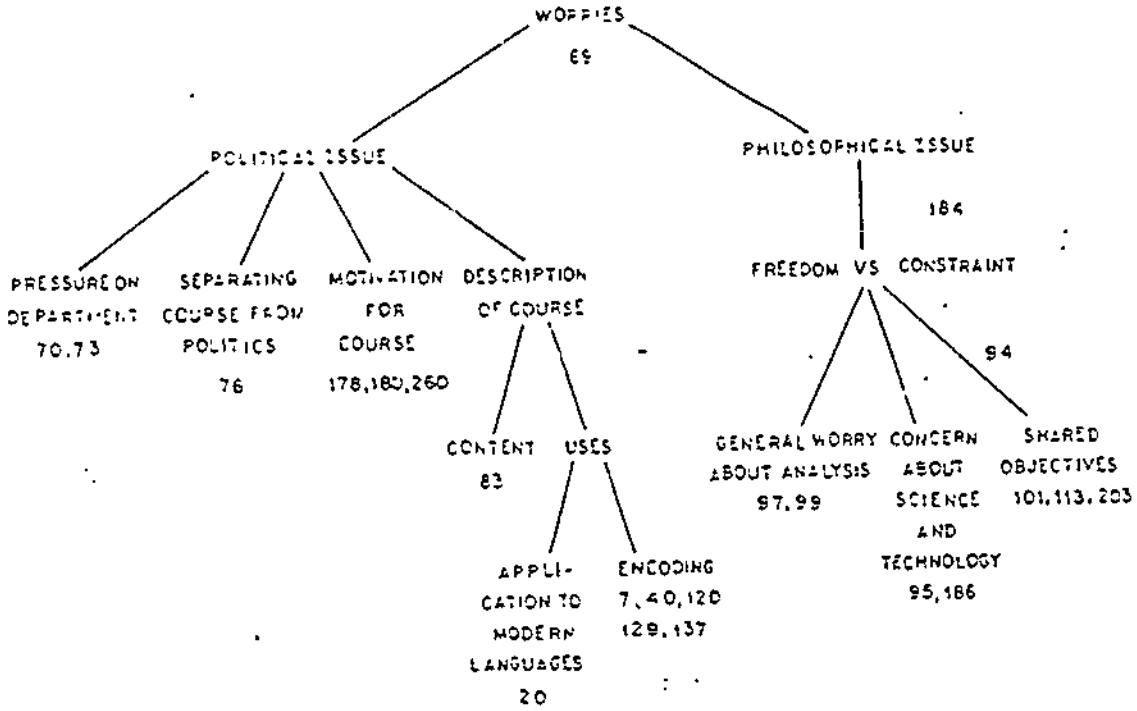


Figure 2.10 The writer's plan and the protocol segments in which the ideas were generated.

1 *L:* This is April, 1977, and Wendy is doing a protocol on motivation.
2. *W:* Ok, um the issue is motivation and the problem of writing papers. For
3 me, motivation here at Carnegie-Mellon is the academic pressure and grades that
4. are involved, so I'd better put that down . . . and grades . . . Um, they kind of
5 compel me, that's really what motivation is, um, kind of to impel or start or
6 a, momentum. (Pause) Ok, I suppose from the academic pressure of the grades,
7 I'm not sure whether—I think personal satisfaction is important., but I'm not
8 sure whether that stems from academic pressures and grades, or whether—I
9. would say personal satisfaction is a major issue Ok, um. Oh.

14. Not only do I get
15. satisfaction from my grades, but I also get satisfaction in turning in something
16 that is good quality So, if I'm happy when I write a good paper, it really doesn't
17 matter what kind of grade I get back on it, if I'm happy with it So, um, um,
18 let's see Um, what are the—I'm thinking of, I'm trying to relate personal
19 satisfaction between academic pressure and the grades, but I'm not really sure
20. how to do it, how to branch it

25 Um, but
26 of course, the reason I'm writing the paper in the first place is for that grade,
27 or to raise that back Those two ideas are very interlocked—maybe that's not
28 the right term Um, ok

Figure 3.1 Segments of a protocol.

M MOTIVATION
P PRESSURE
G GRADES
PS PERSONAL SATISFACTION
Q QUALITY

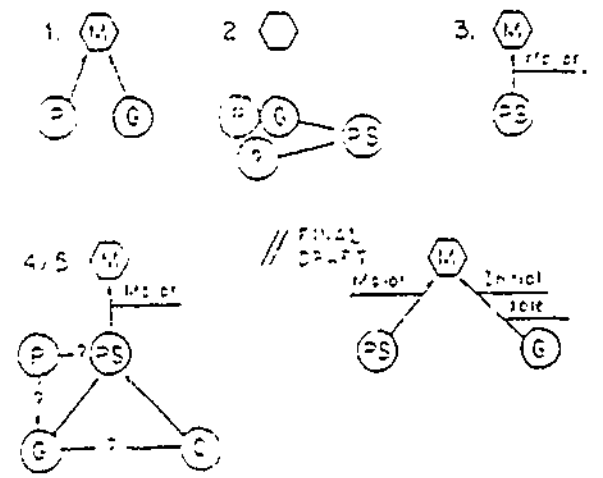
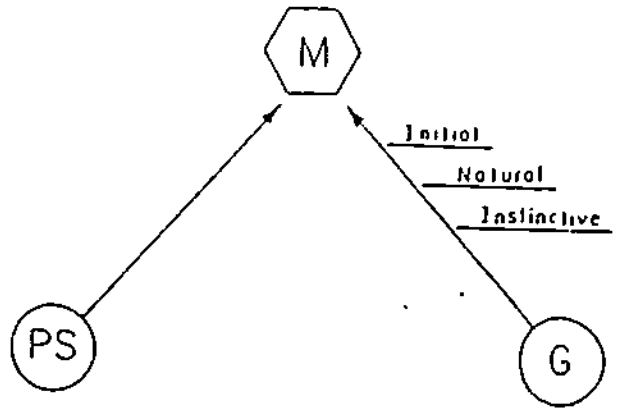


Figure 3.2 The writer's developing knowledge structure.

1. *L:* This is April, 1977, and Wendy is doing a protocol on motivation.
2. *W:* Ok, um, the issue is motivation and the problem of writing papers. For
3. me, motivation here at Carnegie-Mellon is the academic pressure and grades that
4. are involved, so I'd better put that down — and grades . . . Um, they kind of
5. compel me, that's really what motivation is, um, kind of to impel or start or
6. a momentum. (Pause.) Ok, I suppose from the academic pressure of the grades.
7. I'm not sure whether—I think personal satisfaction is important, but I'm not
8. sure whether that stems from academic pressures and grades, or whether—I
9. would say personal satisfaction is a major issue. Ok, um. Oh.
10. *L:* What are you thinking?
11. *W:* I'm trying to think of the first sentence to start with. Um, maybe something
12. like, personal satisfaction is the major motivating force in the writing of my
13. papers and reports. Ok, I'm trying to think of—ok, I want to somehow get it into
14. the academic pressures now. Um, well, maybe not so soon. Ok. Not only do I get
15. satisfaction from my grades, but I also get satisfaction in turning in something
16. that is good quality. So, if I'm happy when I write a good paper, it really doesn't
17. matter what kind of grade I get back on it, if I'm happy with it. So, um, um,
18. let's see. Um, what are the—I'm thinking of, I'm trying to relate personal
19. satisfaction between academic pressure and the grades, but I'm not really sure
20. how to do it, how to branch it. I'm really having a hard time getting started.
21. Well, maybe I'll just write a bunch of ideas down, and maybe try to connect them after
22. I finish. Ok. When I feel that I've written a high quality, and I put in parts
23. theses, professional paper, um, to be graded, when I submit it, the grade is not
24. always necessary for the teacher to hear the same. Ok, that's kind of ———
25. ———. I'll check with that one. Ok, and—Let's see what else. Um, but
26. of course, the reason I'm writing the paper in the first place is for that grade,
27. so to relate that back. Those two ideas are very interlocked—maybe that's not
28. the right term. Um, ok. I'm not always sure whether my personal satisfaction,
29. this is kind of off on a tangent, and it might not be included in my final draft,

Figure 3.3 Wendy protocol.



Sentences from Final Version:

2. Because of the emphasis on 4.0s here at CMU, grades become an instinctive motivator for myself.
4. The initial motivator in the outset of writing a paper is the fact that a grade will be attached to it upon completion.
6. After I begin writing a paper, the grade emphasis diminishes and a higher level of personal satisfaction takes over.

Protocol Excerpt:

Um, because of the, maybe because of the emphasis—Um, 4.0's. Trying to be more specific. Um, even though I don't have a 4.0. Um, because of the emphasis on 4.0's. Ok, because of the emphasis on 4.0's, grades are maybe a natural, or maybe instinctive, are instinctive motivator.

So um, ok. The *initial* motivator, this is, grades are *natural instinctive* motivator. —I should say *initially* again, but I'm not really sure how to say it. Ok, maybe I can leave it *natural*, or *instinctive*—maybe that'll bring that out. Um, ok, maybe I can refer toward *initially* again. After the um, after I begin perhaps, writing. Ah, a paper, the fact that a grade, wait a minute, the fact that a grade, I don't know if I used later, attached—oh, I did. I don't want to use that again. Ok, um.

After I begin writing a paper, the grade emphasis—I don't know if I want to use that again—the grade emphasis is foreshadowed by the, by the fact or maybe I'll come back and put that in, — oh, ok. After I begin writing a paper the grade emphasis is foreshadowed by the something, um, something that instead.—I'll have to look up the wording.

Figure 3.4 Turning thoughts into acceptable sentences.

The Rhetorical Problem	
Elements of the Problem	Examples
THE RHETORICAL SITUATION	
Exigency or Assignment	"Write for Seventeen magazine; this is impossible."
Audience	"Someone like myself, but adjusted for twenty years."
THE WRITER'S OWN GOALS involving the	
Reader	"I'll change their notion of English teachers . . ."
Persona or Self	"I'll look like an idiot if I say . . ."
Meaning	"So if I compare those two attitudes . . ."
Text	"First we'll want an introduction"

Figure 4.1 Elements of the rhetorical problem writers represent to themselves in composing.

	Analysis of rhetorical situation Audience and Assignment	Analysis of goals				Total
		Audience	Self	Text	Meaning	
Novice	7	0	0	3	7	17
Expert	18	11	1	5	9	42

Figure 4.2 Number of times writer explicitly represented each aspect of the rhetorical problem in first 60 lines of protocol.

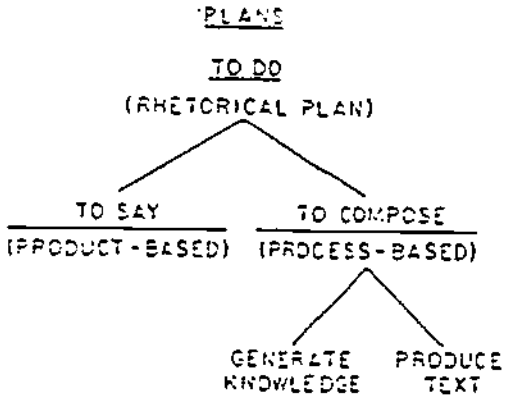


Figure 5.1 Plan for dealing with a Rhetorical Problem.

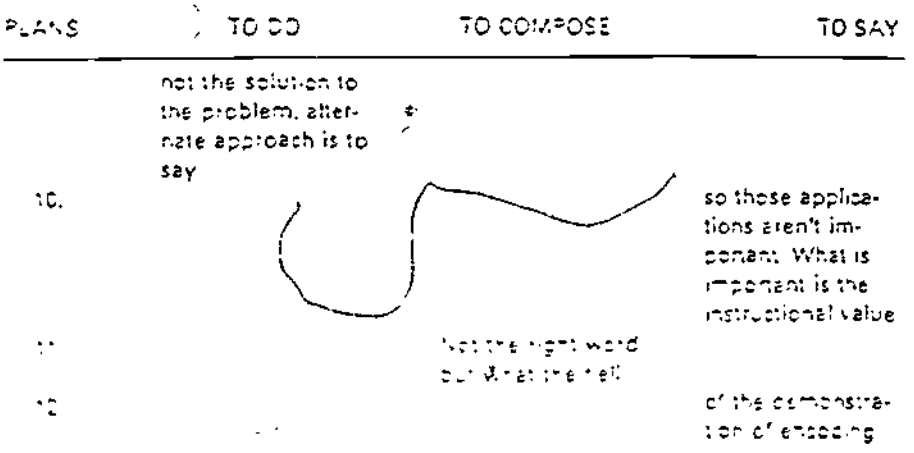


Figure 5.2 Excerpt from a protocol: Working by plan.

PLANS:	TO DO	TO COMPOSE	TO SAY
1.	Write an exposition for humanities teachers about Memory I (a group of specialized memory techniques).		
2.		What I'll do is jot down random thoughts about	
3.	What the teachers might want to hear and I might want to to tell them.		
4.			First thing that occurs randomly is encoding.
5.		That word means a lot but I won't explain it now.	
6.			Thinking about objections heard at the workshop. Rote memory is trivial.
7.		A point I will want to make someplace is that	
8.			*Memory I Procedures* are useful in modern language. They are also more useful generally. Unfortunately, by more generally I mean things like grocery lis
9.	One of the problems in writing this essay will be to expand on that usefulness and make it seem more plausible. To make uses more general and acceptable That's the wrong word, I mean important seeming Uh Or, if that's		

(continued)

PLANS:	TO DO	TO COMPOSE	TO SA
1.	If we were to describe Memory I (as example) what do we want to say about? (Searches notes) There it is. Let's do that.		
2.		All right, *I will take*take *as an example of the sorts of material . . . presented in the course* . . . Now this is a terrible sentence but we can revise it. *. . . the first subunit of . . . unit . . . unit.* That's not quite right, but, *called Memory I. In Memory I, Memory . . . In Memory I the students learn . . .* Now what am I going to do here cause I don't really have an organization for Memory I yet. *. . . the students learn . . .* Now at this point we should break off and plan.	
3.	Let's see . . now what we want to get across in this plan. we want to illustrate the practical nature . . nature of skills		

Note. Lines in italics are fragments of the growing text interrupted by plans and r
comments

Figure 5.3 Protocol of the beginning of a writing session.

Figure 6.1
Episodes in an Expert Writer's Protocol.

Episode 1 My Job for a young - Oh I'm to describe my job for a young thirteen to fourteen year-old teenage female audience - Magazine - Seventeen. -a- My immediate reaction is that its utterly impossible. I did read Seventeen, though - I guess I wouldn't say I read it -a- I looked at it, especially the ads, so the idea would be to describe what I do to someone like myself when I read - well not like myself, but adjusted for - well twenty years later. -a- Now what I think of doing really is that - until the coffee comes I feel I can't begin, so I will shut the door and feel that I have a little bit more

Episode 2 privacy,// -um- Also the mention of a free-lance writer is something I've - I've no experience in doing and my sense is that its a - a formula which I'm not sure I know, so I suppose what I have to do is -a- invent what the formula might be, and - and then try to -a- try to include - events or occurrences or attitude or experiences in my own job that would -a- that could be -

Episode 3a that could be conveyed in formula so let's see -// I suppose one would want to start - by writing something - that would -a- attract the attention of the reader - of that reader and -a- I suppose the most interesting thing about my job would be that it is highly unlikely that it would seem at all interesting to someone of that age - So I might start by saying something like - Can you imagine yourself spending a day - Many days like this - waking up at eight a.m., making a pot of coffee...looking around...my - looking out... our house, letting in your

cats... -a- walking out - out with coffee and a book and watching the dawn materialize...I actually do this...although 4:30's a bit early, perhaps I should say 5:30 so it won't seem - although I do get up at 4:30 -a- watching the dawn materialize and starting to work - to work by reading - reading the manuscript - of a Victorian writer...with a manuscript of a...a Victorian writer...a person with a manuscript of a student - Much like yourself - Much like - Much like -a- a student or a book by Aristotle they've heard of Aristotle or - who could I have it be by - Plato probably When it gets to be - When you've... -a- finished your coffee and whatever you had to do (Oh thanks) - whatever - now I've gotten just coffee - finished your coffee (mumbling)...when you've finished your coffee and -a- foreseen - and -a- Ummmmm - when you've finished your coffee, you dress and drive - about three miles to the university where you spend another - where you spend - you spend hours - you spend about - oh what - four or five - supposed to be four hours - about three hours a day - about three hours teaching - many more hours talking to students - talking

Episode 3b to - talking to other teachers...Um -/ should I (mumble) - the thing is about saying teachers - the - the teenage girl is going to think teachers like who she has, and Professor I always feel is sort of pretentious and a word usually - usually I say teacher, but I know that means I...It's unfortunate now in society we don't - but that

Episode 3c that isn't a prestige occupation./ Talking to other people like yourselves - that's whoever it may be - other people at your job - other - other people like yourself - uh a lot like yourself but - talking to other people like yourself - going to meetings...committee meetings...and doing all this for nine months so that the other three...and doing all this for three months - okay - nine months...If you can imagine that....

Plan	Essay
1. The controversy about abortion	1. An example of the controversy
2. The con-p. tion	2. The con-position
a. historically	a. historically
1. religious reason	1. religious reason
2. economic reason	2. economic reason
3. pro-life view	3. pro-life view
b. currently	
1. religious	
2. pro-life view	
c. snapper line	
3. Counter-argument	3. Counter-argument
a. economic reason obsolete	
b. religion less influential	a. religion less influential
c diversity on moral issues	b. diversity on moral issues
d. Supreme Court view	c. Supreme Court view
4. The pro-position	4. The pro-position
a. problems of unloved children	a. problems of unloved children
b. problems of poverty and age	b. problems of poverty
	c. problems of young and old
c. unmarried mothers	d. unmarried mothers
d. feminist view	e. feminist view
5. Snapper line	5. Conclusion

Figure 6.1 Structure of plan and essay.

...The biggest mistake that beginning writers made is that they try to write as -let's see--write the first thing that comes into their mind--write as soon as anything comes into their mind--try to write...that they try to write...write down whatever comes--but it's not that they write down whatever comes into their minds--some of them do that--yeah--like uh--but some of them are afraid to write anything down...Okay--so they write a sentence at a time...The biggest mistake that beginning writers make is that they try to write without looking ahead--yeah, I guess that's better...they try to write without looking ahead--they only--they only think one sentence at a time and don't see where the next sentence is going to lead them...

Figure 8.2 A protocol segment in which the writer appears to clarify his thinking while composing a sentence.

Protocol: The best thing[1] about it is that--what?[2] Something about[3] using my mind--it[4] allows me the opportunity to--uh--I want to write something[5] about my ideas--to put ideas into[6] action or to develop my ideas into[7]--what?[8] Into a meaningful form?[9] Oh, blah--um--say it allows me/[11] to use--na--allows[12][13][14] me--scratch that.[15] The best thing about[16] it is that it allows me to use/ my mind and my ideas[17] in a productive way.

Final Sentence: The best thing about it is that it allows me to use my mind and my ideas in a productive way.

Figure 8.3 An example of sentence generation.

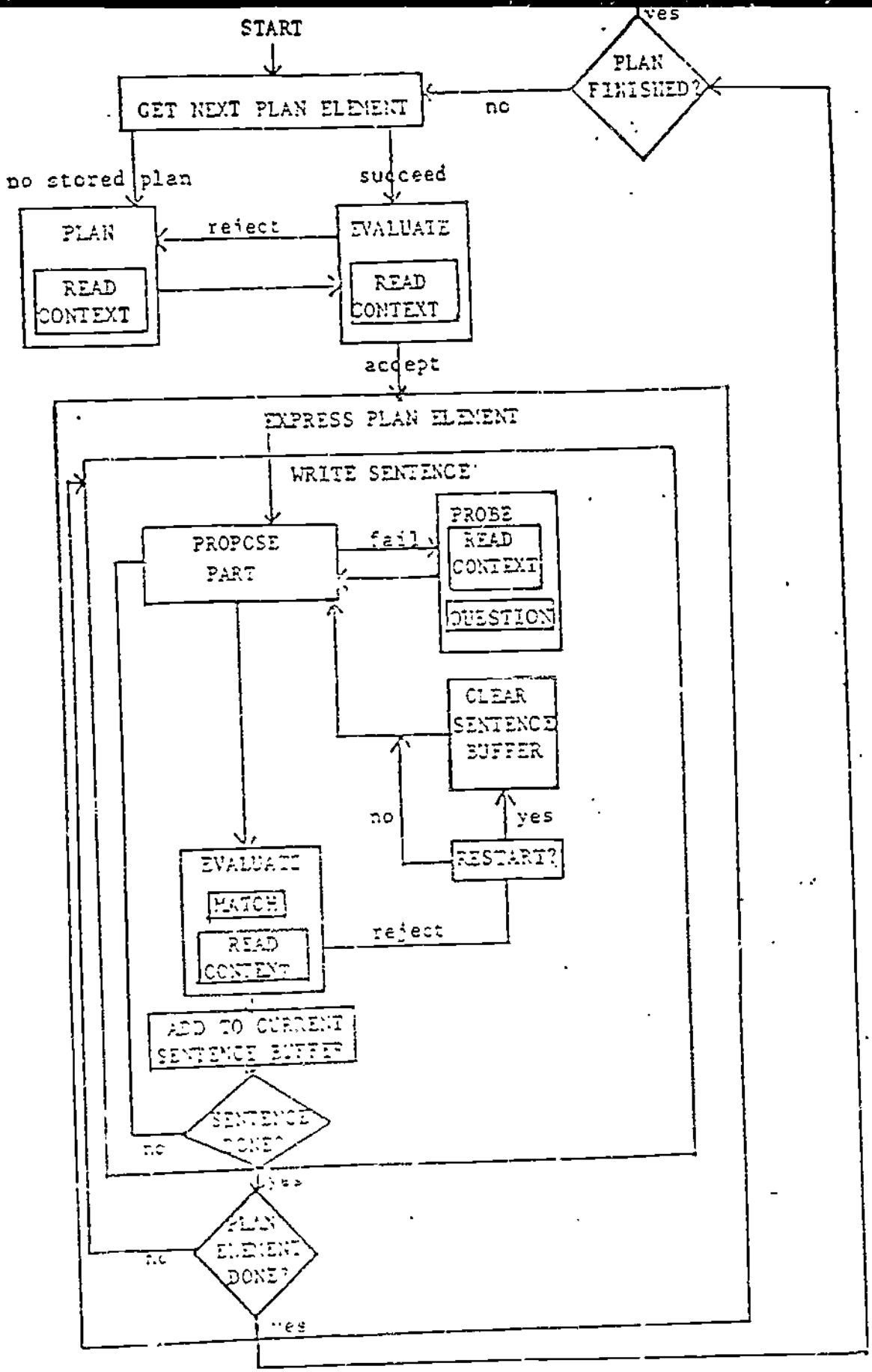


Figure 8.4 Model of Sentence Construction.

TABLE 6.1
Characteristics of Episodes

	No. Episodes	Mean # Clauses/ Episode	Range of Clauses/ Episode	DURATION OF EPISODES (time in minutes & seconds)		
				Range	[illegible]n	Standard Deviation
Expert #1	25	9	1 - 23	22 sec. - 8 min. 15 sec.	2 min. 11 sec.	2 min. 5 sec.
Expert #3	58	10	1 - 44	9 sec. - 12 min.	1 min. 31 sec.	2 min. 1 sec.
Novice #1	44	13	2 - 38	7 sec. - 6 min. 33 sec.	1 min. 43 sec.	1 min. 42 sec.

Oh, what can I say?--Drat, I broke the pencil point again--keep on breaking the pencil point--I also have to-- i-e- drop the e--to do what is called a - quote - back-up - dash - semi-colon--This is a way of storing--g- looks like an -f- on top--of storing--uh--the computer--Oh drat--broke it again--for information--uh--to a roll of magnetic tape--My -c- looks like an -e- at the end of magneric--I have to change that--Let me get the eraser out here—put it up on my pencil--um--Okay--Here we go--Okay, where am I at?

Figure 8.5 A poor writer attempting to construct a sentence.

TABLE 2.1

Agreement Among Raters in Assigning Properties to Written Items

Agreement Between Raters	Question A	Question B	Question C
1 & 2	.935	.968	1.000
1 & 3	.935	.984	.952
2 & 3	.903	.968	.952
Triple Rater Agreement	.924	.973	.968

TABLE 2.2

Proportion of Written Items With Each Property

	Section 1	Section 2	Section 3
[illegible]	0.385	0.000	0.667
[illegible]	0.154	0.917	0.000
[illegible]	0.000	0.000	0.417

TABLE 2.3

Proportion of Segments Assigned to Each Process

	Section 1		Section 2		Section 3	
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

TABLE 6.2

Percent of Episode Boundaries Agreed Upon by Knowledgeable Judges

Writer	No. of Judges Agreeing	Expected* % Agreement	Actual % Agreement	
Expert 1	4	0	5	67%
	3	1	30	
	2	12	32	
	1	87	33	
Expert 2	4	0	30	70%
	3	1	20	
	2	43	20	
	1	56	30	
Expert 3	4	0	23	66%
	3	1	23	
	2	12	20	
	1	87	34	
Expert 4	4	0	21	75%
	3	1	19	
	2	10	35	
	1	89	25	
Average of all writers	2 or more	20	70	

*[illegible] t-test

		Total New Ideas	Response to Rhetorical Problem	Response to Topic	Response to Current Element	% Response Rhetorical Problem	% Response to Topic & Current Element	Group Ratio
Good Writers	G1	150	106	40	4	67%	33%	
	G2	93	56	30	7	60	40	
	G3	115	66	45	4	57	42	
	G4	85	45	36	4	53	47	
Average		113	68	40	5	61%	39%	61/39
Poor Writers	P1	129	22	66	41	17%	83%	
	P2	85	20	63	2	24	76	
	P3	53	15	37	1	28	72	
	P4	134	41	77	16	31	69	
	P5	67	31	36	0	46	54	
Average		94	26	56	12	28%	72%	28/72

TABLE 7.1 Differences In How Good and Poor Writers Generate New Ideas

TABLE 8.1
Chunk Size and Essay Length of Expert and Novice Writers

Experts			Others		
S	Chunk Size	Essay Length	S	Chunk Size	Essay Length
1	12.06	893	7	9.26	522
2	16.79	912	8	5.95	377
3	13.54	760	9	11.09	413
4	11.54	939	10	5.97	451
5	8.68	656	11	7.10	704
6	4.76	553	12	4.51	317