Writing for the reader !!!

WRITING FOR THE READER

by John O'Rourke
of
Digital Software Publications

prepared by
Digital Software Document Preparation

digital equipment corporation
maynard. massachusetts

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IS THIS BOOK FOR YOU?

You should answer this question before you turn to Chapter 1.

This book is for you if you are, first of all, a person who has a firm grasp of a technical subject but is relatively weak in the principles of written communication. That is not to say that you have no background in English. Rather, you've had the usual high school English courses, with perhaps two additional courses in college or technical school. So you know clauses and sentences and parts of speech. And you either have at your fingertips the accepted rules of punctuation and usage or know where to get such information when you need it.

Too, you are no stranger to writing: you've written letters and memos and reports. But you are new to this task of writing technical manuals for a large and varied readership. So you need a book of tips on how best to write for that body of readers. You need a book of ideas and principles. On the other hand, you don't want to be burdened with rules to memorize and exercises to do.

If you fit this reader profile, then WRITING FOR THE READER is indeed for you.

CHAPTER 1
TECHNICAL WRITING AS COMMUNICATION

On the West Coast they tell the story of a plumber who started using hydrochloric acid on clogged pipes. Though he was pleased with the results, he wondered if he could be doing something wrong. So he wrote to Washington to get expert advice on the matter. In six weeks he received the following reply:

> "The efficacy of hydrochloric acid in the subject situation is incontrovertible, but its corrosiveness is incompatible with the integrity of metallic substances."

The plumber, who was short on formal education but long on hope, was elated. He shot a thank-you letter back to Washington. He told them he would lose no time in informing other plumbers about his discovery. Five weeks later he got another message:

> "In no case can we be presumed responsible for the generation of pernicious residues from hydrochloric acid, and we strongly recommend, therefore, than an alternative method be utilized."

The plumber was delighted. He sent his third letter in the next mail. In it, he said that about 15 plumbers in his city were now using hydrochloric acid for pipes. All of them liked it. Now he wondered whether the good people in Washington could help him spread the news of his discovery to plumbers throughout the country. At this point, the correspondence fell into the hands of a rare Washington bureaucrat – one who knew how to write to plumbers. Within a week the plumber was reading these words:

> "Stop using hydrochloric acid. And tell your friends to stop too. It eats the hell out of pipes."

Certainly the letters in this interchange are a far cry from technical writing. Nevertheless, they offer a lesson

to the new technical writer: Write so your reader can understand.

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The chief function of a technical writer is to inform – to supply the reader with technical facts. Thus, each sentence you write must be aimed at the reader. If your sentences are not so aimed, you fail as a technical writer. Your message is like an arrow shot blindly into the air. It will fall somewhere. But the chances are that it will not hit the target.

In other words, you, as a technical writer, cannot concern yourself merely with putting words on paper, as does the writer of a diary or the ill-fed poet in a garret. These people can enjoy the luxury of self-expression. They can exist without readers. Or they can, if they wish, write to parade their knowledge before the reader rather than to convey it to him. But you must concentrate on how best to convey meaning to the reader; you must strive to make your sentences mean the same to him as they do to you.

It's too bad, in a way, that the term *technical writer* is used at all. The *writer* part of it has lost most of its meaning. Doesn't everyone write? The answer to that question is all around you. Programmers write, managers write, marketing people write, secretaries write. Look at the mountain of memos and reports these people produce. As each day brings a stream of such papers across your desk, you're forced to strain eye and mind to discover meaning amid the welter of words. Sure, everyone can write. But daily experience tells you only a few can communicate.

In this book we will often use the term *communicator* instead of writer. In doing so, we realize we're replacing a word of two syllables with one of five, but we think the longer term is more descriptive of the unique skill of the technical writer. Consider for a moment the origin of the word *communicator.* It comes from the Latin *communis*, which means common. And as we've already emphasized, the main business of the technical writer is to communicate: to pass technical information along to the reader so that it becomes the *common* property of both.

The remainder of this chapter will continue the emphasis on communication as the key to the whole art of technical writing. First you will see a verbal communication system in operation. Then you will get a closeup of each element of that system.

A VERBAL COMMUNICATION SYSTEM

Figure 1 is a simple diagram of a communication system, as seen in communication theory.

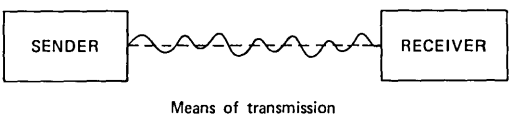


Figure 1. A Verbal Communication System

Each system has a sender, a receiver, and a means of transmission. The sender is the writer; the receiver is the reader. The means of transmission, represented by the broken line in the diagram, is in our case written language. The wavy line stands for noise. Noise is anything in the system that changes or distorts the meaning being transmitted. In all transmission, you the communicator try constantly to eliminate noise.

Since clear, accurate meaning is what the communicator always strives to transmit, you can get some idea of the difficulty of the task by looking at Figure 2. It shows the four forms of meaning operating in the communication of technical information.

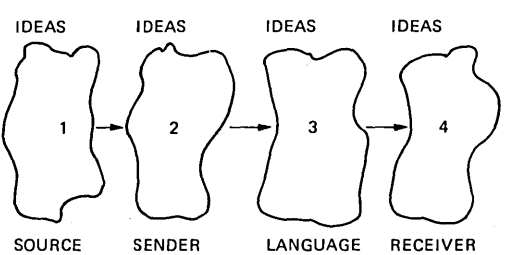


Figure 2. Four Forms of Meaning

The source is the meaning in specifications, flow-charts, schematics, oral and written reports, and any other documents you use to get the facts for your writing. This meaning will always be different from the meaning (2) that lodges in your head after reading those documents. The degree of difference depends on your skill in interpreting the language of the source. Notice in Figure 2 that the size of 1 and 2 is roughly equivalent. The difference occurs mainly around the edges. This happens whenever words are used in the source, for words are variable in meaning. Thus, you will interpret some words right and others wrong. But the greater your skill in decoding the language of the various documents, the more the data in your head will approximate that of the source.

You further distort and lose meaning when you start to write. For one thing, you aim to write only what the reader needs to know. Thus, you must select certain facts from the array in your head and reject others. Secondly, since most of the words you choose have multiple meanings, you always send additional – if unintentional – meaning along with your technical facts. For these reasons, 3 in the diagram is different from 2. Happily, in this instance it is only slightly different.

Finally, the receiver, or reader, extracts a different meaning (4) from your written language, because it is impossible for all the words to mean the same to him as they do to you. Thus the meaning that ultimately resides in the reader's head is different in various respects from the other three meanings.

All these things considered, we can rightly call the communication in Figure 2 effective because the reader's head contains a sizable chunk of the meaning originally in the source. You can, however, further improve the communication. Whenever you get feedback from the reader, you modify the wording of the language (3).

But the transmission can never be perfect. That is what makes your task as a communicator continue long after the software has gone to the customer. You have to struggle to make 3 clear the first time, and then you strive just as hard for clearness each time you modify 3 because of feedback from the reader. In this way you

avoid the defective communication of the secretaries, managers, etc. mentioned at the beginning of this chapter. A diagram of their faulty communication appears below (Figure 3).

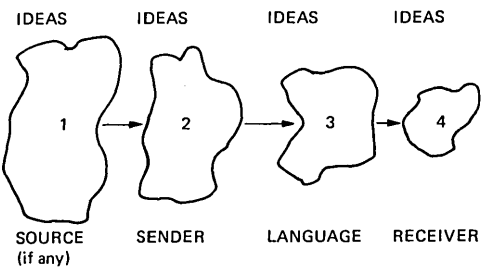


Figure 3. Faulty Communication of Ideas

THE SENDER

The blunt truth about the job of communication is that the entire burden of it rests on the writer's shoulders. You are the only one to blame if the process fails. Hence, yours is a vital role. And here is a partial list of what is expected of you as the sender in the communication system. (You will get a detailed view of yourself in Chapter 2, WHAT THE EXPERTS SAY ABOUT THE WRITER.)

1. You are totally responsible for getting clear, accurate information from the source.
2. You must gather the data on the experience and background of the reader so that you will use terms and other symbols the reader will understand.
3. You're expected to have a firm grasp of the needs of the reader so that you will know which facts to communicate.
4. You must be motivated by the desire to make the reader understand. This feeling guides you in organizing the technical information and in emphasizing important points.
5. You are presumed to have mastered the art of communicating: making your words mean

what you want them to mean in the mind of the reader.

6. You must realize that language does not have to be elegant. You have to see it correctly as a tool for transferring ideas.
7. You must constantly monitor your documents to ensure that self-expression does not take the place of informative writing.
8. You must remember that the deeper the subject, the harder you must work to make it understandable.
9. You must never lose sight of your overall goal: to simplify the complex for the reader.

THE MEANS OF TRANSMISSION

The written language of the verbal communication system is called exposition. It is the link between the outside world and the ideas in your mind. Since its purpose is to inform, it appeals to the reader's intellect, not to his feelings or imagination. Ideally, you should make it clear and unambiguous, sending ideas by the shortest, most efficient route. It should always give the reader all he needs to know about the subject. Above all, you should write it on a level that the reader can understand. Remember the Washington experts who didn't know how to write to the plumber.

THE RECEIVER

The receiver of your exposition is the reader. He comes to your writing to learn some technical facts. That learning may be a knowledge of ideas and their relationships. Or it may be a grasp of procedure: knowledge of the steps to follow to do a certain task. In either event, communication takes place when he extracts from your writing the meaning you put into it; that is, when his interpretation of the meaning closely approaches yours. Only then can he perform the procedure you wrote about, or discuss the ideas you expressed.

However, if he cannot decode your message correctly, communication breaks down. And poor communication is mostly a matter of interpretation. Sometimes the reader responds more to the implied meanings (connotation) of the words than to their literal meanings (denotation). Sometimes he distorts the meaning because the language is too difficult for him. Most of the

time he goes astray because of the various kinds of *noise* accompanying the message.

NOISE

In communication theory noise is any unnecessary or misleading information conveyed by your writing. Like static or other interference on radio or television, noise impedes communication. It prevents the reader from getting the meaning intended.

The reader experiences noise as a lack of clearness. Such unclearness can range from slight trouble in understanding a word or phrase, to total inability to understand any of the message. A lot of noise, or unclearness, causes the loss of meaning shown in Figure 3.

Noise can originate in the writer's failure to extract clear, accurate information from his source. Most of the time, however, noise is caused by the writer's style. It arises from the six major ills of technical writing discussed in Chapters 4 through 9 of this book:

1. Poor organization of paragraphs.
2. Excessive use of abstract words.
3. The fog of sentence complexity.
4. Overuse of the passive voice.
5. Bunching together of too many technical terms.
6. Vague, empty, and difficult words.

CHAPTER 2
WHAT THE EXPERTS SAY ABOUT THE WRITER

All exposition, according to the experts, is written on two different levels: the level of literacy and the level of competence. Literacy has to do with the so-called mechanics of writing – with punctuation, usage, and grammar, for example. (And you'll note that the mechanics lend themselves to testing and measurement.)

Do you know what a sentence is? If so, you have mastered one phase of literacy. Can you tell nouns from verbs and prepositions? Can you use periods and question marks correctly? Do you know the difference between *principle* and *principal*? Do you start each sentence with a capital letter? Can you detect and correct a run-on sentence? Are you a good speller?

Such questions test your knowledge on the literacy level. But answering them all in the affirmative does not make you a good writer. Regardless of the emphasis that schools nowadays put on literacy, it is not the really important level of writing. In fact, at least one authority implies that literacy is not a part of good writing at all.

The important level of writing involves the ability to move ideas from your head to the reader's. This level is what Edwin R. Clapp of Western Washington State College calls the level of competence.

Competence in writing, then, has to do with how well you can pass technical facts along to the reader. Unlike literacy, it doesn't lend itself to objective tests or measurements.

Can you recognize a topic and then explore it to discover its limits? If so, you have some skill on the competence level. Can you tell which ideas belong to that subject? And which do not belong? Can you write those ideas in the same order as they appear in your

thinking? In other words, can you show one idea as the effect of the other? Is one the whole and the other a part? Can you show this relationship in writing? Does one follow the other? How do you express that sequence? Can you similarly express likenesses and differences among your ideas? How about equality and subordination? Are you proficient in writing definitions and classifications of your ideas? Can you develop theories or laws or principles from them?

These questions show that competence in writing is connected with competence in thinking. In fact, they cannot be separated. Thus a writer can never be both skillful on the competence level of writing and fuzzy in his thinking. He can, however, be very skillful on the literacy level of writing and very incompetent in his thinking.

Notice that the experts mentioned in the following sections are concerned only with competence. They don't stoop to deal with literacy at all. Rather, they harp on clearness, organization, exactness, relevance, and effectiveness. These are the marks of competence in writing.

GUNNING'S WARNING TO TECHNICAL WRITERS

About thirty years ago articles in the popular magazines were dry statements of fact backed up by cold statistics. The style was consistently stiff and dull, and the competence of the writing was low. So readers, finding them hard to read, sent loud complaints to the magazines. Not only did the readers voice their dislike of the articles, but they also specified what they wanted in place of them. The result is the modern article, which in contrast with the old is highly competent because it is highly readable.

The point is that magazine articles changed because the magazines themselves responded to reader dissatisfaction.

Invariably, this is what happens when publications must depend on the reader for their existence. So says Robert Gunning in his book THE TECHNIQUE OF CLEAR WRITING. Either they produce what the reader wants, or they go out of business because the reader goes elsewhere.

Such, in Gunning's opinion, is not the case with technical writing. The technical audience cannot similarly make its demands felt because it cannot go elsewhere for its technical information. Thus, the technical writer can afford to write in a vacuum. But this situation will not last forever. Eventually, the demand for more readable technical writing will be as effective as was the demand for more readable magazine articles.

THE GULF BETWEEN WRITERS AND READERS

When talking about writers, Gunning pulls no punches. He boldly asserts that the writer has created a wide gulf between himself and the reader – a gulf impeding the communication of ideas. And he goes on to describe the distressing situation.

> "The gulf between writers and readers is very great. Readers want careful organization in what they read. They desire concreteness to help them picture and apply ideas. They like variety, it maintains their interest. They prefer short but variable sentences and not too rich a mixture of hard words.
>
> "Writers, on the other hand, enjoy *self*-expression. They would as lief use abstractions to which they give their own special meanings. And a writing job goes easier and faster if you can simply set down the facts without the exacting thought needed for careful organization."

Here, Gunning is speaking about writers in general. But another author singles out the technical writer for his part in creating the gulf. In ANALYTICAL WRITING, Thomas Johnson calls the technical writer to task for (1) lack of organization, (2) impersonal style, (3) use of big words, and (4) reluctance to state an idea directly.

WRONG ATTITUDE

Johnson implies that the writer creates the gulf deliberately. A better explanation blames the writer's attitude – his view of the writing task. As you will see later, Gunning supports this view.

The new writer, according to the better explanation, is apt to have a wrong attitude toward writing. Talking about technical matters involves him in no difficulty at

all. In the role of speaker he is usually logical and straightforward. But when he sits down to write, he changes. He is not himself. His natural directness disappears; he becomes stiff and formal, and, striking a pose, proceeds to erect a wall of artificiality between himself and the reader. Whereas in speaking he would say:

> "You must learn the operating system before you start working as a data base administrator."

In writing it becomes:

> "Familiarity with the operating system must be acquired prior to attempting the undertaking of the role of Data Base Administrator." (DEC Manual)

What transforms a clear speaker into a murky writer? The experts offer a number of reasons. Robert Gunning, for one, has strong feelings about the matter:

> "Many writers who are set the job of writing for a technical group believe their first task is to lengthen sentences and increase the mixture of polysyllables. They read technical communications in the new field, noting all odd departures from standard English. Thus in addition to picking up the technical vocabulary they are after, they absorb the bad habits of written expression that have impeded communication for years."

Another view is that the new writer wants to impress the reader with his knowledge of the English language. He chooses to forget that writing and speaking have the same goal: to move ideas from one head to another. So he abandons the level of competence he used to good effect in speaking and descends to the level of literacy.

A third body of opinion says that the new writer is stiff and formal because he wants to play safe. Observing the style of other technical documents, he fears his will seem unprofessional if written differently.

A final view is that his writing is complex because his thinking is complex. He refuses to take the trouble to

simplify it for the reader. In other words, he refuses to work for competence in his writing.

RIGHT ATTITUDE

Well, that's the ailment. What's the cure? The experts offer the following suggestions:

1. Always remember that your chief concern is to get your content across.
2. Often ask yourself "What am I doing?" Be honest in your answer. If your answer is that you are trying to impress the reader, then in the interest of competence you must change.
3. Put your voice in your writing. This is Gunning's famous dictum. He says that when you talk you use your own voice, which is as uniquely you as your fingerprints. When you write, however, you forget your voice, with the result that your writing is not you. Competent writing, he says, has "voice" in it; if you know the writer, you can easily imagine him speaking to you as you read his writing.
4. Copy the good points of conversational style. Use short sentences and short words. Divide ideas into small pieces and give the reader one or two pieces per sentence. Avoid inverted sentences. (Here is an example of an inverted structure that does not normally appear in conversation: "Sure he was that it wouldn't happen." You will be more effective if you change it to the normal subject-verb-complement format of conversation: "He was sure that it wouldn't happen.")
5. Use a 4-step approach to writing in order to retain "voice" and clarify thought. First, write as quickly as possible, as the ideas come to you. (Don't revise at all at this point.) Second, analyze your written expression to uncover errors or gaps in your thinking. Third, revise what you have written to make it correct, clear, and exact. Finally, read it aloud to yourself to make sure your voice is in it.

Note that these suggestions help you to acquire competence in writing. They help you transfer ideas from your head to the reader's.

THE WRITER'S PURPOSE

A lot of writing misses the mark, experts say, because the writer takes his eye off the target. In other words, he forgets his purpose.

You should have the purpose of your document clear in your mind before you begin to write. Write it down in a single sentence and post it where you can look at it often. For example, you may write it as follows: "I want to explain all the duties of a data base administrator to a manager." Or, "I intend to describe all the components of this operating system so that a manager will understand what they are and what they do." Or, "I will explain SNOBOL so that the reader will be able to write a practical program after he finishes reading the manual."

All these purposes have to do with enlarging the reader's knowledge or giving him a new skill. As such, they are your chief concern as a technical writer. But you should also be aware of other purposes. You have to consider your manual in relation to those of competitors. Is a prospective customer likely to turn to a competitor because your manual does not explain DEC's software as well as the competitor's manual does his? Too, are you interested in gaining the largest possible readership for your document?

If either of these purposes applies in your case, then you'd better aim to make your document highly readable. This is the suggestion of George Klare, author of the book MEASUREMENTS OF READABILITY. Not only will highly readable writing get the reader to accept your manual over another, but it will also attract more readers. He says that readers like readable writing because they can read it faster and get more out of it.

OTHER FAULTS NOTED BY THE EXPERTS

Most of the foregoing statements are pretty general. But here are some specific faults the experts see as harmful to technical communication. Again, they all concern

competence in writing or, rather, the lack of it. For each fault, we have included at least one example from a DEC manual.

1. The writing is dull and dry because words do not say what they mean and syntax gives false cues that force the reader to go back and read again. "Reading in that case," says Jacques Barzun and Henry Graff "is like wading through a swamp."

   (Example) "All files are subject to being compressed with the exception of installed task files, the checkpoint file, and the save image file. Because of system linkages, these tasks (which are already contiguous) are left in their original position."

   (Comment) To what does the phrase *these tasks* refer? To the task files? Or to all three files? The reader has to reread because reference is unclear.

   (Example) "All privacy locks and keys are assigned by the Data Base Administrator, and the strictest security must surround their use. They should not, for instance, appear in the DBD or any other document which may be viewed by more than one user or multiple personnel."

   (Comment) What does *multiple personnel mean*? Is it different from *more than one user*? The reader has to reread looking for clues to the meaning. Unfortunately, there are no clues in the entire paragraph.

   (Example) "This manual describes DBMS-10 from the point of view of the Data Base Administrator, and as such, it is the reference manual for the whole system. It is not, though, intended to be a tutorial guide for beginning Data Base Administrators or DBMS-10 users. In addition, it is assumed that the reader has a knowledge of the COBOL language."

(Comment) Two stumbling points are the word *beginning* and the phrase *in addition*. *Beginning*, the minor fault, should have *the* in front of it to prevent people from reading it as meaning *starting* something. *In addition* poses another problem. Since the previous fact was negative the reader is set for another negative fact when he reads "*in addition*." And when he learns it isn't negative, he has to go back to verify that the mistake isn't his.

(Example) "Occasionally, you may want to calculate a function, for example, the square of a number. Instead of writing a small program to calculate this function, BASIC provides functions as part of the language, some of which are described in Chapter 1."

(Comment) Because the word *writing* modifies BASIC, the reader thinks BASIC can do two things: (1) write small programs to calculate and (2) provide a function. This he realizes is illogical, so he has to back up and read again.

2. The writer is addicted to abstract words, passive constructions, long words and vague words.

   (Example) "Sophisticated application specifications thus might require complex data structures involving many interrelationships."

   (Comment) *Sophisticated application specifications* is long, abstract and vague, as are the words *complex* and *interrelationships*.

   (Example) "Many computer languages are currently in use, but BASIC is one of the simplest of these because of the small number of clearly understandable and easily learned commands that are required, its easy application in solving problems, and its practicality in an evolving educational environment."

   (Comment) This sentence contains a handful of long, abstract terms that obscure its

precise meaning: *clearly understandable, readily learned, easy application in solving problems, practicality,* and, last but by no means least, *evolving educational environment*. In addition, the sentence is confusing at the word *but*. At that point the reader is set for a contrast involving the idea of being in use. He expects something like "but when BASIC goes to the field most of them will no longer be in use."

3. The writing reveals an inner confusion of thought.

   (Example) "Strings can be concatenated by means of the plus sign operator (+). The plus sign can be used to concatenate string formulas wherever a string formula is legal, with the exception that information cannot be stored by means of LET or CHANGE statements in concatenated string variables."

   (Comment) The exception talks about the storage of string variables; whereas the main assertion talks about the use of the plus sign to concatenate string variables. The exception is irrelevant.

   (Example) "BASIC is a problem-solving language that is easy to learn and conversational, and has wide application in the scientific, business, and educational communities."

   (Comment) The language says that these ideas ("easy to learn and conversational" and "wide application in the scientific, business, and educational communities") are equal. Actually, in thought they should be related as cause and effect. The sentence should begin with *because* or one of its synonyms.

   A minor defect is seen in the words easy to learn and conversational. The phrase is choppy and lacking in rhythm. It serves to disconcert the reader momentarily. However, if the writer puts the word *conversational* first, he can make that phrase flow

for the reader: *conversational and easy to learn.*

(Example) "This software provides features which allow more than one run-unit to concurrently retrieve the data in the data base even while one run-unit is updating it."

(Comment) Although this is a much less serious offense than the previous two, it still causes the reader to wonder what is going on in the writer's mind. Concurrently and *even while* have the same *meaning*. Writers should delete *concurrently* and *even*.

4. The writer fails to put his main idea at the beginning of the paragraph. "Suspense," according to Thomas Johnson, "defeats the purpose of exposition. The information the reader needs to know should be at the beginning . . ."

   (Example) "This mode should be used with caution. When this option is assembled in the module, GTRCAL and DISSKP are used in combination to determine what is to be done to the display file. This mode is provided for the careful user who has one or more curves being displayed and wishes to change one or more of them without turning off the display while it is being done. To do this, the user must first create the display file with GTRCAL set to 1 and DISSKP set to 1 in all INIT/DISPLAY tables. To recalculate the display file, set GTRCAL to -1 and for any INIT-DISPLAY table which is not to be calculated, clear DISSKP. DISSKP will be reset to 1 upon return. The user in effect is saying that the space required for recalculation of each curve will not exceed that required initially . . ."

   (Comment) The first two sentences do not contain the main idea of the paragraph. The third one does. It should be the first sentence in the paragraph.

5. The writer failed to simplify the opening paragraphs of his exposition. "In any piece

of technical writing," Thomas Johnson says, "no matter how difficult, the opening paragraphs should be intelligible to every interested reader. Don't avoid technical terminology, but simplify the language around it."

(Example) (This is the paragraph labeled "Introduction" in Chapter 3 of a DEC document.)

"The AFC11 and AD01 devices are used for industrial and laboratory analog data acquisition. The AFC11 is a flexible, high performance, multi-channel analog to digital (A/D) converter. Under program control the AFC11 performs a 13-bit A/D conversion at a rate of 200 channels/second. The AFC11 can multiplex a maximum of 1024 differential input analog signals. The AD01 is also a multi-channel A/D converter; however, it differs from the AFC11, in that it multiplexes up to 64 analog signals. In the following sections, the AFC11 device handler task is discussed first, and then the AD01 device handler is described."

(Comment) Actually, this paragraph of introduction causes more reader pain than the technical description of the AFC11 device handler task that follows it.

6. The writer's presentation of detail is so dense that reader cannot absorb all the ideas at his normal reading pace.

   (Example) The paragraph in No. 5 illustrates this fault.

   (Comment) The word *dense* refers to the clustering of ideas. In the preceding paragraph density appears in such expressions as *industrial and laboratory data acquisition, flexible, high-performance, multi-channel analog to digital (A/D) converter,* and *multiplex a maximum of 1024 differential input analog signals.*

CONCLUSION

That's the substance of what the experts have to say about the writer. Although they may appear to condemn technical writing, that is actually not the case. They realize it has been performing an essential function for a long time. What they are saying is that it has obvious faults. They stress the need for improvement. Unanimously, they urge you to sharpen your skill on the competence level; they suggest that you make technical writing more readable.

CHAPTER 3
WHAT THE EXPERTS SAY ABOUT THE READER

"Who is my reader?"

This question will plague you every time you begin a writing task. And rightly so. As we have already indicated, the reader is by far the most important element in a verbal communication system. Indeed, he is the reason it exists. He influences the language of the technical document, its format, illustrations, typography – everything about it. To ignore his needs, then, is to endanger your very prospects as a technical writer. On the other hand, if you create an accurate image of him, and choose your words well according to that image, you greatly increase your chances for success.

In this chapter you will observe the reader as if he is under a microscope. You will see the two profiles of him created from the findings of many experts in the fields of reading and writing. As far as we know, this is the first time such information has been assembled in a book for writers. Most of it is scattered among some 20 research projects conducted under the auspices of the U.S. Office of Education.

ONE READER PROFILE

George Klare, longtime reading researcher and author of the book MEASUREMENT OF READABILITY, strongly urges the writer to construct a detailed profile of the reader. Here are questions that Klare says can help you form this detailed reader image.

1. *Previous experience.* What is the reader's previous experience with the subject? Be specific. Mark it down in years and depth of knowledge. Indicate depth of knowledge by showing exactly what he can do: Say that he can program in COBOL, FORTRAN, and SNOBOL rather than say that he has been a

programmer for 4 years. Is it educational or work experience? Or a combination? Spell it out in kind and years. Does he understand technical terms or must you simplify them for him? Remember that material difficult for the general reader may be perfectly understandable by a person with a specialized background.

2. *Educational level.* What was the last grade completed in school? This is crucial because a high correlation exists between grade completed and the individual's reading level. Thus the language chosen for a high school graduate would ordinarily be simpler than that chosen for a reader with a college education. Besides, readability tests give ratings in terms of grade level. So if your writing is to undergo a readability test, you should have the grade level of the reader firmly in mind before you write. If your book is targeted for the general reader, Klare's statistics on the median number of years of schooling completed by American adults could help you:

   1940 – between 8 and 9
   1950 – between 9 and 10
   1957 – between 10 and 11
   1960 – about 11
   1970 – around 12

   At any rate, he suggests that sometimes you may want to use U.S. Census data to get a better picture of the educational level of your readership.

3. *Motivation.* Does he have a strong desire to read what you write? Does he have to read it to do his work? If so, he's likely to have a strong motive for learning. Or is he a voluntary reader likely to lay the book aside if the subject or style either bores him or forces him to expend too much effort in extracting the meaning. If you're trying to attract the voluntary reader, then you must use simpler language. He is not looking for a challenge and won't stay around long if your book offers him one.

4. *Intellectual level.* Is the reader smart? How smart? Smarter than you? Smarter than the communicator in the next office? Take a guess at his I.Q. 110? 120? How do you know he's smart? What does he do that indicates high intelligence? Reads the classics? Writes poetry? Plays chess? What does he do in his spare time? Granted, you can't answer all these questions. But by asking them, you can get a better notion of your reader's brain power. Don't forget that your words have to percolate through his mind in order to be understood.
5. *Interests.* All the experts agree that you communicate more effectively when you use terms and examples familiar to the reader. If he's interested in inventories and payrolls and you give him examples from the world of finance and banking, you'll very likely lose him. Ask yourself: When he learns the subject, how is he going to apply it? This is one indication of his interests.
6. *Attention to the material.* Where and under what circumstances will he be reading your document? If he is to read it in the computer room, seeking information to use in a panic situation, then lists, examples, outlines, boldface typography, and quick-reference tables will dominate in your presentation. However, you can resort to a different strategy if he can give it undivided attention in a relatively calm atmosphere. In this case you can furnish longer explanations and repeat information to aid his comprehension. Exactly what is the reader's situation? Visualize it. Write it down. Take it into account.

Another expert, Herbert Michaelson, adds two more categories to the reader profile.

7. *Superior or subordinate to you in knowledge.* You treat your subject matter differently for different readers. The result of this attitude toward the subject matter is called the *tone* of your writing. Does the reader

know less than you about the general field your topic is in? If he does, simplify it. However, if he's an expert – superior to you in knowledge – give him the full technical treatment.

8. *Administrator or technical person.* Again tone is a factor. The administrator is interested in concepts, significance, responsibilities, and potential. He is, in a word, your subordinate in technical knowledge. For him you must select and combine data to teach him what he needs to know to understand the software. The technical person, however, gets the full load of technical details – all he needs to know in order to use the software.

And Tyler Hicks, prolific engineer-turned-writer, adds a directive to complete your reader image.

9. *Select a particular reader.* From all the flesh-and-blood people you know, choose one person who represents the readership you're aiming at. Keep that person's name constantly in mind as you write. Paste it on the wall near your desk. Use him as the test of everything you write. Ask: Can he understand this? If not, rewrite it so he can. (And it wouldn't be a bad idea to let your typical reader review the entire manuscript when it's finished.)

There you have all you need to create a good reader image. To be sure, you won't use all these categories for the template of your particular reader. You should use what you need. That's the spirit in which they are given – as principles to guide your imagination, rather than as rigid rules to hamper it.

ANOTHER READER PROFILE

You can further sharpen your reader image with facts about readers in general: about how poorly they read and how inefficiently they process information. To be sure, it's a universal truth that all readers read differently. But some of the facts supporting that truth show readers to be much less proficient than even the most pessimistic views have them.

For instance, in 1970 J.R. Bormuth of the Department of Education at the University of Chicago wrote a monograph entitled "Illiteracy in the Suburbs." In it he asserted:

1. That 51% of the students graduating from American middle-class suburban high schools cannot read and understand the textbooks in their classes, and
2. That 41% cannot read and understand ordinary newspapers and magazines.

Before looking at the implications of these statements, we want to emphasize two facts. Mr. Bormuth is no sensation-seeking newspaperman. He is a highly respected educator, a painstaking researcher, and a renowned interpreter of facts. Secondly, he has limited his observations to "middle-class suburban high schools," where the quality of education has usually been considered better than in the teeming cities. In other words, he's talking about the so-called *better* schools. If he had included the big cities, the percentages would have been higher.

What do Bormuth's percentages mean in concrete numbers? Well, each year American high schools graduate about 3 million students. (In fact, in 1969, the year immediately preceding Bormuth's report, our high schools graduated 2,839,000 students.) Of the nearly 3 million graduates – remember that Bormuth's percentages would likely be higher if he considered the cities – *at least* half cannot read their textbooks. And what's even more jolting, these students are in a situation where they can get help in reading their texts!

What does this mean for you as a technical communicator? At the outset, let's agree that not all these people went to work for factories and diners or joined construction crews. There's nothing to indicate they're unintelligent. They just cannot read well. Doubtless many of them went on to become secretaries, clerks, technicians, computer operators, key-punch operators, programmer aides, etc. Aged 22 and 23 today, they probably form part of the readership of your manuals. Surely, the way events fall out, some of them will become managers and assistant managers of data centers.

And when you add the number of illiterate graduates this year to that of last year and the year before, and so on, you should gather that at least half the adult population of the United States has trouble reading. Such people have a difficult time getting meaning from written material. They are likely to misunderstand big words and misinterpret long complex sentences.

Another view of American readers, almost as startling as Bormuth's, was given by Helen R. Lowe in an article in the November 1959 issue of ATLANTIC MONTHLY. She worked for many years with *superior* tenth-, eleventh-, and twelfth-grade students. She found them making such disturbing reading errors as the following:

Word Appearing in Book	Word Read by Student
delicacy	delinquency
bivouac	bifocals
timid	diminished
groceryman	clergyman
hurricane	hammer
bos'n	cow
neurosurgeon	trapeze
phosphate	phosphorous
hydride	hydroxide
God knows	good news
antiseptic	adhesive
Oxonian	example
inert	inherent
industrial	international
imbecility	implicitly
Solomon	salami

To darken the picture still more, she said this is just a sample from a list of some 100,000 errors by excellent students all the way up to the college level. Add to these misreadings the errors in comprehension arising from distorting the tenses of verbs and applying modifiers to the wrong words, and the picture of reader inefficiency gets even worse.

Once again, what is the significance of all this to you as a communicator? Two observations are relevant. One is reinforcement of the notion that you cannot generalize about readers on the basis of your own good reading ability. Take it as gospel that readers are generally not as good as you are. In fact, they are much worse.

The second point concerns your choice of words. Choose many-syllable words only if you want to run the risk of missing your reader. Granted, you as a writer have a perfect right to use words like *inert, antiseptic*, and *hydride*. But if your reader is likely to read them as *inherent, adhesive*, and *hydroxide*, what have you gained? One thing is certain, you've failed to inform the reader, you've failed to communicate. Anything you think you've gained is trivial beside the failure to communicate. A purely practical point shedding additional light on this topic comes from the experiments of E.B. Coleman and C.R. Miller. They found that college sophomores learned the most from instructional materials written on the fifth grade level. Moral: to communicate the most, use small words and short sentences.

One thing we know with absolute certainty about readers is that they all get a somewhat different meaning from a piece of writing. This is so partly because each one judges your words by his own unique experience. Moreover, they adapt your words to their own expectations, limitations, and ignorance. To illustrate this truth, Helen Lowe tells the story of the student who constantly read *elephant house* for *elephant cage*. The writer made a mistake, she said when asked for an explanation: elephants live in houses not cages. Another one continually read *supper* for *dinner*, because people eat supper at night, not dinner.

It would indeed be helpful if you could tell the good reader from the bad by looking at him. But this of course is impossible. You cannot even tell one from the other by observing their eye movements and reading speed.

As educator George Klare points out, in cases where experimenters used a camera, they could not differentiate the reading habits of normal people and the feebleminded. Both groups read at the same speed and with the same kind of eye movements. Only a comprehension test can tell which is which.

WRITER'S GRAMMAR VERSUS READER'S GRAMMAR

Another point to remember is that the grammar of the poor reader is not always the same as your grammar.

Thus, your writing may be grammatically perfect. Yet it may fail to communicate because the inefficient reader habitually distorts the grammar. Donald Dansereau found this to be so in his research for the Department of Health, Education, and Welfare. (Helen Lowe said pretty much the same thing in her article in ATLANTIC MONTHLY.)

Dansereau's readers – who go all the way up to the college level – were insensitive to structural cues in written material. For example, they got no sense of time whatsoever from the -ed on a verb in a sentence like the following:

> He hurried to keep all his appointments.

Perhaps the sentence would communicate better if the writer inserted the word *yesterday*.

The net result is clearly pictured in the words of Helen Lowe:

> "In addition to these spectacular distortions, most students make many less startling errors through constant deviations in tenses and pronouns and by omissions, interpolations, paraphrases, conjectures, and complete improvisations, so that paragraph after paragraph reaches their minds garbled, blurred, altered, vitiated – and ungrammatical."

FACTORS IMPEDING COMPREHENSION

Researchers in reading and writing have proved in experiment after experiment that certain factors tend to interfere with a reader's understanding of written material. Some of the latest findings on this subject appear below. Others appear in Chapters 4 through 9 of this book.

Long Sentences and Long Words

Rudolf Flesch, Robert Gunning, George Klare, and others too numerous to specify are unanimous in identifying long sentences and long words as barriers to reader understanding. Gunning (in his TECHNIQUE OF CLEAR WRITING) implies that they waste the reader's energy so that he cannot grapple with the ideas involved. Klare makes the case that long sentences and long words slow down reading and tax the reader's memory. The

length of the word affects word recognition, he says; so the longer the word the slower the word recognition time. This means the reader must invest more time and energy in learning what you are trying to say. Klare also contends that long sentences place a greater burden on the reader's memory span. The longer the sentence, the more the reader has to remember till he gets to the end of it.

But the most telling indictment of long sentences and long words comes from a scholar of the 19th century: Herbert Spencer. In his PHILOSOPHY OF STYLE appears the following passage:

> "A reader or listener has at each moment but a limited amount of mental power available. To recognize and interpret the symbols presented to him requires part of this power; to arrange and combine the images suggested requires a further part; and only that part which remains can be used for realizing the thought conveyed. Hence, the more time and attention it takes to achieve and understand each sentence, the less time and attention can be given to the contained idea; and less vividly will that idea be conceived. . ."

Sentence Structure

Your sentence structure may serve to burden the poor reader. We will say more about this in Chapter 6, but here we want to relate some interesting observations by Ernst von Glasersfeld. He points out that a lot of split-second internal processing takes place when the reader sees a sentence that begins with the words:

> The coding she did. . .

At this point the reader has to pull two possible interpretations into temporary mental storage. One of them is that the structure is a relative clause equal to "The coding that she did" in case the sentence is:

> The coding she did was praised by her supervisor.

The other interpretation is that the structure is inverted, in case the sentence is:

> The coding she did but the documentation she refused to do.

Von Glasersfeld labels such sentences "prospective ambiguity." They make for greater difficulty than normal sentences, he says, because two or more different interpretations have to be made and kept in temporary storage during processing of the sentence. Since they do indeed cause greater reading difficulty, the writer should question whether the reader can derive enough benefit to warrant their use.

Of course, the sentence structure in the example appears infrequently in technical writing. But the same cannot be said of the conditional clause without the word *if*. It appears often and has just as much "prospective ambiguity" as von Glasersfeld's example. Here is one such sentence from a DEC manual:

> "Should the Data Base Administrator, or any user, suspect that a privacy key has become public knowledge, the Data Base Administrator should immediately issue a new unique lock/key combination to replace the one in question."

At the word *should* the reader must be prepared for (1) a question or (2) a conditional clause. And he must keep these alternatives in mind until he reaches the word *that*. Truly, the conditional without *if* – especially if the clause is long – serves to burden the poor reader.

Position of Information in a Paragraph

Does the position of information in a paragraph influence a reader's ability to remember it? The answer is an emphatic yes. This was the finding of Bonnie Meyer and George McConkie, who presented a paper on this topic in April 1974 at the annual meeting of the American Education Research Association. The experiments of Meyer and McConkie showed that information at the beginning of a paragraph is retained longer than that at the end. In fact, the deeper in the paragraph the information appears, the less likely it is to be remembered. An additional finding is that topic sentences at the beginning of paragraphs are remembered longer than the supporting details following them. (Apparently, the details lose their independent identity in the reader's

memory over a period of time and merge with the information in the topic sentence.)

This information is important when you write tutorial, or instructional, material. Remember you defeat your own purpose when you put the most important data in the middle or at the end of a paragraph.

Position of Adverbial Clauses in a Sentence

An adverbial clause at the beginning of a sentence is more difficult to understand and remember than one at the end. Many researchers (notably H. Clark, K. Smith, L. McMahon, and V.M. Holmes) have proved, for example, that the first of these two sentences poses the greater comprehension difficulty to the reader:

1. When Tom arrived everybody cheered.
2. Everybody cheered when Tom arrived.

The reason for this really doesn't matter. (Suffice it to say it concerns the reader's memory span and the way the human mind processes information.)

The important thing is its significance to you as a communicator: *You reduce your chances of communicating when you place adverbial clauses at the beginning of sentences.*

Bearing in mind the information in the preceding section, you *triply* reduce your chances of communicating if:

1. You put adverbial clauses at the beginning of sentences.
2. You make those adverbial clauses long.
3. You fill them with long words.

As Lois van Rooy points out, readability decreases as clause length increases.

One Clause Instead of Two

Experiments by E.B. Coleman in 1965 showed that the reader can understand information in two clauses better than he can in one. Thus, the subjects in his experiments understood sentence 1 much better than sentence 2:

1. If you knew the Mississippi, it would be helpful.
2. A knowledge of the Mississippi would be helpful.

And to hark back to the statements in the preceding section, you can improve comprehension still more by revising sentence 1 as follows:

1. It would be helpful if you knew the Mississippi.

Once again, we want to emphasize that you compound the difficulty of sentence 2 when you add words. Thus, the writer of this sentence inflicts much pain on the reader:

2. A comprehensive knowledge of the salient facts about the Mississippi from its discovery to the extensive government dam-building projects of the 20th century would be helpful.

Changes in the Logical Order of Your Exposition

Experiments with college students by E.K. Darnell in 1963 proved that changes in the logical order of a piece of writing interferes with comprehension. This means that you as a writer can expect a diminishing of reader comprehension if you alter the logical order you have led him to expect. For example, suppose someone had written a piece about the American Revolution for the Bicentennial. In writing about the events leading up to the outbreak of hostilities, he treated them in the following order:

1. Stamp Act (1765)
2. Declaratory Act (1766)
3. Boston Massacre (1770)
4. Boston Tea Party (1773)
5. Destruction of the Gaspee (1772)
6. Intolerable Acts (1774)

As soon as he mentions 1, 2, 3, and 4, with their dates, he has led the reader to believe he is going to follow sequential, or chronological, order. The reader believes, in other words, that the writer has made a contract with

him to follow that order. The writer's move to 1773, then 1772, and then to 1774 disturbs his comprehension. Later, the reader will experience difficulty in recalling facts 4, 5, and 6.

Subject Complements Instead of Object Complements
Look at these two sentences:

1. Your suggestion that the programmer should do the user manual seemed to alarm him.
2. He seemed alarmed by your suggestion that the programmer should do the user manual.

In Sentence 1 the underlined clause is called a subject complement. In Sentence 2 it is called an object complement.

Although the clauses are identical, the one in Sentence 1 is, in the words of V.M. Holmes, "significantly more difficult" to understand. His explanation focuses on the occurrence of the main verbs. In Sentence 2, the main verb comes early, so you know the main idea of the sentence as soon as you reach the third word. In Sentence 1, the main verb comes late, so the reader has to carry from 10 to 12 words in temporary memory before the meaning of the sentence is resolved for him.

Processing the main clause first, Holmes concludes, decreases perceptual complexity and increases comprehension.

FACTORS INCREASING COMPREHENSION

Here are some tips on how you can help the reader comprehend your exposition.

1. Be logical in your presentation. Decide on a systematic order – and stick to it.
2. Use explaining links such as *because, therefore, so, if . . . then, as a result*, etc. They call attention to the logic of your thinking by pointing out a cause, means or result. (Chapter 4 tells you more about links, or transitions.)
3. Introduce examples frequently, especially where the material is difficult.

4. Let daylight into your copy. Long paragraphs have an unfavorable psychological effect on the reader. Break them up. Maybe 3 or 4 paragraphs a page would be a realistic goal. As Robert Gunning says: "Readers like periods and white space."
5. Make your writing readable: write shorter sentences and smaller words.
6. Use structural paragraphs throughout your document. Structural paragraphs serve to introduce, summarize, or review a topic for a reader. Usually appearing at the beginning or end of a section, they help orient the reader. They give perspective.

PRINCIPLE OF LEAST EFFORT

Stated simply, the principle of least effort says that an individual will invariably choose to get to his goal by the route involving the least work. Applying this to reading, George Klare says the reader prefers readable material over the difficult because it requires less effort on his part. Klare observed that people will read two grades below their level when reading for pleasure. Sometimes they will tackle material above their grade level, but their motivation must be powerful. Usually this happens when the subject matter is very interesting or very necessary, as in the case of health information, or when the reader has a strong urge to learn.

There's a moral here. Don't get the notion that you can "challenge" the reader with difficult passages. If he sees there's too much effort involved, he'll drop your book and get the information elsewhere. Perhaps he'll telephone the software specialist to get it orally. At any rate, you can be sure he'll take the easy road.

UNDERSTANDING AND MISUNDERSTANDING

That's the picture of the reader that emerges from the latest research. We hope we've made one fact about him stand out: generally he reads poorly. And the larger the readership you aim to reach, the greater the number of poor readers you'll meet. They certainly won't admit they're poor readers. Perhaps they don't even realize they are. So unless you take pains to help them in the ways suggested in this chapter, you'll miss them with your message. Then they'll have a perfect right to scream

that your manual is garbage, because the burden of communicating rests squarely on you.

When you stop to think about it, your job is much tougher than you thought. Not only must you write to be understood by the reader; but considering his many reading disabilities, you must also make certain you are not misunderstood.

CHAPTER 4
CURING THE FIRST MAJOR ILL: THE UNORGANIZED PARAGRAPH

One sure way to help your reader is through strong organization of the paragraphs you write. This advice is especially apt when your ideas are totally unfamiliar to him or when his background in the subject is weak. In either case, the tighter you make the organization, the better the transfer of ideas.

This view has the unqualified support of prominent professionals in the field of verbal communication. Two such professionals – Ludwig Mosberg and Fred Shima – tell of an experiment that typifies the beneficial effect of tight structure on communication. Although the experiment had to do with oral rather than written discourse, the findings are applicable to both. In the experiment, college students listened to speeches rated low, moderate, high, and very high in structure or organization. (Incidentally, the very high speeches contained transitional words and phrases and summaries of the main points.) After each speaker delivered his speech, the students took a 30-item test. Final results showed that all students, without exception, scored higher as the speech structure increased.

This chapter tells you how to gain such organization in your technical writing. The chief emphasis is on two guiding principles: unity and coherence. In reading about these, you will learn about topic sentences, connectives, and the concept of motion. You'll also learn how to recognize the foremost example of unorganized writing: the haystack paragraph. All the examples used to highlight the discussion of unity, coherence, and the haystack paragraph are from DEC software manuals.

UNITY

The first sentence of every paragraph is a kind of contract between you and the reader. That sentence, in

effect, tells him: "The paragraph will discuss the topic, or idea, presented in this sentence." When he reads the first sentence, he decides what the topic of your paragraph is. Thereafter, he expects you to live up to the contract: to stick to your topic. You break the contract – and risk losing his attention – when your first sentence discusses one topic, and any part of the paragraph discusses another.

Thus, you focus his attention with the first sentence. Then you hold his attention by making your paragraph stick to the topic in that sentence. We call the first sentence the *topic sentence.* In writing other than exposition the topic sentence can appear anywhere in the paragraph.

Consistency in sticking to the topic throughout the paragraph is called *unity.* Briefly, a paragraph is unified when all its sentences discuss the topic appearing in your opening sentence. When you give such unity to a paragraph you take the first step in organizing it.

Here are some examples of good, unified paragraphs from DEC software documentation.

> "The programmer must write a program, which is a list of instructions for the computer to follow to arrive at a solution for a given problem. This list of instructions is based on a computational method, sometimes called an algorithm, to solve the problem. The list of instructions is placed in the computer memory to activate the applicable circuitry so that the computer can process the problem. This chapter describes the procedure to be followed when writing a program to be used on the PDP-8 family of computers."

The first sentence tells us the paragraph will discuss a program, or list of instructions. This is the essence of the writer-reader contract in this paragraph. And the writer fulfills the contract not only by discussing the topic in each sentence but also by specifically mentioning it in each sentence.

Another good example from the same manual:

> "A program written to perform a specific operation often includes sets of instructions which perform intermediate tasks. These intermediate tasks may be finding a square root, or typing a character on a keyboard. Such operations are often performed many times in the running of one program and may be coded as subroutines. To eliminate the need of writing the complete set of instructions each time the operation must be performed, the JMS (jump to subroutine) instruction is used. The JMS instruction stores a pointer address in the first location of the subroutine and transfers control to the second location of the subroutine. After the subroutine is executed, the pointer address identifies the next instruction to be executed. Thus, the programmer has at his disposal a simple means of exiting from the normal flow of his program to perform an intermediate task and a means of return to the correct location upon completion of the task. (This return is accomplished by using indirect addressing, which is discussed later in this chapter.) The following example illustrates the action of the JMS instruction."

Here the writer promises to talk about sets of instructions which perform "intermediate tasks." And the promise is kept all the way through the paragraph. A new paragraph could have been started at "To eliminate the need of writing," but that would be a stylistic choice of the individual doing the writing. Actually, the material on the JMS instruction is wholly relevant because that instruction is intimately related to intermediate tasks. Notice how the writer repeated the term *intermediate task* in the third-last sentence to reinforce the unity of the subject matter. (The term was first used in Sentence 2.) Notice too that the one sentence that is slightly off the topic is properly placed within parentheses. Notice, finally, how the last sentence carried the reader smoothly into the relevant example.

It's too bad Robert Gunning did not come upon writing of this caliber before he wrote his TECHNIQUE OF CLEAR WRITING. It could have altered his undeniably

pessimistic view of technical writing. And remember that we are now analyzing the paragraph for unity only. We're saying nothing about it being clear and exact. Nor do we mention the skillful use of transitional words (*these, such, after, thus*, etc.) to tie the whole paragraph together. Taking all these things into account, both Gunning and Thomas Johnson would have to conclude that this is good technical writing.

The final example is a unified paragraph from a different DEC manual – this time a programmer's reference manual.

> "PIREX (peripheral executive), a component of the UNICHANNEL-15 (UC15) Software System, is described in Chapters 3 and 4 of this manual. PIREX is a multiprogramming peripheral processor executive executed by the PDP-11. It is designed to accept any number of requests from programs on the PDP-15 or PDP-11 and process them on a priority basis while processing other tasks concurrently (e.g., spooling other I/O requests). PIREX services all input/output requests from the PDP-15 in parallel on a controlled priority basis. Requests to busy routines (tasks) are automatically entered (queued) onto a waiting list and processed whenever the task in reference is free. In a background environment, PIREX is also capable of supporting up to four priority-driven software tasks initiated by the PDP-15 or the PDP-11."

The one defect in this paragraph is slight: for a moment the reader is in doubt as to the topic of the paragraph. It could be a thumbnail sketch of PIREX, or a short overview of Chapters 3 and 4. The first word in Sentence 2, however, resolves the doubt. Again, as in the previous paragraphs, the writer makes a contract and abides by it.

But sometimes we break faith with the reader. Look at the following paragraph, for example:

> "A computer, like any other machine, is used because it does certain tasks better and more efficiently than humans. Specifically, it can receive more information and process it faster than a human. Often, this speed means that weeks or months of pencil and paper work can be replaced

by a method requiring only minutes of computer time. Therefore, computers are used when the time saved by using a computer offsets its cost. Further, because of its capacity to handle large volumes of data in a very short time, a computer may be the *only* means of resolving problems where time is of the essence. Because of the advantages of high speed and high capacity, computers are being used more and more in business, industry, and research. Most computer applications can be classified as either *business* uses, which usually rely upon the computer's capacity to store and quickly retrieve large amounts of information, or *scientific* uses, which require accuracy and speed in performing mathematical calculations. Both of these are performed on general purpose computers. Some examples of computer applications are given below."

Analysis of this paragraph shows that the writer promised in the topic sentence to talk about how a computer "does certain tasks better and more efficiently than humans." That's his contract with the reader, and in the second and third sentences he lives up to his obligation. Sentence 4, however, breaks the contract. It talks about computer use in relation to cost. The next sentence moves to still another topic: computer use in business, industry, and research. A wholly new topic – computer applications – confronts us in the last three sentences. These needless shifts of topic destroy the unity of the paragraph and disturb the reader. (They also interfere with reader comprehension. As a test of this last statement, reread the paragraph, then wait five minutes before trying to recall the facts in it.)

Another instance of breach of contract appears in the following paragraph.

> "The Data Base Administrator must be aware of his organization's long-range plans as well as of long-range needs of the users. For instance, several groups of users might be formulating plans for data bases using interrelated data. The Data Base Administrator should be able to provide common access for these users. Understanding short-range user plans and needs as they pertain to specific application requirements is also necessary. A user,

> for instance, might require data from an existing data base which could possibly cause conflicts with the current users' interests. These differences must be reconciled. The Data Base Administrator has the responsibility to see that the data base is an effective, efficient tool for all users."

Looking at the first sentence, you discover the topic to be the long-range plans of the administrator's organization and the long-range needs of the user. But Sentence 4 introduces a new topic: short-range user plans or needs. What the writer needs to do to improve this paragraph is to move his last sentence up front. Certainly it wears the trappings of a topic sentence. Then he should change the second sentence to read:

> To do this he must be aware of both the long-range plans of his organization and the long-range needs of the users.

The result will at least be a unified paragraph.

The final paragraph comes from a different manual.

> "The text Editor (EDIT) is used to create and modify ASCII source files so that these files can be used as input to other system programs such as the assembler or BASIC. Controlled by user commands from the keyboard, EDIT reads ASCII files from a storage device, makes specified changes and writes ASCII files to a storage device or lists them on the line printer or console terminal. EDIT allows efficient use of VT-11 display hardware, if this is part of the system configuration."

The breach of contract appears in the last sentence in this paragraph. There, the writer introduces "the efficient use of VT-11 display hardware" as a topic to compete with the one in the first sentence.

COHERENCE

A less elementary way of organizing paragraphs to help the reader is by means of coherence, or continuity. Coherence, from one point of view, refers to the smooth connection between the sentences in a paragraph. It is the flow or movement from sentence to sentence, which the reader senses as an ease in passing from one thing to

another. To the reader the sentences are tightly linked, rather than loosely associated. He is therefore likely to describe such writing as "easy to read" or "easy to follow."

Looked at from another point of view, coherence refers to the smooth flow of thought in written material. Seen as such, it is merely a verbal reflection of the linkage among the ideas in the writer's mind. Coherence in this sense is like thought itself. It has the lively onward motion of thought, as it carries the reader through the material. Thus, coherence is vitally connected with the competence level in writing. You can be effective in getting your ideas into the reader's head only when you show him how they are connected.

And how does the writer show such connections? In other words, what are the transitions (i.e., words and expressions) you can use to guide the reader?

The simplest transitions, of course, are pronouns and the repetition of keywords from preceding sentences. These are basic connectives that tie facts together but contribute little to the flow of ideas. They have value because by indicating identity or sameness of ideas they keep the reader oriented. But they are of secondary value in that they fail to show the reader the kind and order of your ideas.

For the latter aim, you need the words and expressions listed in Table 1.

As a quick test, why don't you go through a couple of pages of your own writing and underline any words appearing in Table 1? If you don't find them often enough, then you are not tying your ideas together logically and naturally. And your sentences, in the words of Jacques Barzun and Henry Graff are "weak at the joints."

Similarly, let's test the joints of some examples from DEC software manuals.

> "*When* speaking of memory locations, it is very important that a clear distinction is made between the address of a location *and* the contents of that location. A memory reference instruction refers to

a location by a 12-bit address; *however*, the instruction causes the computer to take some specified action with the content of the location. *Thus, although* the address of a specific location in memory remains the same, the content of the location is subject to change. *In summary*, a memory reference instruction uses a 12-bit address value to refer to a memory location *and* it operates on the 12-bit binary number stored in the referenced memory location."

There is no joint trouble in this excerpt. In the four sentences the writer guides the reader with seven of the words and expressions in Table 1.

He uses *when* to denote time; *however* and *although* to show contrast between ideas; *thus* to indicate a cause-and-effect relationship; *and*, in two instances, to show equality of ideas; and *in summary* to signal the reader that a summary of the paragraph is coming his way. All these things considered, the paragraph is a good example of coherence in writing.

Another model of effective coherence in DEC software writing is as follows:

> "Writing the above program was greatly simplified *because* mnemonic codes were used for the octal instructions. *However*, writing down the absolute address of each instruction is clearly an inconvenience. *If* the programmer later adds or deletes instructions, *thus* altering the location assignments of his program, he has to rewrite those instructions whose operands refer to the altered assignments. If the programmer wishes to move the program to a different section of memory, he must rewrite the program. *Since* such changes must be made often, especially in large programs, a better means of assigning locations is needed. The assembler assigns this better means."

Here, in the skillful use of *because, however, if, thus* and *since*, the writer guides us through the ideas in his paragraph. The paragraph is coherent because it is the verbal reflection of the writer's ordered thinking.

Table 1
Some Transitional Words and Expressions

Simple Conjunctions and Adverbs		
also	however	so
and	incidentally	still
besides	likewise	then
but	meanwhile	therefore
for	moreover	thus
furthermore	nevertheless	too
generally	next	usually
hence	similarly	whatever
		yet
Adverbs of Time		
eventually	next	secondly
finally	now	when
first	once	ultimately
Simple Expressions		
another way to	in essence	instead of
as well	in fact	more specifically
at the same time	in general	no matter what
for the same reason	in other words	on the other hand
in addition to	in short	to begin with
in brief	in the same sense	that's what (why)
in contrast	in sum	what's more
	in summary	
Subordinate Conjunctions		
although	if	whenever
as	since	where
because	when	wherever
		while

But not all the paragraphs in technical writing are as unified and coherent – that is, as organized – as the two you've just read. Indeed, many technical paragraphs are almost devoid of guiding words. And because they lack the organization that coherence supplies, they place the

entire burden of interpretation on the reader. In effect, the writer says to the reader: "Here are the facts. You connect them."

The typical example of such unorganized writing is the haystack paragraph. (It is also called the catalog or grocery list paragraph.)

The Haystack Paragraph

At DEC a short time ago a programmer returned a manual she had been reviewing to the supervisor of the writing group where it had been written. The supervisor asked her how she liked it. She was hesitant in her reply. "I don't know," she said. "There's something wrong, but I can't put my finger on it." He asked her whether it was accurate. She said: "Oh, technically, it's all right. All the facts are there. But it's just. . . ." She paused and shrugged. "Well, you have to work too hard to read it."

As soon as the supervisor looked at the manual he spotted the trouble: it was filled with haystack paragraphs. These are clusters of technical facts swept into neat paragraph piles by the technical writer who gives the reader little or no guidance.

Here is an example of the kind of paragraph that appears often in DEC software documentation.

> "EXPAND is an RT-11 system program which processes the macro references in a macro assembly language source file. EXPAND accepts a subset of the complete macro language and, using the system library file SYSMAC.8K, produces an output file in which all legal macro references are expanded into macro-free source code. EXPAND is normally used with ASEMBL, the RT-11 assembler designed for minimum memory configurations."

Here you have a catalog or list of facts with no attempt on the part of the writer to connect one idea to another. You can shuffle and rearrange these three sentences and they would be just as informative as they are now. What is the common relevance of these facts about EXPAND? If the writer had to supply a heading for this paragraph, would it be "Important Facts About EXPAND"? Or "Introductory Information About EXPAND"? Or. . .?

As the paragraph now stands, the reader has to do all the interpreting – all the guessing. He has no way of knowing whether the list is partial or complete. Too, he doesn't know whether one fact is more important than the others. In a haystack paragraph all facts are grammatically equal. Thus, there is no emphasis, no selective impact on the reader.

From a different software manual comes the following example.

> "Lab Applications-11 modules are available to perform operator console interaction, data acquisition, data editing, Fast Fourier transformation, output printing and displaying. Lab Applications-11 allows many variations of these functions. The library of modules will be enhanced as time goes on, and as application needs are defined, more and more of the requirements for laboratory computing will be supplied by DIGITAL."

Only one connective is used in the whole paragraph. That's the word *these* in the second sentence; and it serves to identify ideas, not to indicate any logical relationship among them. Replace *these* with *the*, and you can shuffle and rearrange these sentences and still retain the same effect – or lack of it. Again, there is no indication of relative importance, or of what all these facts mean to the individual reader, or even why they are assembled in this paragraph at this time. And as in the previous paragraph, the reader must assume the whole burden of interpreting the data – a task no reader of exposition should ever have to undertake.

The next example is more frustrating to the reader because the logical relationships are implied, but not explicitly shown.

> "As these data bases increase both in use and sophistication, their creation and management must be relinquished by individual application programmers in favor of greater coordination and centralized control. It has become too costly and/or impractical, in most instances, for individual programmers to create data bases for single applications on a one-to-one basis. The need at present is for data bases which are suitable for

processing by, and available to, multiple applications."

Three cause-and-effect relationships reside in this paragraph, but the writer uses no signals like *because, since, thus*, or *therefore* to reveal them to the reader. The reader is forced to dig them out – if he's interested. And if he's not interested, he misses the whole content of the passage.

Pause for a moment to consider how the writer of this paragraph defrauded the reader. At the time of writing he must have had ideas similar to the following, in his mind:

1. Because data bases are increasing in use and complexity, management by individual application programmers must give way to centralized control.
2. Because the creation of data bases for single applications costs so much, individual programmers will soon stop creating them.
3. Because of the cost and the increase in use and complexity, programmers must create data bases that multiple applications can use.

But when he wrote about the contents of his mind, he withheld the most important elements – the logical connections. Thus he made a mystery out of what should have been a revelation. The upshot is that he either overworks the reader or loses him entirely.

Although the final haystack example is long, it is worth including because it contains most of the deficiencies of haystack writing.

> "Each line of the program begins with a line number of 1 to 5 digits that serves to identify the line as a statement. A program is made up of statements. Line numbers serve to specify the order in which these statements are to be performed. Before the program is run, BASIC sorts out and edits the program, putting the statements into the orders specified by their line numbers; thus, the program statements can be typed in any order, as long as each statement is prefixed with a line number indicating its proper sequence in the

order of execution. Each statement starts after its line number with an English word which denotes the type of statement. Unlike statements, commands are not preceded by line numbers and are executed immediately after they are typed in. (Refer to Chapter 9 for a further description of commands.) Spaces and tabs have no significance in BASIC programs or commands, except in messages which are printed out, as in line 65 above. Thus, spaces and tabs may, but need not be used to modify a program and make it more readable."

The writer attempted feebly – with *these* and *thus* and *unlike* – to connect parts of the paragraph. But his connectives were too few and too weak to alter the net reader impression that the paragraph is unorganized. Clearly his main trouble is that he started out in the haystack style and couldn't shake it entirely later on. Notice, for instance that his first three sentences contain a catalog, or list, of unconnected facts. This fault later leads him to include a discussion of statements, commands, and spaces and tabs in the same paragraph without attempting to show how they are related.

The two uses of *thus* are especially weak. In the first instance, *thus* and the words with it do not expressly tell the reader that if he puts line numbers on his statements, BASIC will put them in order for him. On the contrary, he has to read through the sentence and then go back to piece together this information. The second use is much less effective. How tabs and spaces modify a program is not at all clear. And how they make a program "more readable" is vaguer still. The writer could greatly increase the effectiveness of both sentences by revising them to substitute *because* for *thus*.

THE IDEAL SYSTEM

In the ideal communication system the writer provides paragraphs that are unified and coherent; the reader easily follows the writer's presentation, understanding all the ideas and their relationships. Granted, you'll never see such a system in operation. But if you follow the suggestions in this chapter for organizing your paragraphs to help the reader, you'll take a giant step toward realizing your part in it. You'll become a more effective communicator.

CHAPTER 5
CURING THE SECOND MAJOR ILL: AN ABSTRACT STYLE

All words are abstract. There are absolutely no exceptions to this truth. This is the teaching of Alfred Korzybski, author of SCIENCE AND SANITY, which was first published in October 1933. Korzybski, a philosopher and scientist, gave us many new insights into the nature of language and meaning. Two of his contributions are discussed in this chapter. The first deals with the relationship between language and reality. The second has been popularized by his disciples as the "ladder of abstraction."

LANGUAGE AND REALITY

There is no direct connection between language and the world around us. The connection is indirect – through the minds of the people who use the language. Because you and I agree that a particular word shall refer to a certain thing in the external world, we can use that word to communicate about that thing. Our agreement, then, is the only connection between the word and the thing. And such an agreement is purely arbitrary: we could just as easily have agreed that another word would stand for that thing.

In Figure 4 a dotted line stands for the indirect relationship between words and the external world.

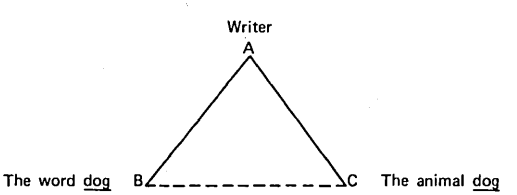


Figure 4. Indirect Connection Between Word and Thing

In the diagram, the writer (A) sees an animal (C). He uses the word *dog* (B) to refer to this animal. This word is what users of the English language have agreed shall refer to that kind of animal. If (A) were among people who knew only French, the word *dog* would have no meaning. (A) would have to know the word *chien* in order to communicate. Similarly, among Spanish-speaking people, (A) would have to know the word *perro*. In fact, the very existence of different languages proves there is no direct connection between words and things.

So the connection between any word and what it refers to lies in the minds and experiences of the writer and the reader. The writer depends on the reader to relate the word to its referent. But what is clear to one class of reader may be as meaningless to another as the word *dog* is to people who know only *chien* or *perro*.

THE LADDER OF ABSTRACTION

As soon as we use a word, say *dog*, we start the abstraction process. For there is no such thing as dog in the real world. Out there exist "Fido" and "Rex" and "Prince" and all the other individual dogs with their individual names and individual characteristics. What we have done with the word *dog* is make it refer to certain selected characteristics of all dogs. In doing so, we left out other, specific, characteristics of individual dogs. This is the essence of the process of abstraction: we leave out certain specific characteristics.

Thus, we use *dog* to mean, in the words of the ENCYCLOPEDIA AMERICANA, "a domesticated carnivorous mammal remarkable for its intelligence and its attachment to man." What have we left out? For one thing, we say nothing about overall size, shape of head, or the color or kind of fur. Nor do we mention the sound "dogs" make, their odor, or their sleeping and eating habits. Too, we leave wholly out of account any notion of the dog as a living organism, ingesting food, transforming it, and getting rid of it. Moreover, we fail to focus on the dog as science sees it: a mass of swirling electrons. Hence, *dog*, as a word, becomes a shorthand term for a small subset of the total number of specific characteristics of all the dogs in existence. In sum, *dog* is a general word.

The ladder of abstraction is a graphic means of showing (1) how we get more abstract and general as we ascend the ladder, and (2) how we get more concrete and specific as we descend the ladder. Figure 5, for instance, illustrates this in the case of dog.

Notice that when we go up the ladder, each level refers to more items and says less about any one individually.

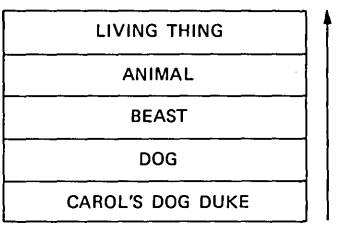


Figure 5. Going Up the Ladder is More Abstract

Carol's Duke, for example, refers to one specific member of the entire dog population. Up one rung on the ladder, *dog* designates any one or all of the approximately 100 million dogs in the world. Still higher on the ladder, *beast*, can be applied to all animals except man – not only dogs, but also cats, bears, beavers, elephants, etc. On a still higher level of generality is *animal*, which designates any living thing that is not a plant. *Living thing*, on the topmost rung, is the most abstract, or general, term of all: it covers all plants and animals.

There is an important lesson here for you as a writer: the higher your words on the abstraction ladder, the more meanings your reader can read into them. Remember what we said in the preceding section ("Language and Reality"): the writer depends on the reader to relate the word to its referent. Thus, you can use *living things* to refer to dogs, if you wish. But you risk having some of your readers apply it to plants, others to bears and coyotes, still others to men or fish.

On the other hand, the lower you go on the abstraction ladder, the more specific you get. Thus, going down betters your chance of communicating.

Look at the example in Figure 6. This time let's take a different perspective. Let's say that as we move down the ladder we become less abstract.

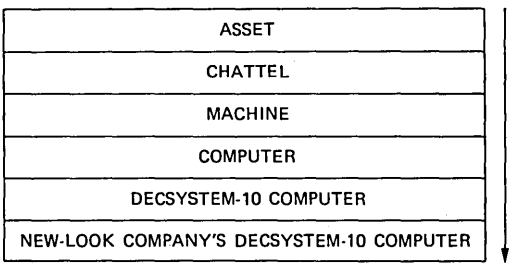


Figure 6. Going Down the Ladder is More Concrete

Suppose the public relations group at New-Look Company issued a press release containing the following sentence:

> New-Look expects its newly acquired asset to bring accuracy to its inventory and speed to its payroll operation.

The reader doesn't get much information from that sentence. The word *asset* can mean anything at all of value. So if we have no more concrete reference, we could think it referred to a building, a machine, or a system or organization. Going down the ladder, here's what information the other terms convey:

chattel:	Here we have taken a small step in the direction of communicating. This term rules out real estate but covers all other tangible possessions.
machine:	This covers any complex device for doing work.
computer:	Now we have zeroed in on a particular type of machine. But it could be the product of any of a score or so manufacturers.
DECsystem-10 computer:	More specific still. We know it's a DEC computer. But we don't

know what it consists of; that is, we don't know its memory size, the number and kind of peripherals, the specific pieces of software, etc.

New-Look DECsystem-10 Computer: We have arrived at the bottom of the verbal ladder. Here is something we can actually see and touch. Peripherals, configuration, size, software – all make this designation less abstract – more concrete – more specific.

In summary, the higher you climb the ladder of abstraction, the more general you get. The lower you go, the more specific you get. Stay low on the ladder for more efficient communication. For when you're low, there's less chance of the reader's projecting erroneous meanings into your words.

Abstract Words vs. Concrete Words

In everyday language we use the terms *concrete* and *abstract* to refer to the different kinds of words we speak or write. Generally speaking, an abstract word refers to something that does not exist in the physical world; that is, it does not have a specific referent against which it can be checked. Thus, *component* and *system* and *implementation* are abstract words in this sense. So are *facility, maintenance, establishment, honesty, evil, beauty*, and *configuration*. Notice that a number of these words refer to qualities, ideas, conditions, or relationships.

Concrete words, on the other hand, do have physical referents. And as we have seen in the discussion of the ladder of abstraction, concrete words are either specific or general. They are specific when they refer to particular things in the physical world: Carol's Duke, Senator Kennedy, the Declaration of Independence, Digital Equipment Corporation. They are general when they refer to a class of persons or things: dog, hill, programmer, physicist, computer, newspaper.

In regard to communication, the consensus of the experts is that concrete words are by far the more effective. As Robert Gunning says: "Words that stand

for things we know by the senses are safest in communication because there is greater possibility that you and the reader will have a large area of overlap in experience with these words." And Lois Van Rooy, in her advice to writers of books, echoes Gunning: "Write in terms as concrete and specific as possible."

In summary, use concrete words for better communication. As an aid in finding concrete words use the following three tests:

1. Can this be seen or touched?
2. Does this exist in the physical world?
3. Is this picturable? (A picturable term names something that the reader can visualize as having size and form. The word *car* is picturable. The word *experience* is not.)

WHAT'S GOOD ABOUT ABSTRACT WORDS?

Words high on the ladder of abstraction are useful as tools of thought. Since you can pack them with any number of details of your own choosing, you can use them as a kind of logical shorthand. For example, you can make the word *sophistication* stand for 5 years of programming experience with MACRO, a working knowledge of FORTRAN and ALGOL, and two years of supervising experience in data base management. Clearly, it is much more economical for you to use the word *sophistication* than the specific details it stands for. The same can be said for any abstract word, say, *optimization* or *enhancement* or *quality*. As long as the term has definable meaning for you as the thinker, you can use it with benefit in your thinking. As an additional bonus, you can very likely organize your thoughts better because you are dealing with fewer terms.

But abstract words are usually no good for communication. So the trick is to use them for thinking and then translate them into more concrete terms when you write.

If, however, you must use an abstract word in your writing, use it as a shorthand way of referring to details you've already given. For example, suppose you have already described for your reader a DECsystem-10 computer consisting of the following: 150K of memory, a line printer, 2 tape drives, a disk, 3 terminals, a

monitor, and PIP, DDT, MACRO and TECO. Therefore, you can use the abstract word *system* instead of repeating the elements listed in the preceding sentence. Actually, you have made *system* concrete in this instance by giving it precise meaning. It now refers to something that can be seen in the physical world. And this is the only way of communicating successfully with abstract words.

WHAT'S WRONG WITH ABSTRACT WORDS?

Writing that contains a high percentage of abstract nouns reveals the following faults:

1. It is difficult to understand.
2. It is inefficient in transferring information from the writer's head to the reader's.
3. It is difficult to memorize.

These findings were reported by E.B. Coleman and C.R. Miller in the READING RESEARCH QUARTERLY in 1968. In sum, these educators aim the following message at the technical writer: you cannot communicate successfully by using a lot of abstract nouns.

The reason for this is clear. Words high on the ladder of abstraction are vague in meaning. They tend to make a passage general and indefinite. Unaccompanied by concrete nouns and active verbs, they cloak a passage in a smog-like haze of ambiguity that hides the writer's intended message.

Since no word – even the most specific of concrete terms – means the same thing to all readers, the best we can say about an abstract style is that it means different things to different readers. Whereas the worst we can say is that it means nothing at all to any readers.

Take the word *freedom* for example. Obviously, it means one thing to a reader of COSMOPOLITAN and another to a reader of TRUE. And those meanings would perhaps fail to square with the meaning given it by the reader of GAY WORLD MAGAZINE or the CATHOLIC DIGEST or THE AMERICAN ATHEIST MAGAZINE. Similarly, a writer who uses the abstract word *vehicle* to convey the notion of Conestoga wagon runs the risk that his reader thinks of a buckboard when he reads it, or even a phaeton.

"Abstractions," in the words of Thomas Johnson, "are detrimental to exposition, because they are open to interpretation." Thus, they defeat the purpose of informative writing, which should say the same thing to all the readers it's aimed at. Jokingly, Johnson suggested that when you don't know what you're trying to say, throw in a few abstract words. Further, if you want to bury an idea like a needle in a haystack, slip it into some abstract words.

Morris Freedman in his SEVEN SINS OF TECHNICAL WRITING puts abstractions under the sin labeled "general fuzziness in communication." He, too, urges the use of specific concrete terms that say much the same thing to all the target readers.

Two big dangers in the use of abstractions were pointed out by Robert Gunning and Herbert Michaelson. The former said that the writer gets so used to abstract words that after a while such words seem concrete to him. Thus, the writer is unaware of any need to question whether his words are fuzzy or misleading to the reader. What's even worse, he's writing prose only he understands. Michaelson pointed to a similar danger on the part of the reader. Most of the time, he said, the reader does not see the words as ambiguous. He just interprets them according to his own understanding and experience, and then goes on his way. This kind of faulty communication – where the minds of the reader and the writer meet only through the wildest of coincidences – can easily result in accidents with equipment, loss of sales and of good will and, quite possibly, lawsuits.

Our own documentation has many examples of the use of abstract terms whose meaning the reader is allowed to supply as he wishes. At least, the writer seems to have failed to give a meaning for him. In this vacuum the reader's mind will provide a meaning from his own experience. Here are a few of those examples from DEC software documentation.

1. (Example) "VERIFY provides the user with a facility for verifying the consistency and validity of a file structure on a specified device."

(Comment) *Facility*, *consistency*, and *validity* are high on the ladder of abstraction. Notice that they can be neither sensed nor pictured. Nor are they readily seen in the physical world. Such words are likely to leave the writer and reader poles apart regarding their meaning.

2. (Example) "Therefore, while the scientist designs experiments or tests from content-area principles of his discipline, DIGITAL has designed implementation conventions, processes, and functions from computer principles. The processes and functions are the software elements of Lab Applications-11. This manual, as well as the whole nature of Lab Applications-11, is a set of system conventions or framework used in implementing applications. This generalized system design structure allows the user to create data handling systems which reflect experience the user personally may not have had time to acquire."

   (Comment) This entire paragraph is on a very high level of abstraction. How much of the writer's meaning is actually communicated can be known only by a quiz of both the writer and a typical reader. Certainly, ambiguity and emptiness appear in words and phrases on every line. For example, does content-area principles have an exact meaning? How about such abstractions as *implementation conventions, processes, computer principles, nature, system conventions, framework, applications, generalized system design structures, systems,* and *experience*? Because of such abstract words and expressions, trying to pin down the meanings of words in this paragraph is like trying to put uniforms on a squad of ghosts.

3. (Example) "Many computer languages are currently in use, but BASIC is one of the simplest of these because of the small number of clearly understandable and readily learned commands that are required,

its easy application in solving problems, and its practicality in an evolving educational environment."

(Comment) Here, again, the meaning is elusive and constantly changing because of the abstractions the reader has to pour meaning into. Look, for example, at *application, problems,* and *practicality.* All three are vague and ambiguous. But for abstractions that mean little to anybody, consider "evolving educational environment" and "clearly understandable and readily learned commands." *Commands*, of course, is a technical term but the qualifiers disturb its set technical meaning. *Understandable* to whom? What's the difference between *understandable* and *learned* in this phrase? Are the commands "readily learned" because they are "clearly understandable?"

4. (Example) "DOS/BATCH has been designed to manage resources efficiently and to be easy to use. It is suitable both for regular production work, and by reason of its data storage facilities and debugging aids, for program development. However, while it provides a response time fast enough for most requirements, it is not intended for use in on-line real-time data acquisition applications."

   (Comment) In this paragraph you'll find a number of abstract words people think have meaning because they've gotten used to them. High-level abstractions like *resources, facilities, aids, requirements,* and *applications* still mean different things to different people. This paragraph is an excellent example of a case where the reader doesn't sense ambiguity. He merely supplies his own meaning and moves on.

5. (Example) "Lab Applications-11 is an integration of software, hardware, and theory which provides the laboratory computer user a combination of resources to solve his particular laboratory application problem."

(Comment) Try, if you can, to state the meaning of "integration of hardware and theory." Then try "integration of software and theory." In this way you'll get some idea of the emptiness of the entire phrase "integration of software, hardware, and theory."

6. (Example) "Consider a research company which is organized into departments. Some of these departments are actively engaged in research; others are support departments, e.g., accounting, payroll, legal, etc. Each research department is broken up into research project groups, although there are some special projects which overlap departments. The research projects are supported by contracts and grants which come from external sources – some projects receiving funds from more than one contract or grant."

   (Comment) At first glance, this paragraph seems more concrete than the others, But it is still on a high level of generality. Witness words like *departments, projects, research, research project groups,* and *grants.* The writer failed to give these specific meaning, even though he intended this description as an example in his manual. And what can we say about the word *funds*? Surely the writer could have stepped down the abstraction ladder and used the word *money.* It's more exact – and more picturable.

MAKING ABSTRACT SENTENCES MORE MEANINGFUL

"What can I do to improve an abstract style?" you may ask. The experts (specifically Rudolf Flesch, Robert Gunning, Jacques Barzun, Henry Graff, Thomas Johnson, E.B. Coleman and C.R. Miller) offer a number of suggestions.

1. When you are writing on a very high level of abstraction, you can communicate more effectively, according to Flesch, by adding

restatements on a more concrete level. This "corresponds to the use of illustrations, practical applications, examples, parables, and the like in teaching." In a word, Flesch advises you to back up abstract writing with concrete illustrations.

(It is interesting to consider why the readers of technical manuals constantly clamor for more illustrations. Is it because the concrete examples make the abstract text more understandable?)

2. Gunning says you should always be aware of the position of your words on the ladder of abstraction. "Make certain that the terms you use actually have a connection at the ladder's bottom to observable facts."

   Remember the loose generality of the phrase "integration of software, hardware, and theory." If you are prone to write like that, ask yourself: What do these words refer to in the physical world? If the answer is nothing, then ask yourself: What am I trying to say? What am I trying to tell the reader?
3. Similar to Gunnings's advice is Jacques Barzun's and Henry Graff's suggestion that you constantly ask: "Can this be touched or seen?"
4. Coleman and Miller say that much writing is difficult to understand because the writer chooses verb-nominalizations instead of verbs. A verb-nominalization is an abstract noun derived from a verb. For example, *operation, construction* and *creation* are verb-nominalizations derived from the verbs *operate, construct,* and *create,* respectively. Coleman and Miller conclude that the writer can make his sentences more meaningful by reducing the number of verb-nominalizations. You do this by changing the verb-nominalization into an active verb. Thus, you would change "Peter's creation of the program" to "Peter created the program."
5. Gunning, a very articulate proponent of the use of short words, suggests that you use big words sparingly. Most big words, he points out, are abstract. They stand for qualities of

things and relationships among things. Short words, on the other hand, are concrete: they refer to persons, places, things, and acts.

6. Thomas Johnson asks you to spot fuzzy words in your own writing and then either eliminate them or give them specific meaning. Typical words that tend to make your style abstract appear in the following list:

ability	extent	practice
achievement	features	problem
activity	flexibility	procedurality
applications	function	procedure
area	interest	process
characteristics	interrelationships	prospect
circumstance	management	provision
concepts	manner	purpose
concern	measure	quality
condition	medium	question
connection	method	reliability
connotations	nature	respect
definition	necessity	responsibility
developments	objectives	situation
document	optimization	sophistication
effect	option	standpoint
effort	persuasion	strategies
enhancement	policy	substance
environment	position	utilization
establishment	possibility	

SUMMARY

You will frequently have to use abstract terms in your technical writing. In doing so, you should realize that the farther you get from the concrete, the greater your chances of missing the reader. Therefore, your big need is always to know where you are on the ladder of abstraction so that you can intelligently question whether your terms will be understandable to the reader. When the level of abstraction is too high, consider using concrete examples to give meaning to your abstract words. Too, never stop trying to find a concrete replacement for the abstract term. As Rudolf Flesch pointed out, concreteness is even more important for successful communication than short sentences. And the reason is that there is an excellent chance you and your reader will have an overlap in experience of the things concrete words stand for.

CHAPTER 6
CURING THE THIRD MAJOR ILL: SENTENCE COMPLEXITY

Traditional grammar defines a complex sentence as one that contains an independent clause and one or more dependent clauses. Thus, the following sentences are properly labeled complex:

1. He came when he was ready.
2. He said that he would come when he was ready.

But this definition gives little indication of the real nature of a complex sentence. For one thing, it deals only with the surface appearance of the sentence. For another, it leaves the reader entirely out of account.

The complexity discussed in this chapter is what the reader encounters when he tries to extract meaning from a piece of writing. In this sense, complexity refers to the total number of relations he must unravel to understand a passage. This definition, then, sees complexity as a composite of a number of factors.

One of these factors is, of course, the surface structure of the sentence, for that is what the reader sees first. Actually, you as a writer can present the same content in a number of different surface structures. But the structures differ in effectiveness; that is, the reader can extract information more easily from one form than from another. For example, both of these sentences have the same content:

> The programmer drove his car to work.
>
> The car was driven to work by the programmer who owned it.

The first sentence, however, is likely to prove more effective from the reader's viewpoint than the second.

Another factor is the cluster of relationships beneath the surface. Ernst von Glasersfeld, a typical proponent of this view, analyzes this kind of complexity into the following parts:

1. The occurrence of unfamiliar relationships.
2. The prospective ambiguity of certain phrases.

An illustration of unfamiliar relationships is seen in the following sentences about the Americans and the Japanese:

1. Americans fought with the Japanese in Peking in 1900.
2. Americans fought with the Japanese in Manila in 1945.

In the first sentence the Americans and Japanese are related as allies, whereas in the second they are related as enemies. And the difference is due to the relationship set up by the preposition *with*. In sentence 1 it means "on the side of" – an unfamiliar usage; and in sentence 2 it means "against." Structurally, these sentences are identical – each has an independent clause and three prepositional phrases.

Von Glasersfeld's concept of prospective ambiguity was discussed in Chapter 3. There, we saw that the sentence

> The coding she did but the documentation she refused to do.

required more reader effort to understand. For this reason von Glasersfeld called it complex. Traditional grammar, on the other hand, labels it compound – a designation that says nothing about its complexity.

This, then, is the mark of complexity as discussed in this chapter: It makes the reader work hard to get meaning from a sentence. And when he must struggle too much with complexity, he cannot process the information properly for recall later.

What does all this mean to you as a technical writer? The answer is simple: Make your sentences less complex in

order to communicate successfully. In this chapter you'll find a discussion of required memory level and sentence length in their relationship to complexity. And the closing paragraphs offer you some suggestions for the cure of this major ill of technical writing.

REQUIRED MEMORY LEVEL

One way to understand sentence complexity is to view it as a burden on the reader's memory. Jackson Morris coined the term *required memory level* to describe this burden. *Required memory level*, as he uses it, refers to the reader's capacity to remember facts and relationships as he reads. More specifically, it means the maximum number of facts he must remember at any point in the sentence. Thus, the larger the number of facts to be remembered, the greater the complexity of the sentence. In other words if the required memory level is high, the sentence is difficult for the reader. The more facts the reader must remember, the harder he must work to understand your writing.

As a simple example, look at this sentence.

> The fifth house on the right on Dan's street is being sold.

The reader has to remember four facts (fifth, house, right, and Dan's street) before he reaches the verb, which clarifies the subject for him. That is, when he gets to the verb, he knows what the subject means in this sentence. This is an important aspect of required memory level: it is usually equated with the distance between subject and verb.

Many word puzzles, Morris points out, are based on required memory level. The following one has been around a long time.

> "If a hen and a half lays an egg and a half in a day and a half, how many eggs does one hen lay in a day?"

Another familiar oldie asks the reader to identify the person who says these words while looking at a picture.

> "Brothers and sisters I have none.
> But this man's father is my father's son."

Some technical writing imposes a burden as great as that of the word puzzles. Here is an example from one of our manuals:

> "Systems for digitizing and storing analog data, sorting and averaging multiple analog signals, and sequencing processing events, are all examples of laboratory problems where DIGITAL has knowledge independent of scientific discipline."

In this case the reader must temporarily store and remember 13 facts before the predicate lets him know what they mean. Admittedly, there are individual variations in the capacity to cope with a required memory level. But retaining 13 facts would be a prodigious feat for even the most retentive of memories. Just for the fun of it, reread that sentence and, when you reach the word *problems*, try to remember the three problems. This exercise puts you in the place of the reader and tells whether you can cope with the required memory level.

Another burdensome sentence from DEC software documentation reads as follows:

> "By dividing the DBS files into pages, and storing selected records on these pages, and using a page as the basic I/O buffer size, DBCS operations that affect the records on only one page can be handled with a single disk access."

This 42-word sentence requires the reader to grasp 19 facts before he reaches the verb. And to make his burden even heavier, he's forced to retain 14 facts before he even gets to the simple subject (DBCS operations). Translated into other terms, this means he must read 24 words before he gets his first inkling of what the sentence is about. You can test your memory, too, on this one, if you wish. But it really isn't necessary. Obviously, the required memory level is impossibly high. This is a first-rate example of how sentence complexity can help inhibit communication.

Although the next example is shorter than the previous ones, it is by no means less complex. In fact, its complexity is so fascinating that on one occasion 12

college graduates were given this sentence as a test. They had to read it, then wait five seconds before stating all the facts it contained. Not one of them was able to do this successfully. Here it is for your edification:

> "The establishment and maintenance of relationships between records specified by means of declaring sets in the schema, is a responsibility of DBMS-10."

To be sure, there is no known way to measure required memory level. But this shouldn't deter you from using it to your advantage as a communicator. Accept the fact that it does indeed exist. It is real because there is a limit to the temporary complexity that any human mind can adjust to. Hence you can help the reader by anticipating his difficulty with sentences having too great a distance between subject and verb. Revise such sentences before they get into the manual. Revert to the subject-verb-complement word order of the declarative sentence. This order not only reduces the required memory level, but it also clarifies relations among the various sentence elements. For example, say declaratively:

> DBMS-10 is responsible for setting and keeping up relationships between the records declared by sets in the schema.

Transformational grammar presents a view similar in effect to Morris' required memory level. Coleman and Miller, who represent the transformational approach, speak of kernels as the simple units of language. Writers transform these kernels to make complex sentences. As an example of a single-kerneled sentence they offer the following:

> They gave her a dollar.

On the other hand, a many-kerneled sentence is

> They admired her intelligent lectures.

This sentence is made up of three kernels: *she lectured*, *she was intelligent*, and *they admired*.

The more kernels a sentence contains, the more complex it is. And what is even more important for the communicator, Coleman and Miller's experiments proved that passages with few kernels (i.e., short sentences) are more easily understood by the reader. Again, because the few-kerneled sentences are less complex, the reader does not have to work so hard to unravel their meaning.

SENTENCE LENGTH

Sentence length is a basic measure of complexity in a piece of writing. At least this is the view of George Klare and other longtime professionals in the study of readability. And all the practical tests of readability so far devised – notably Flesch's Reading Ease Formula, Gunning's Fog Index, and the Dale-Chall Formula – embody sentence length as a factor.

But it is not length per se that causes difficulty, for as we've just seen, a simply worded sentence of 22 words can engender as much reader pain as a rambling sentence of 42 words. Rather, it's the number of relationships in the sentence that causes the trouble. For this reason, we cannot say that a 30-word sentence is always twice as hard to understand as a 15-word sentence. We can say, however, that since relationships depend on words, long sentences are usually harder to understand simply because they contain more words. Further, we can indict long sentences because they strain the reader's memory span – his ability to recall material correctly after reading it once.

Thus, the writing of informative sentences requires much skill on the part of the technical writer. In fact, it demands much more from you than most people realize. Not only must you give the reader the facts he needs, but you must also put it into chunks small enough for him to digest. Yours, then, is a job of constant adjustment: adjusting your technical material to sentence lengths the reader can understand. And you must do this more or less instinctively, on the basis of what you know about the reader and the complexity of the subject matter.

How long should sentences be? The experts say that no one can put a ceiling on sentence length. They also say

that sentences don't have to be of a uniform length. They advise you to adopt the standard of *average* sentence length. That is, some sentences will be very long, some short; but *on the average they should be short.*

Rudolf Flesch in THE ART OF PLAIN TALK and Kenneth Houp and Thomas Pearsall in REPORTING TECHNICAL INFORMATION are quite specific in relating number of sentence words to ease of understanding. Here is Flesch's correlation of number and difficulty:

Number of Words	Reading Ease
8 words or less	Very Easy
11	Easy
14	Fairly Easy
17	Standard
21	Fairly Difficult
25	Difficult
29 words or more	Very Difficult

To summarize Flesch's findings, he says that an average length of 17 words makes for good readability. Houp and Pearsall, on the other hand, suggest a 21-word average as a good target to aim for.

Reducing sentence length doesn't mean you'll confine your presentation to simple sentences. No, you'll still balance and mix simple sentences with compound and complex, though the proportion of simple sentences will doubtless increase. What you will do, however, is reduce the *number* of subordinate clauses, phrases, and other modifiers in each sentence.

To illustrate how our documentation would shape up against the Flesch and Houp-Pearsall measures, let's analyze some passages chosen at random. Here are the paragraphs; the analyses follow.

1. "These procedures might include, but are not limited to, relationships between transactions and data bases, and responsibilities of the users and data base personnel. In order to fully accomplish all the tasks

assigned to him and his staff, the Data Base Administrator should schedule time when the data base is not available to users in order to perform reorganization procedures (such as reassigning areas to different devices/media), FAILSAFE procedures, and other "house-cleaning" chores. This time is in addition to the normal preventive maintenance time for the computer system as a whole, and the users must be made aware of these activities. Likewise, users who merely want to retrieve information from the data base should know when this information is being updated by other users so that fresh copies of data are always available." (Average sentence length = 33 words)

2. "Any format conversions and I/O control routines not needed in the resident section but required by overlay sections must be forcibly loaded into the resident section. This can be done by declaring the appropriate globals in an assembly language routine or inserting dummy FORMAT and Input/Output statements in the resident main program for all those routines needed in the overlays and not required in the resident section. See Section 9.10 for further details." (Average Sentence Length = 26 words)
3. "The entry existence indicator is set nonzero when a buffer entry is made. When a requester has removed or processed an entry, it must clear its existence indicator in order to free the buffer entry position. Entries are made in a circular fashion, starting at the top (low address) filling in order of increasing memory addresses to the bottom (high address) and wrapping around from bottom to top. If input data occurs in a burst sufficient to overrun the buffer, data is discarded and a count of data overruns is incremented. The nonzero entry existence indicator also serves as an overrun indicator. A positive value (+1) indicates no overruns between entries, and a negative value is the two's complement of the number of times data has been discarded between entries.

Word zero of the buffer is used by the handler task as a pointer into the buffer where the next set of interrupt information is to be entered. It is expected that the connected task maintains a pointer to that location in the buffer where it is to next retrieve contact interrupt data. When a task is triggered by the handler, it should process data in the buffer starting at the location indicated by its pointer and continuing in a circular fashion until the two pointers are equal. Equality of pointers means that the connected task has retrieved all the contact interrupt information that the handler has entered into the buffer. The pointer maintained by the handler is to be thought of as a FORTRAN index into the buffer, i.e., the first location of the buffer is associated to the number (index) 1. The second location associated to the module number indicates a module on which a change of state in the direction of interest has been recognized for one or more discrete points." (Average sentence length = 25 words.)

4. "The detection of any card reader error condition in Batch signifies a 'Device not Ready' state which elicits a AØØ2 message and disables the reader interrupt. If the operator issues a CONTINUE command to resume processing, the error processor will recall the Transfer routine to repeat the read and exit to await the next interrupt. The operator is given the opportunity to correct the error before entering the CONTINUE command. The card using the error should be replaced and the replacement card should be the first card read when processing resumes. An exception to this procedure occurs whenever the A37Ø diagnostic message is printed. In this case, the last card from the output side should *not* be replaced in the input hopper for it has already been read." (Average Sentence Length = 21 words)
5. "Three indirect command files for system generation are provided in RSX-11D. Either 32KGEN.CMD or 44KGEN.CMD can be

used to define the system to Phase 1 instead of typing directives in response to Phase 1 requests. SYSBLD.CMD is always used to perform Phase 2. If the user wishes to tailor the system to a particular installation, he can either edit the existing files or create new ones." (Average Sentence Length = 14 words)

Flesch's formula would give a high readability rating only to Paragraph 5; Houp and Pearsall would find only Paragraphs 4 and 5 acceptable. For a quick comparison of the paragraphs, see the data listed below.

Paragraph	Average Sentence Length	Flesch Rating	Houp-Pearsall Acceptance
1	33 words	Very Difficult	No
2	26 words	Difficult	No
3	25 words	Difficult	No
4	21 words	Fairly Difficult	Yes
5	14 words	Fairly Easy	Yes

SOME SUGGESTIONS FOR REDUCING COMPLEXITY

Complex writing can hardly be called good informative writing because it makes the reader work too hard for his information. So anything you can do to reduce complexity is a step in the right direction. With that thought in mind, here are a few suggestions to help cure this major ill of sentence complexity.

1. Use this as a guiding principle: No reader should ever have to analyze one of your sentences in order to understand it.
2. When you have to write a long sentence, put the predicate close to the subject.
3. Break compound sentences in two once in awhile. And then begin the second sentence with *and*, *but*, or *for*.
4. See if you can use a period where you'd be inclined to use a comma or a *which*.
5. Count the words in any long sentence. If there are more than 21, consider revising it.

6. Use balanced, or parallel, phrasing to make long sentences more understandable. Consider that this 73-word sentence from Lincoln's Second Inaugural Address is understandable because of its balance or symmetry:

   "With malice toward none, with charity for all, with firmness in the right, as God gives us to see the right, let us strive on to finish the work we are in, to bind up the nation's wounds, to care for him who shall have borne the battle, and for his widow and orphan – to do all which may achieve and cherish a just and lasting peace among ourselves and with all nations."

   (The balance in that sentence is seen in the three phrases starting with the preposition *with* and the three infinitive phrases: to bind up . . . to care . . . to do.)

7. Imitate the natural structure of speech. One result is that your subjects and verbs will be close together.
8. Constantly ask yourself this question when you revise: Can I write this sentence more briefly and clearly?
9. Be encouraged by Robert Gunning's observation: "Nearly any subject can be discussed in prose that does not go beyond mid-high-school level in complexity."

CHAPTER 7
CURING THE FOURTH MAJOR ILL: OVERUSE OF THE PASSIVE VOICE

Many experts on writing aim their heaviest verbal artillery at the use of the passive voice. Morris Freedman, for example, calls it the "deadly passive" and labels it Sin Number 6 in his famous article "Seven Sins of Technical Writing." He asserts that it makes "any reading matter more difficult to understand, to get through, and to retain." In a similar vein, Herman Struck, writing in the SCIENTIFIC MONTHLY, advises: ". . . A writer might well consider every passive sick until he proves it healthy."

This chapter also takes issue with the passive voice. But, as the title clearly indicates, "overuse," not use, is the ill that needs treatment. In other words, we do not condemn the passive voice per se. It can and should be used to good effect in technical writing – where the emphasis is more often on the thing rather than on the person. What we do condemn, however, is the technical writer's needlessly heavy dependence on it. This, we submit, is what helps give technical writing the deadliness that Freedman detects: a lack of emphasis, vitality, and motion.

This chapter discusses (1) identification of the passive voice, (2) the case against the passive, (3) the case for the passive, (4) the passive in literature and in technical writing, and (5) suggestions on how to shift from the passive to the active. And as was the case in the preceding chapters, examples to illustrate the principles in the text are taken from DEC software documentation.

RECOGNIZING THE PASSIVE

In grammar the term *voice* refers to the way the subject is related to the action expressed by the verb. If the subject is the doer of the action, then the verb is in the

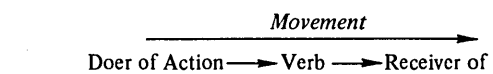
active voice. On the other hand, if the subject is the receiver of the action, the verb is in the passive voice.

A sentence with its verb in the active voice usually has an object as well as a subject. The object is always the receiver of the action expressed by the verb. The verbs in the following sentences are in the active voice. Notice that the subject is enclosed in a [rectangle], the active verb is underlined once and the object twice.

1. [John] hit the ball.
2. The first five [instructions] initialize the loop.
3. Output [devices] record the results of computer operations.
4. The arithmetic [unit] of a digital computer performs the actual work of computation and calculation.
5. [You] verify the contents of memory with the EXAM switch.

Here is a summary of the outstanding features of the active voice:

1. The subject (John, instructions, devices, unit, you) performs the action expressed by the verb.
2. The line of action in the sentence is direct. That is, the subject does the verb's action on the object; and movement goes forward from the beginning of the sentence to the end.



3. The forward movement in the sentence is similar to that in thought or in actuality. (This is what gives the active voice its naturalness and force.)
4. Since the subject spot is the emphatic spot, emphasis in the active sentence is on the doer of the action.

The word *passive* comes from the Latin *passivus*, which means *suffer*. So in the passive sentence the subject is the sufferer, or the receiver, of the action. If you want to include the doer of the action (the person or thing that inflicts the suffering) you must put it after the verb in a phrase starting with the preposition *by*. Thus, the underlined verbs in the following sentences are in the passive voice:

1. John was hit by the ball.
2. The loop is initialized by the first five instructions.
3. The results of computer operations are recorded by output devices.
4. The actual work of computation and calculation is performed by the arithmetic unit of a digital computer.
5. The contents of memory are verified by the EXAM switch.

Here is a summary of the important points about the passive voice.

1. The subject of the verb in the passive voice is the receiver of the action. In the preceding sentences, for instance, the following are receivers of the action: John, loop, results, work, and contents.
2. The passive verb always has two parts: (a) some form of the verb *be* (e.g., is, am, are, was, were, has been, have been, had been, etc.) and (b) the past participle of another verb. Usually the past participle ends in -ed, as is the case in sentences 2, 3, 4, and 5. Sometimes, however, it doesn't end in -ed, as in Sentence 1.
3. The line of action in the passive sentence is backward, the reverse of what it is in thought or actuality. (This is why readers find passive sentences more difficult to understand than active sentences: they must search out the doer of the action.)

4. Since the subject spot is the emphatic spot, emphasis in passive sentences is on the receiver of the action.

THE CASE AGAINST THE PASSIVE

The experts indict the passive voice on the following eight counts.

Weakness – Robert Gunning and Thomas Johnson use such words as *inert, motionless, inactive,* and *dull* to describe verbs in the passive voice. And when you consider the role of the verb in the sentence, you can readily see their point. The verb is usually thought of as the power house of the sentence, the focus of action, energy, vitality, and movement. So widespread is this thinking that to speak of a *passive* verb sounds like a conflict of terms. In fact, most people, if given the word *verb* in a free association test, would doubtless respond with action words like *run* or *push* or *climb* or *attack*. Rarely would anyone come up with one of the pallid passives that abound in technical writing:

is accomplished	is designated	is observed
is achieved	is established	is performed
is allowed	is effected	is permitted
is arranged	is employed	is provided
is assigned	is enabled	is required
is attained	is facilitated	is specified
is based	is featured	is used
is considered	is involved	is utilized
is defined	is made	

So the first point in the case against the passive is that it usually weakens the force, or impact, of the sentence. And you can sense the general truth of this contention by observing the feebleness of the passive in these sentences:

1. No moss is gathered by a rolling stone.
2. Early in the morning a utility pole was crashed into by a speeding car.
3. Except where specified, each line typed by the user must be entered to the computer by typing the RETURN key. (DEC manual)
4. The worm is caught by the early bird.

5. The international dateline was crossed by the airplane.
6. This was immediately realized by me.

Complexity – A second point is that the passive is harder to understand than the active. The reader feels that the passive sentence is unnatural. Its subject is the receiver of the action, rather than the doer. And this, says researcher Alvin Granowsky, disconcerts the reader because he expects the subject to be the doer. Thus with the passive he has to keep track of the doer – a chore the active does not impose. To all this, Dan Slobin, writing in the JOURNAL OF VERBAL LEARNING AND VERBAL BEHAVIOR in 1966, adds: the negative passive is even more complex than the positive. Slobin tested subjects who ranged in age from 6 to 20. All of them found the negative passive the hardest of all sentences to understand.

Concealment – Experts find the passive defective because it often fails to identify the doer. Some critics call this the case of the lost subject or the missing agent. It would be amusing if the failure did not sometimes have serious consequences:

> All doors in this building must be locked before you leave work for the day.

Who's going to lock them? Chances are that no one will, because the directive does not specify the doer. At other times, the missing agent poses no serious problem.

> "Once these statements are mastered, the user can investigate the more advanced applications of these statements and the additional statements and features explained in Parts II and III." (DEC manual)

In this instance the reader can leap without strain to the conclusion that the user is the doer. But why not make the doer explicit and thus remove all uncertainty?

> After mastering these statements, the user can investigate the more advanced applications of these statements and the additional statements and features explained in Parts II and III.

Misconstruction – The passive increases the likelihood of grammatical errors. This is especially so in the case of dangling modifiers. A modifier is said to dangle when, logically, it has nothing in the sentence to modify. For example, the underlined modifiers in the following sentences are dangling:

1. In *packing* the car, his typewriter was overlooked.

   (Typewriter is packing the car? Yet typewriter is the only word that *packing* can modify. To correct the sentence, change the verb to the active voice and put the logical doer in the subject spot: In packing the car, we overlooked his typewriter.)

2. To *examine* the television set, the plug should be removed.

   (Plug is going to examine the television set? But *plug* is the only word that *to examine* can modify. Again, part of the correction of this fault is to put the logical doer into the subject spot: To examine the television set, you should remove the plug.)

3. *Flying* his helicopter close to the ground, the two-year-old wanderer was spotted in the woods.

   (A two-year-old wanderer is flying? Once again we have a dangling modifier: *Flying* has nothing but wanderer to modify. And as before, we can correct the sentence by (1) putting the verb in the active voice and (2) inserting a logical doer in the subject spot: Flying his helicopter close to the ground, the pilot spotted the two-year-old wanderer in the woods.)

In most cases the danglers aren't really misread. People smile at them and then quickly apply their own logic to extract the right meaning. However, when a passage contains a lot of them, the reader has to slow his pace needlessly. Consequently, he could become bored with the book and put it aside. And there is always the possibility that a dangling modifier may convey erroneous – perhaps disastrous – information.

Our documentation, with its emphasis on the use of the passive voice, contains many danglers. Here are a few examples:

1. "By *dividing* the DBS files into pages, and *storing* selected records on these pages, and *using* a page as the basic I/O buffer size, DBCS operations that affect the records on only one page can be handled with a single disk access."

   (DBCS operations is dividing, storing, and using?)

2. "*To clarify* this, the concept of public disks and private disks must be explained."

   (The concept is clarifying this? If so, why must it be explained?)

3. "In describing each of these statements, a line number is assumed and brackets are used to denote a general type."

   (Line numbers and brackets are describing the statements?)

4. "*To indicate* that a statement is to be continued, the line is terminated with the LINE FEED key instead of the RETURN key."

   (The line is doing the indicating? Why not the user?)

5. "This statement is used when *writing* a program to process data to be supplied while the program is running."

   (Who is writing a program? Not statement.)

6. "Before *considering* data access, several aspects of data organization should be discussed."

   (Aspects are considering?)

7. "CTRL/C is typed by *holding* down the CTRL key while *typing* the C key."

   (We have two danglers and a verb – but no doer. When actions occur without an actor,

the whole scene seems as eerie as the movement of the keys on a player piano.)

Another grammatical confusion connected with the passive is the misreading caused by the pronoun *it*. One example from our documentation will illustrate the point.

> "The GOTO statement is used when *it* is desired to unconditionally transfer to some line other than the next sequential line in the program."
>
> (Not until the reader gets to the word *to* does he realize that *it* does not refer to GOTO statement. Frequent occurrences of the passive with *it* as the subject throws the reader off stride. This is especially so when the structure appears deep in the sentence, as it does in this example. For the more words that *it* can refer to, the greater the effort the reader must expend to extract the meaning.)

Wastefulness – Some critics fault the passive because it requires more words. Houp and Pearsall, for example, state flatly that the passive is uneconomical because it costs more to print more words.

Let's apply the principle of economy to some sentences in our own documentation. Each sentence is shown as it appears in the manual. The revision follows it. And finally, there appears a statement of the saving in words gained by the revision.

1. (Original) "A READ statement is used to assign to the listed variables those values which are obtained from a DATA statement." (20 words)

   (Revision) A READ statement assigns to listed variables the values obtained from a DATA statement. (14 words)

   (Saving) From 20 words to 14: A saving of 6 words.

2. (Original) "The value assigned to a variable does not change until the next time a LET,

INPUT or READ statement is encountered that contains a new value for that variable or when the variable is incremented by a FOR statement." (39 words)

(Revision) The value assigned to a variable does not change until another LET, INPUT, or READ statement assigns a new value to that variable or until a FOR statement increments the variable. (31 words)

(Saving) From 39 words to 31: A saving of 8 words.

3. (Original) "TABS, like spaces, are used to make a program easy to read." (12 words)

   (Revision) TABS, like spaces, make a program easy to read. (9 words)

   (Saving) From 12 words to 9: A saving of 3 words.

4. (Original) "An expression is a group of symbols which can be evaluated by BASIC." (13 words)

   (Revision) An expression is a group of symbols BASIC can evaluate. (10 words)

   (Saving) From 13 words to 10: A saving of 3 words.

5. (Original) "The exclamation mark is normally used to terminate the executable part of a line and begin the comment part of a line." (22 words)

   (Revision) The exclamation mark normally terminates the executable part of a line and begins the comment part. (16 words)

   (Saving) From 22 words to 16: A saving of 6 words.

6. (Original) "If the relationship is found false, then control is transferred to the statement following the IF statement (the next sequentially numbered line)." (22 words)

   (Revision) If the relationship is false, then control transfers to the statement following

the IF statement (the next sequentially numbered line). (20 words)

(Saving) From 22 to 20 words: A saving of 2 words.

7. (Original) "The COS-300 2780 Remote Data Communications Package (RDCP) is designed to provide remote users of IBM 360 and 370 systems with both on-site processing and remote job entry (RJE) compatible with the IBM 2780 Data Transmission Terminal Model 1." (39 words)

   (Revision) The COS-300 2780 Remote Data Communications Package (RDCP) provides remote users of IBM 360 and 370 systems with both on-site processing and remote job entry (RJE) compatible with the IBM 2780 Data Transmission Terminal Model 1. (36 words)

   (Saving) From 39 words to 36: A saving of 3 words.

Wordiness – Both Freedman and Thomas Johnson say that the passive voice and awkward wordy constructions seem to go together. For example, the passive verb *is assumed* usually calls for *on the part of*. Too, the passive *is questioned* drags the lengthy *as to whether* along with it. Finally, as we have seen in the examples in the section on "Wastefulness," the passive *is used* and the infinitive invariably in its wake add up to four words that can easily be reduced to one. (Notice that the extra words the passive draws into the sentence are idle as far as meaning goes and serve only to obscure the words that do the work.) The net result of the passive and its wordy accompaniment is an unemphatic, verbose style.

Some examples of that kind of style appear below.

1. (Original) "Debugging of the program can be achieved *through the use of* DDT."

   (Revision) The user can debug his program with DDT.

2. (Original) "The user is advised that the following hardware is required *in order to* run this software."

   (Revision) The user needs the following hardware to run this software.

3. (Original) "A working knowledge of COBOL is assumed *on the part of* the programmer who wants to understand this manual."

   (Revision) The programmer must know COBOL to understand this manual.

Deemphasis – The passive helps to bury the action of the real verb in the sentence. Not all passives do this, but the pallid passives listed under "Weakness" certainly have this as a built-in fault. Again, we turn to our documentation for sentences to highlight this fault.

1. (Original) "It can be used to synchronize the central processor to external events, count external events, or measure intervals of time between events. It can be used to start an analog to digital converter with the firing of a Schmitt trigger."

   (The real verbs in this passage are *synchronize, count, measure*, and *start*. The revision below eliminates the passive verbs and elevates the action words from their gramatically inferior position as infinitives.

   (Revision) It can synchronize the central processor to external events, count external events, or measure intervals of time between events. It can also start an analog to digital converter with the firing of a Schmitt trigger.

2. (Original) "It is commonly required to retain the final data in a readily accessible medium . . ."

   (The real verb in this sentence is *retain*. The revision promotes it from its infinitive status and thus puts the action in the verb spot where it belongs.)

(Revision) The user should retain the final data in a readily accessible medium . . .

Abstractness – Finally, the experts say that passive verbs attract abstract nouns. Thus, in the final analysis, the passive and the abstract work together to deprive the reader of the meaning he looks for in the passage.

In the following examples, you can see how the passive allies itself with abstract nouns.

1. (Original) "The practice of documenting software is disliked by many programmers."

   (Passive verb: *is disliked*. Abstract noun: *Practice*)

   (Revision) Many programmers don't like to document software.

2. (Original) "The capability of the system to be used for solving laboratory problems is stressed in this manual."

   (Passive verb: *is stressed*. Abstract noun: *capability*.)

   (Revision) This manual stresses the use of the system for solving laboratory problems.

3. (Original) "The chief measure of the software's success is indicated by the absence of SPR's in the last three months."

   (Passive verb: *is indicated*. Abstract noun: *measure*.)

   (Revision) The absence of SPR's in the last three months proves that the software is successful.

THE CASE FOR THE PASSIVE

Despite what some experts seem to imply, the active voice is not always more effective. There are many occasions when the passive is much the better choice.

Of course the decision in regard to use rests with the writer. And it depends on what you want to emphasize.

If you want to stress the receiver and take the emphasis off the actor, then you should turn to the passive. Too, if the doer of the action is unknown or unimportant, you should use the passive. The following sentences, for example, are more effective in the passive.

1. The data center was wrecked by vandals last week.

   (Comment: Emphasis is on the receiver of the action.)

2. Abraham Lincoln was defeated for the U.S. Senate by Stephen A. Douglas.

   (Comment: Emphasis is on the receiver. However, in a paragraph about Douglas, we would use the active voice and make Stephen A. Douglas the subject.)

3. The twelve bits of the accumulator are numbered 0 to 11.

   (Comment: Doer is unimportant.)

4. The input and output units are combined in Figure 2-1 because in many cases the same device acts as both an input and an output unit.

   (Comment: Emphasis is on the receiver; doer is unimportant.)

5. Winter wheat is harvested in Saskatchewan.

   (Comment: Doer is unimportant.)

6. The airplane was loaded in Saigon yesterday morning.

   (Comment: Doer is unknown, very likely unimportant.)

7. The first instruction of the subroutine is put in the second location of the subroutine.

   (Comment: Doer is unimportant.)

8. Rubouts are not stored in the text buffer but are inserted by the Editor following all tab characters on the output tape.

   (Comment: Emphasis is on the receiver.)

9. A validation error is flagged when the information written is not the same as the information read in.

   (Comment: Doer is unimportant.)

THE PASSIVE IN LITERATURE AND TECHNICAL WRITING

Thomas Johnson in his book ANALYTICAL WRITING says that active verbs predominate in good literature. In Lincoln's "Gettysburg Address," he points out, only 3 verbs out of the 30 are passive. In Hamlet's "To be, or not to be" there are only 2 passive verbs out of 25. And in the Twenty-third Psalm (King James Version) not one of the 15 verbs is passive.

Quite in contrast to these figures are the proportions in technical writing.

Three pages in DEC software manuals sampled at random show the following breakdown:

Manual	Page	Verbs	Passive
BASIC-PLUS (Sept 1974)	2-3	21	10
DECsystem-10 BASIC	3-1	21	10
RSTS/E SYS. MANAGER'S GUIDE	3-74	29	13

To show how indiscriminate use of the passive results in unnatural prose, Johnson "passivized" the Twenty-third Psalm. To be sure few people would ever write some of the sentences he produced, but the passage can serve as an extreme to remember when you monitor your own writing.

> The Lord is designated as my shepherd; nothing shall be wanted by me.
>
> I am made by him to lie down in green pastures;
> I am led by him beside the still waters.

My soul is restored by him; I am led in the paths of righteousness for his name's sake.

Yea, though the valley of the shadow of death is walked through by me, no evil will be feared by me; for I am accompanied by thee; I will be comforted by thy rod and thy staff.

A table is prepared by thee in the presence of my enemies; my head is anointed with oil by thee; my cup is made to run over.

Surely I will be followed by goodness and mercy all the days of my life; and the house of the Lord will be dwelled in by me forever.

SHIFTING FROM THE PASSIVE TO THE ACTIVE

"Shifting to the active from the passive automatically improves a writer's style." This is the view of authors Menzel, Jones, and Boyd in their book WRITING A TECHNICAL PAPER. But don't interpret this quotation to mean improvement comes when *all* passive verbs are changed to the active. The passive, we repeat, has a place in technical writing, where the doer is often unimportant. Thus, you should accept the statement by Menzel and his colleagues as merely a guide to improvement. Don't try to eliminate the passive; strive rather to curb its overuse. Improvement in communication comes when all *needless* passives are changed to the active.

Here are some specific suggestions for shifting from the passive to the active:

1. When revising, ask of each sentence "Where's the action?" If the verb in the sentence is one of pallid passives listed in the section on "Weakness," you know the action isn't in the verb. Look for an active verb to substitute for the pallid passive.

2. In trying to find an active substitute for the passive, look for an infinitive right after the passive verb. Change the infinitive to an active verb.

   This is what we did to the following sentence in the section on "Wastefulness."

(Original) A READ statement is used to assign to the listed variables those values which are obtained from a DATA statement. (Infinitive is underlined.)

(Revision) A READ statement assigns to the listed variables the values obtained from a DATA statement. (Active verb is underlined.)

3. Or you may locate the active verb in a noun made from a verb:

   (Original) When this option is assembled in the module, GTRCAL and DISSKP are used in combination to determine what is to be done to the display file. (Noun made from verb is underlined.)

   (Revision) When this option is assembled in the module, GTRCAL and DISSKP combine to determine what is to be done to the display file. (Active verb is underlined.)

4. Watch the proportion of passive verbs in your writing. Robert Gunning says that the proper balance for effective communication is one passive to every 9 active verbs. This seems rather lopsided for technical writing – where 3 to 9 throughout a manual would appear more reasonable.

CHAPTER 8
CURING THE FIFTH MAJOR ILL: FAST PACING AND DENSITY

The scene is the corner of Boylston and Tremont Streets in Boston. A new visitor to the city stands before the entrance to the MBTA subway. He wants to go to Copley Square to get a close-up view of the architecture of Trinity Church, the Boston Public Library, and the Old South Church. Above the entrance to the subway he sees a solitary sign:

INBOUND TRAINS ONLY

From his position, he can see another subway entrance across the street. This one is likewise labeled with a single sign:

OUTBOUND TRAINS ONLY

Which way to Copley Square? Is Copley "in" or "out"? The signs fail to enlighten him. To answer the question he must either ask one of the Bostonians whizzing past him or descend the 50-odd steps into the subway to ask the person in the change booth.

These two signs are examples of what is called *fast pacing* in writing – reliance on a few words to convey a lot of meaning. Fast-paced writing is terse, compressed, and compact.

But no matter how it is described, it can always be identified by a sometimes disturbing characteristic: it leaves much information unsaid. Thus, in assuming a large background of knowledge on the part of the reader, such writing often leaves him more baffled than informed – with more questions than the text can answer. Look, for instance, at what the sign INBOUND TRAINS ONLY does not say:

It does not tell the new visitor that this entrance leads to cars marked "Park Street" and "Lechmere"; or that "Park Street" cars go just one stop (to Park Street) and then he'll have to get off; or that "Lechmere" cars go to Park Street and beyond – to Government Center, Haymarket and Lechmere; or that he can alight at Government Center and make connections with rapid-transit cars to East Boston; or that he should take the entrance across the street to get to Copley Square.

All this information is implied in that one sign. But there is no way this reader can know any of it – let alone all of it. Without someone to supply such details, he is lost, immobilized, unable for a time to proceed any further.

Many times the fast pacing of technical writing does the same thing to the reader. For example, look at the three instructions given below. They are taken from a DEC software manual for relatively new users.

1. Turn the Teletype control to LOCAL (see Figure C-1).
2. Feed the blank tape into the punch.
3. Depress the LOCK "ON" control.

Step 2 is akin to INBOUND TRAINS ONLY. It doesn't tell the reader (1) how to start feeding the tape and (2) how to verify that he has fed it correctly. If someone should say that the reader of this manual should know these things, then the obvious question arises: Why is there an illustration to help him with steps 1 and 3 but nothing to help him with the seemingly more difficult second step? The existence of the figure indicating the controls shows that the writer considers the reader to be without experience. On the other hand, the terseness of Step 2 assumes that the reader does indeed have experience. The confusion of such fast pacing in technical writing could leave the reader as frustrated and immobile as the visitor in Boston reading INBOUND TRAINS ONLY for the first time.

From another point of view, fast pacing refers to writing that packs a lot of technical data into few words. Seen on this level, fast pacing is called *density*.

This chapter takes a close look at density in technical writing: at what it is, at the various forms it takes, at its effects, and at the ways it can be cured.

WHAT IS DENSITY?

Density is the bunching together of technical details so closely that the reader cannot read them at his normal reading rate. The writer makes little attempt to articulate the details; he merely lays them down side by side. The impression on the reader is that he is being fed too rich a diet of technical information.

The common forms of density in technical writing are (1) adjective strings, (2) stuffed paragraphs, (3) unexplained series, and (4) lumpy paragraphs.

Adjective Strings

In this form there is a high concentration of technical terms in front of a noun. The terms are either normal adjectives or adjectives made from nouns. Two examples from DEC software manuals appear below:

1. "The AFC11 is a flexible, high performance, multi-channel analog to digital (A/D) converter."

   (Comment) Here *flexible, high performance, multi-channel,* and *analog to digital* are all adjectives qualifying converter. They compress a wealth of technical data into a small space. For example, take *flexible* and *high performance*. A paragraph or two could be written on each one. But as they now stand, the writer hasn't bothered to define and analyze them for the reader. They are merely part of a cluster of details before a noun. And the reader is left with the job of interpreting them.

2. "Because of the interactive, conversational, rapid-response nature of timesharing, a wide range of tasks – from solving simple mathematical problems to implementing complete and complex information gathering and processing networks – can be performed by the user."

(Comment) This sentence contains two instances of piling up. What heightens the pain of the first one is that the adjectives are piled up before an *abstract* noun. Even so, the second one is more burdensome to the reader because there is a very real question as to the meaning of "implementing complete and complex information gathering and processing networks." If the reader expects to learn something from this sentence, he'll be disappointed.

Happily, this kind of density is fast disappearing from DEC software documentation.

Stuffed Paragraphs

In this kind of density the paragraph is packed to the bursting point with technical details. For the most part, they are unanalyzed and unconnected. One thing all such paragraphs have in common is: They cannot be read and digested at a normal reading speed. Rather, they have to be poured over laboriously, at pretty much the speed used to decipher code or to locate an item in a catalog of television parts.

Here are four stuffed paragraphs from our software manuals:

1. "The DC71 remote batch station consists of a PDP-8/I processor, an operator Teleypte, a card reader, a line printer, and a synchronous interface. The DC71 connects to the DS10 or the DC75 via a full-duplex synchronous communications link. The remote batch terminal can be either a DC71A or DC71B terminal. The DC71A is configured with a 132-column line printer with a 64-character set. The DC71B is configured with a 96-character set line printer. The DC71D Teletype Concentrator package includes eight lines for connecting to the DC71A or DC71B. Another eight lines can be added by connecting the DC71E to the DC71D. Terminals can be Teletypes, VT06

or VT05 display terminals, or other Teletype-compatible terminal interfaces, at speeds up to 2400 baud.[1]"

(Comment) Perhaps the facts in this paragraph would look better in a vertical list – because that is exactly what the paragraph is: A list of very thinly related technical facts. A long sequence of such paragraphs would be deadening to the reader. Inevitably, they would cause the breakdown of communication.

The writer should do two things. First, he should ask whether all these technical facts are necessary. That is, does the reader of this manual need to know them all? If the answer is yes, then he should break up the paragraph into at least three smaller ones. Thus, he could consider the remote batch terminal, the line printer, and the other terminals as topics for separate paragraphs.

2. "Single (DDI) or dual (DSP, DOV) displays are provided along with a set of display control commands. Two small vertical lines known as fixed cursors (DCU) and two bright crosses known as free cursors (DFR) can be displayed. Through these free cursors, it is possible to draw a straight line (DLI), which in most cases represents a base line. The display may also be expanded (DEX) from the data that is between the two fixed cursors. The total number of data points that are displayed may be increased (DIN), decreased (DDE), raised (DRA), or lowered (DLO), by a factor of two. The number of data points may also be changed to some arbitrary value (DPO) and viewed via a window (DWI). The table delta (DTA), used in selecting data points for display, can be varied. The ability to define the zero-data position of a display (BDD), and show the data expanded to the scope limits (DNO) is provided. The buffer identification name (DID), in conjunction with the free (DFV)

[1]Teletype is a registered trademark of the Teletype Corporation.

and fixed (DCV) cursor values, may be displayed. It is essential that a display be active in order that all display control commands work efficiently."

(Comment) What an awesome pile of technical data to squeeze into a single paragraph! Again, this is a mere catalog of details with absolutely no attempt to relate or interpret them. This information would be far more effective in a chart or table. Notice that it is impossible to insert logical connecting words or transitional expressions in a paragraph like this. In fact, the inability to put in such words and expressions is a mark of the stuffed paragraph.

3. "Random access files, unlike sequential access files, do not distinguish between read mode and write mode. The user can read or write any item in a random access file at any time by first setting a pointer to that item. A random access file contains either string data or numeric data, but not both. Each data item in a random access file takes up the same amount of storage space, called a record, on the disk. BASIC must know the record size for the random access file in order to correctly move the pointer for that file from one data item to another. The record size for a random access numeric file is set by BASIC because the storage space required for a number in such a file is always the same. The storage space required for a string, however, is dependent upon the number of characters in the string. Thus, for a random access string file the user must specify the number of characters in the longest string in the file so that BASIC can set the record size accordingly. This specification takes place when the file is assigned to a channel. Refer to the description of the FILES and FILE statements in Section 10.2. When creating a new random access string file, if the user specifies too few characters an error message is issued when a string too long to fit into a record is written. If too

many characters are specified for a record, the strings will always fit, but space will be wasted on the disk. When he is dealing with an existing file, the user does not have to specify a record size. If he does specify a record size for an existing file, the record size must match that with which the file was written."

(Comment) Part of the difficulty with this paragraph is its size (301 words). But the big trouble is that its wealth of technical facts taxes the reader's memory. Too, there, is little unity and practically no coherence.

The writer should try breaking the paragraph into three parts, as the first step in improving it. One paragraph could be devoted to read and write mode, another to records, and the last to strings. In addition, the writer should show explicitly the relationships among the facts so that the reader is helped through the text. That is, the writer should be liberal in the use of connectives and transitional expressions.

4. "Scheduling may be forced before the time slice has expired if the currently running job reaches a point at which it cannot immediately continue. Whenever an operating system routine discovers that it cannot complete a function requested by the job (e.g., it is waiting for I/O to complete or the job needs a device which it currently does not have), it calls the scheduler so that another job can be selected to run. The job that was stopped is then requeued and is scheduled to be run when the function it requested can be completed. For example: when the currently running job begins input from a DECtape, it is placed into the I/O wait queue, and the input is begun. A second job is scheduled to run while the input of the first job proceeds. If the second job then decides to access a DECtape, it is stopped because the DECtape control is busy, and it is placed in the queue for jobs waiting to access the DECtape control. A third job is

set to run. The input operation of the first job finishes, freeing the DECtape control for the second job. The I/O operation of the second job is initiated, and the job is transferred from the device wait queue to the I/O wait queue. The first job is transferred from the I/O wait queue to the highest priority run queue. This permits the first job to preempt the running of the third job. When the time slice of the first job becomes zero, it is moved into the second run queue, and the third job runs again until the second job completes its I/O operations."

(Comment) Once again you're dealing with a paragraph whose length (276 words) adds nothing to the ease of comprehension of the content. And once again, breaking it up is the best way to improve it. Certainly it can, with benefit, be broken in two at the example. Thereafter, the example itself must undergo some drastic ameliorative surgery. For as it now stands the tortuous rigmarole of the example serves more to obscure than to clarify.

Unexplained Series

A series of phrases or clauses bunched together too compactly is another kind of density. Here the writer crowds three or more advantages or functions into one sentence without showing the what or why of them. The reader, in likelihood, will skim through them without grasping their full significance.

Two examples from a DEC software manual highlight this fault.

1. "The Real-Time Clock offers the user of the Lab Peripheral System several methods for accurately measuring and counting intervals or events. It can be used to synchronize the central processor to external events, count external events, measure intervals of time between events, or provide interrupts at programmable intervals. It can also be used to start the analog-to-digital converter by

means of the overflow from the clock counter or by firing a Schmitt trigger. Many of these operations can be performed concurrently."

(Comment) The second sentence about how the real-time clock can be used is too dense and general. The writer should have devoted a sentence or two to each function. (The third sentence should have been expanded in the same way. And all the needless mystery can be swept out of the last sentence by telling which operations can be performed concurrently.)

2. "Lab Applications-11 modules are available to perform operator console interaction, data acquisition, data editing, Fast Fourier transformation, output printing, and displaying. Lab Applications-11 allows many varieties of these functions. The library of modules will be enhanced as time goes on, and as application needs are defined, more and more of the requirements for laboratory computing will be supplied by DIGITAL."

   (Comment) The first two sentences embody a dense, but general, list. If they are intended to inform, they should be explained. If they are not intended to inform, they should be eliminated.

   (At the very least, the writer should expand on the statement about "many variations of these functions." The sentence is opaque as it stands.)

Lumpy Paragraphs

The term "lumpy" is applied to paragraphs containing an uneven distribution of technical detail. Some sentences in a lumpy paragraph are rich in technical content, others contain little or no technical matter. The net result of page after page of such paragraphs is to keep the reader continually off balance.

The following examples from one of our software manuals show that the technical "lump" can appear anywhere in the paragraph.

1. "The 1040 is the smallest of the five systems. The typical configuration of this system has a KA10 central processor, 32 to 64K high-speed ME10 core memories, the RPO2G disk system with up to two disk packs, the TM10G magnetic tape system with up to two drives, and low-speed peripheral equipment including a CR10F card reader, an LP10A line printer, and local DC10 lines. This is an excellent system for the scientific research lab where multiple real-time tasks and general computing are required, and also for small colleges where there is a need for handling administrative, student, and faculty workloads simultaneously. The system is easily expandable with most equipment on the DECsystem-10 Equipment List."

   (Comment) In this instance the lump appears at the beginning. Sentence 2 contains all the technical fare of the paragraph. And, as you can see, the fare is too rich for comfortable digestion. Incidentally, one bad effect of having the knot of technical data appear at the beginning is that it obscures the main idea of the paragraph. (Remember that the beginning is the usual location of the topic sentence in technical writing.)

2. "The 1077 is the dual-processor 1070 with fast execution of computing loads because of the second KI10 central processor. In addition, this system typically has 128K (640K bytes) of core memory, 690K words (4.1 million characters) of RM10G drum storage, a RPO3G disk system with four disk drives for a total of 41.6 million words (249.6 million characters) of storage, a TU40G magnetic tape system with four 120KC drives, a 1000 line-per-minute LP10C line printer, a 1200 character-per-minute CR10E card reader, and a DC10 or DC68A communication system capable of 128 lines. In expanding to the 1077 from a smaller system, the user notices increased computing power, but he does not need to change his

programs or learn a new command language or operating system."

(Comment) In this three-sentence paragraph, the lump is located in the middle – in Sentence 2. And in its effect on communication the lump is truly malignant. Look at its size. It consists of roughly 9 of the 15 lines of the paragraph. And it encompasses some 13 ideas. A sprawling, technically rich knot of varied data, it serves to interrupt the natural flow of ideas from sentence 1 to sentence 3.

3. "The 1055 is the dual processor equivalent of DECsystem-1050 with fast execution of compute-bound jobs because of the addition of the second processor. This system has two parallel KA10 processors connected with one operating system in order to double the computing power of the 1050 and at the same time to maintain the same interface between the user and the computing system. This approach of co-equal processors gives the user increased computing capacity when processing power is in heavy demand under multi-task loads. In addition to the two KA10 processors, the typical 1055 has 80K of ME10 core memories, with one MX10 memory port multiplexer, one RM10G drum system, one RP03G disk system with up to eight disk packs, one TU40G, 120KC magnetic tape system, one CR10 card reader, the LP10C line printer, and 32 local lines, either a DC10 system or a DC68A system."

(Comment) Appearing in this instance at the end, the lump gives the whole paragraph a kind of foot-heavy look. It's like putting size 18 shoes on a person who is five-seven. And setting aside any further comments on appearance, we can say that this lump is as much of a drag on communication as the lumps in Examples 1 and 2.

SUMMARY OF EFFECTS AND REMEDIES

The overall effect of density is to greatly reduce your chance of communicating with the reader. For one thing, a solid chunk of technical matter is likely to repel him because he finds it dull and unnatural. It disrupts his natural reading pace. For another, density interrupts the natural flow of ideas from sentence to sentence and paragraph to paragraph. Thus, he fails to get a sense of movement, or continuity, to carry him through the writing. In a word, he will probably resent dense writing because he had to plow through it. Finally, a dense presentation is hard for him to interpret. Hence, he is likely to go elsewhere for his information. Bearing in mind George Klare's principle of least effort, you know he won't work hard when he learns of an easier way to get the information. This is especially so if he figures that you should have done the interpreting for him.

So in the interest of effective communication, examine your writing for the kinds of density discussed in this chapter. Read any questionable passages aloud to determine whether they sound natural. If they turn out to be technical tongue twisters, think about density. And then set about revising them. Too, revise any passage in which you find it hard to insert connectives and transitional phrases. Such a test should again get you to think density.

Once density is diagnosed, what's the cure? For a start, use the suggestions sprinkled throughout this chapter:

1. Break up dense sentences and paragraphs. One spinoff benefit of such action is that you have to insert words showing relationships. Thus, you will automatically be interpreting for the reader.
2. Eliminate all unnecessary technical matter. Ask yourself: Does my reader need to know this? Consider substituting a familiar word for a technical term whenever possible. (But be cautious here. This advice must be used sparingly and with discretion.)
3. Break up the lumps in lumpy paragraphs. Distribute the technical details among the various sentences.

4. Use at least one sentence to explain each item in a dense series of features, functions, advantages, benefits, etc.
5. Consider using tables and lists instead of paragraphs to present large clumps of technical details.

Perhaps, as part of the cure, you should ponder Thomas Johnson's law of density to see if you can use it as a guiding principle: "A reader's ability to understand a paragraph is inversely proportional to the number of technical terms that are present."

CHAPTER 9
CURING THE SIXTH MAJOR ILL: FOGGY WORDS

"... There's a glory for you!"

"I don't know what you mean by 'glory,' " Alice said.

Humpty Dumpty smiled contemptuously. "Of course you don't – till I tell you. I meant 'there's a nice knockdown argument for you!' "

"But 'glory' doesn't mean 'a nice knock-down argument,' " Alice objected.

"When *I* use a word," Humpty Dumpty said, in rather a scornful tone, "it means just what I choose it to mean – neither more or less."

> (Lewis Carroll: THROUGH THE LOOKING-GLASS, Chapter 6)

Humpty Dumpty is not just a product of Lewis Carroll's lively imagination. He actually exists. In fact, he abounds in the real world of words. He writes syndicated newspaper columns and learned articles for journals and magazines. His papers and reports appear in business and in science, in law and in medicine – indeed in every trade and in every profession. Sometimes he even stoops to teach English at a high school or college. But wherever he is, he always shows himself as the arch-enemy of communication.

This chapter deals with three classes of words the Humpty Dumpty writer uses to hinder communication: (1) jargon, (2) big words, and (3) deadwood.

JARGON

The meaning of the term jargon has changed over the years. So nowadays jargon can be good or bad.

In its good sense, it refers to the specialized technical language of a trade or profession. It is, in effect, a club language. Thus, medicine has a jargon, law has a jargon, baseball has a jargon. And the computer industry has its jargon. Some familiar examples of good computer jargon are *debug, program, loop, core memory, subroutine, bit, block, branch, flag, checksum, software, flowchart,* and *tag*. Being clear and concise in meaning, such words are excellent tools of communication. Writer and reader alike, as long as they belong to the same club, know what the words mean.

However, when such words are used in communication with nonmembers – with readers who are not privy to their specialized meaning – then good jargon becomes bad jargon.

For, in its derogatory sense, jargon refers to terms and expressions that are unclear either (1) because the audience is unfamiliar with them or (2) because writers attach new, private meanings to them. This second category is designed to impress the reader – to make him think the author is smart because he is "in." Such words may once have been the good jargon of a trade or profession. But they have since been robbed of their precise meaning. Now they are used by vague-thinking writers to hide the vagueness of their thinking. Some examples of computer terms now labeled bad jargon appear below:

capability	maximum support
component	operation
compute-bound	optimization
computing power	processing power
concepts	program parameter input
data values	reliability
environment	sophistication
facility	stand-alone system
features	system
high-level language	system resources
high-speed performance	technique
implementation	utilization
installation	

Such words dare the reader to find out what they mean. But worst fault of all, they convey foggy ideas. On this

ground they should be shunned as poor communication tools.

Another example of bad jargon (i.e., foggy words) is the too easily coined -ize words: Certainly we have a huge number of good -ize words: *pasteurize, sterilize, magnetize, oxidize, galvanize, anesthetize, phosphorize,* etc. The bulk of these are precise scientific terms. But in a way that is unfortunate, for it leads readers to believe that the new -ize words – coined willy-nilly – are equally meaningful. Words like *moisturize, parameterize,* and *vietnamize* convey no precise idea at all. Another good example of this kind of jargon is the word *finalize.* It appeared in the following sentence in a recent DEC memo: "We intend to *finalize* the project plan Thursday afternoon." Does this mean

1. They intend to review the plan for the final time?
2. They intend to insert all input from previous reviews?
3. They intend to decide on exactly what will go into the plan and what will be excluded?
4. They intend to have the plan signed by the people who must approve it?
5. They intend to have it typed and ready to submit to the people who must approve it?
6. They intend to submit it for final review by the people who must approve it?

Most of the new -ize words leave the reader in this kind of quandary regarding their meaning. Thus it is that jargon works its harm on communication. Equally bad are the -wise words. Again, the suffix was formerly used with precision – to denote manner, direction, or position. Thus we have serviceable terms like *clockwise, lengthwise, widthwise,* and *counterclockwise.* But largely through the efforts of the commercial writers -wise came to mean *with reference to.* And readers are flooded with the likes of *taxwise, pricewise, performancewise* (which has been applied to everything from the stock market to partners in the sex act), *saleswise, capitalwise, successwise, weatherwise, profitwise, expensewise, loanwise,* and even *bottom-linewise.* The computer industry contributed *programwise, codewise, logicwise, bitwise, operationwise, recordwise, processingwise, jobwise, devicewise,* and *implementationwise.* Given enough time,

we might even come up with *computing-powerwise* or *high-performance-peripheral-systemwise*.

And finally there is a whole host of miscellaneous fog-words we likewise call jargon. For example, what makes *end product* and *end result* any better than *product* and *result*? Only the autocratic say-so of the Humpty Dumpty writer. And the word *objective*? Is it different from *goal*? Hardly. It is just a high-sounding piece of jargon borrowed, perhaps, from the military. But when Humpty Dumpty writes of "achieving our goals and objectives," he gives it a private meaning he doesn't deign to pass on to the reader. And what about the word *area*? Some people write: "He will be working in the networks area." Or, "He will be in charge of all software in the communications area." Do those sentences say anything more than the following?

1. He will be working on networks.
2. He will be in charge of all communications software.

The Humpty Dumpty writer would have you believe they do. But don't be duped. *Area* here is just an empty four-letter word. Humpty Dumpty uses it because he has no interest in communicating.

BIG WORDS

The modern Humpty Dumpty is adept at using big words – those of three syllables or more – to cloud his meaning. And he often uses them to impress the reader, rather than to inform him. Indeed, his motto seems to be: Never use a small word when a big one is at hand.

The danger of big words lies in their many meanings. When readers cannot readily detect the writer's meaning, they are likely to pick a meaning at random. Thus, communication is left largely to chance. And as we said in Chapter 1, if the technical writer does not communicate, he is a failure.

Typical of the big words that tend to mislead are those on this list culled from the first three pages of a DEC software manual. We are not saying they should be eliminated. Rather, we say they can impede communication because they are more likely to be misunderstood than the smaller words you can put in their place.

Big Word	Small Substitute
accordingly	so
accomplishes	gains
activate	begin
advantageous	useful
boundary	limit
capability	power
consequently	so
demonstrate	show
discontinue	stop
employs	uses
encourage	urge
endeavor	try
enhances	improves
environment	setting
facilitate	ease
fluctuate	vary
initial	first
initiate	begin
manipulated	handled
maximum	greatest, highest
numerous	many
modification	change
optimum	best
relinquish	release
requirements	needs
subsequent	later
terminate	end
utilization	use

But combinations of big words create the densest fog of all. Then the reader is hit with clusters of meanings. And there is no telling what message he goes away with. Moreover, combinations of big words usually add up to long sentences. And long sentences, as the experts assert, are the greatest barrier to efficient communication.

Three examples from DEC software documentation show how combinations of big words make the meaning unclear. Too, they show how word bigness and sentence length go hand in hand.

1. (Example) "The KI10 processor provides measures for handling arithmetic overflow and underflow conditions, pushdown list

overflow conditions, and page failure conditions directly by the execution of programmed trap instructions instead of resorting to a program interrupt system." (36 words)

(Comment) *Measures*, three uses of *conditions*, and *resorting to* spread a meaning-concealing haze over the main idea in this sentence.

2. (Example) "With the increased memory size, the high performance peripheral systems, and the large file system, the 1070 is configured for maximum support of remote batch capabilities through the synchronous communication equipment." (31 words)

   (Comment) Again, such mouth-filling terms as *high performance, configured, maximum support,* and *capabilities* serve to hide the writer's thoughts.

3. (Example) "This approach of co-equal processors gives the user increased computing capacity when processing power is in heavy demand under multi-task loads." (21 words)

   (Comment) Although this sentence is shorter, it has more heavy, multi-meaning words than the previous two. *Approach, increased computing capacity, processing power,* and *multi-task loads* protect the writer's meaning from the prying eyes of the reader. And the preposition *under*, though small, does nothing at all for communication in this sentence.

So the advice in regard to vocabulary is to stick to short words whenever they fit. Every time you use a big word you sacrifice some of the meaning in your sentence. As E.B. Coleman and C.R. Miller learned from their research, short words are more efficient in conveying information.

DEADWOOD

Finally, there is a class of foggy words known as deadwood. Because such words add nothing to the

meaning of a passage, they are empty and lifeless. All they do is occupy space – making long sentences still longer and serving mostly to detract from the meaning of other words. A passage loaded with deadwood leaves the reader with the impression that he, like Shakespeare's Hamlet, is reading "words, words, words."

From a narrow point of view, deadwood is the needless repetition of ideas. Usually such repetition occurs because the writer is not paying close attention to what he is saying. He says "green in color," for example, or "four in number." But he knows full well that *green* has to be a color, and *four* can be nothing but a number. Other familiar examples are "round in shape," "the month of February," "five miles in distance," and "the year 1620." Like dead branches on a tree, these repetitions (*in shape, the month of, in distance,* and *the year*) are not essential and must be pruned.

In larger perspective, deadwood refers to (1) long expressions that a single word can replace and (2) single words that add no meaning to a passage. As an example of an overlong expression, consider "by the use of." Three of the words are freeloaders doing absolutely nothing to carry the burden of meaning. Eliminate them and you're left with "by" as the effective substitute for the entire phrase. Similarly, other sentence-lengthening phrases can be reduced to a solitary word:

Deadwood	Single-Word Replacement
at the rate of	at
by means of	by
for a period of	for
for the purpose of	for
in an area where	where
in an effort to	to
in order to	to
in such a manner as to	to
in terms of	in
involves the use of	uses
is designed to be	is
it is clear that	clearly
it is evident that	evidently
with the aid of	with

On the other hand, an excellent example of a single word that often does nothing to further the meaning of a sentence is the word *nature*. It is, for instance, needless in the following context:

> The specifications are highly technical in nature.

Thus, with the deadwood pruned the sentence becomes

> The specifications are highly technical.

Notice that the sentence becomes smaller but the meaning remains unchanged. Invariably, this is what happens when empty words like *nature* are deleted. Similar examples follow:

DEADWOOD: PROPERLY

(Example) "After the group of modifications have been added to the file, RUNOFF produces a new copy of the file which is *properly* paged and formatted."

(Revision) After the group of modifications have been added to the file, RUNOFF produces a new copy of the file which is paged and formatted.

(Comment) Here, we can assume that paging and formatting are going to be done *properly* – especially when we're touting our own software.

DEADWOOD: SUITABLE

(Original) "TECO manipulates data within the editing buffer in response to *suitable* commands from the user."

(Comment) Delete *suitable*. In a manual that describes all TECO commands, the notion of suitability does not have to be spelled out. The reader knows he won't get anywhere with the software unless he uses a *suitable* (i.e., legitimate) command.

(Original) "The listing can be directed to any *suitable* output device: line printer, teletype, DECtape or disk."

(Revision) The listing can be directed to an output device: line printer, teletype, DECtape or disk.

(Comment) Labeling the devices as suitable is needless when they are listed.

DEADWOOD: ASSOCIATED

(Original) "The DECsystem-10 is more than a processor and its *associated* peripheral devices."

(Comment) Delete *associated*. The word *its* shows the connection between processor and peripheral devices.

DEADWOOD: PARTICULAR

(Original) "This software allows him to define the hardware configuration of his *particular* installation."

(Comment) Delete *particular*. As in the preceding example, the possessive (his) serves to designate the installation. *Particular* just repeats – needlessly.

DEADWOOD: EXISTING

(Original) "Existing programs and data files can be modified directly with BASIC instead of with a system editor by adding or deleting lines, by renaming the file or by resequencing the line numbers."

(Comment) Delete *existing*. Since modifying non-existing programs and data files would appear to be an impossibility, the use of *existing* is needless.

However, when there is a kind of contrast between the existing and the nonexisting, the use of the word *existing* is valid. For example, the following usage from the same manual is all right: Commands to LINED allow the user to create a new file or edit an *existing* file.

DEADWOOD: APPROPRIATE

(Original) "This program determines by *appropriate* dialogue with the user who he is, whether or not he is currently authorized to use the system,

and if so, establishes the user's initial profile, informs him of any messages of the day, and reports any errors detected in his disk files."

(Comment) Delete *appropriate.* Of course the dialogue is appropriate – for two reasons. First, the program cannot make an accurate determination unless the dialogue is appropriate. And, secondly, appropriateness is taken for granted – hasn't this software been tested?

DEADWOOD: FACTOR

(Original) "The project plan does not consider the prohibitive cost *factor.*"

(Revision) The project plan does not consider the prohibitive cost.

(Original) "Field data proves conclusively that this monitor has a high reliability *factor.*"

(Revision) Field data proves conclusively that this monitor has high reliability.

DEADWOOD: ACTIVELY

(Original) "For the last two years we have been *actively* supporting two monitors."

(Comment) Delete *actively.* Unless of course we *passively* support other monitors.

DEADWOOD: ACTUAL

(Original) "There are three major components of the computing system: the *actual* machine, or hardware; the operating system, or monitor; and the languages and utilities, or nonresident software."

(Comment) Delete *actual.* Machine and hardware, as everyone knows, exist in the actual world. So the emphasis provided by actual is not needed. Besides, aren't operating system, languages, and utilities also actual? Moreover, nowhere in this sentence is there any contrast with something not actual.

SUMMARY

Words are the basic building blocks of your writing. And how you pick and choose among them determines your success in getting ideas from your head to the reader's. Choose words your reader understands, and you can build a vehicle to carry your ideas to him. Choose jargon, big words, and deadwood, however, and you build a barrier to stop your ideas in their tracks. For nothing can improve a passage whose words do not inform: not unity, not coherence, not the active voice – not any of the principles discussed earlier in this book. So do your reader a favor: pick building blocks that help him understand. Don't be another Humpty Dumpty.

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