Teaching Technical Writing: Graphics

Edited by Dixie Elise Hickman

Anthology No. 5
TEACHING TECHNICAL WRITING: GRAPHICS

Anthology No. 5

This anthology series was established to provide another service for members of the Association of Teachers of Technical Writing. The Association hopes that the series will encourage members to do research and writing that reflect some of the major concerns of the Association—foremost of which is the improvement of the teaching of technical writing.

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FOREWORD

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In technical communication, graphics is more than the decoration for the text, the illustration to add interest; in technical communication, the visual component is the necessary complement to the words, the other half of the message. The graphic synthesizes information, provides an analog representation of the digital code. Of particular importance to technical writers, graphics allows emphasis on simultaneous processes; it is our means of compensating for the linearity inherent in reading: the sequence of words following single-file. With graphics, we can make clear the complex relationships in technical processes.

It follows, then, that graphics must be made an integral part of every technical writing course. However, those of us who habitually focus on words sometimes feel ill-prepared to deal with this half of technical writing. This anthology aims to give a secure introduction to graphics for the teacher new to graphics and to kindle new ideas for the experienced teacher.

The first two articles lay some theoretical foundation for our classroom activities. Lilita Rodman bridges the gap between graphics and linguistic theory with a classification system parallel to one familiar to most communication teachers, Hayakawa's ladder of abstraction. Such a framework gives teachers the necessary perspective to integrate written language and visuals and to plan such assignments independently.

Dennis E. Minor adds to the theoretical framework, presenting terminology for guiding students to understand how graphics function. Understanding the nature of the concept a graphic illustrates then leads to the decision between static and dynamic graphics.
The next four articles focus more on applications. D. C. Andrews places the choice of graphics in the context of the basic communication model: just as audience, material, and purpose influence a writer's choice of words, so do they affect the choice of visuals. Her article then suggests some specific assignments for exploring the impact on graphics of varying these elements.

Elizabeth Tebeaux offers a progression of assignments that help teachers integrate graphics into the course from the beginning. Her specific suggestions are to include graphics in prewriting analyses, to study graphics in published documents, and to plan realistic writing tasks in which graphics will enhance communication.

Sarah K. Burton presents a means for evaluation. Five questions, with examples, guide both teacher and student in assessing the effectiveness of graphs and charts.

L. V. Brillhart demonstrates the value of computer assistance in graphics. Her article provides a user-friendly introduction to computer graphics that should allay the anxiety of the uninitiated.

John Griffing closes the anthology with an annotated bibliography of additional resources he found to be of special help in getting acquainted with graphics.

One aspect of graphics untreated in this anthology is layout. This anthology's layout follows what we know about the visual impact of a text--generous use of white space, figures placed as close to the text they complement as possible, figures to be compared on the same or facing pages. Type size, leading, and line length accord with guidelines from the Document Design Center ("Simply Stated," No. 30, October 1982). Research into details of the matter, such as reader preferences for ragged right margin as compared to justified right and serifed or sans serifed typeface, is as yet inconclusive. On these two points, the anthology follows the editor's preference.
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LEVELS OF ABSTRACTION IN THE GRAPHIC MODE

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INTRODUCTION

In addition to making the decisions required in composing an entirely linguistic discourse, the technical writer must usually also decide which information to present graphically, how to encode it in graphics, and how to integrate the graphic and linguistic components. The technical writing instructor must, of course, provide guidelines for these decisions. However, this task is complicated by the fact that it is difficult to generalize about the graphic mode, and this is, in turn, partly a consequence of "graphics" including such a wide variety of distinct means of visual communication. It seems to me that one useful variable for discussing graphics, and particularly for discussing graphics as elements of discourse, is abstraction. This article suggests a classification scheme for graphics that is based on levels of abstraction and then shows how this scheme can be related to the use of graphics in technical discourse.

LEVELS OF ABSTRACTION

All graphics are obviously abstractions, in much the same sense that all words are abstractions, but the different classes of graphics--such as photographs, line graphs, maps, drawings, and so on--vary both in the specific graphic means used to achieve abstraction and in the degree of abstraction reached. Since there has been considerable theoretical debate about precise definitions of abstraction,¹ it seems prudent to adopt an eclectic stance and to say that even though not all of them will necessarily coincide, there are three general tendencies as graphics become more abstract: a movement from the depiction of the particular to the depiction of the generic, a movement from a
focus on surface characteristics to a focus on structure or organization, and a movement from mimetic to symbolic means of representation. In other words, a graphic that illustrates the particular, portrays the surface, and is essentially mimetic, is also at a low level of abstraction; a graphic that illustrates the generic, portrays structure, and uses symbols, is at a high level of abstraction.

Within these broad guidelines, we can think of there being a continuum of abstraction on which relative levels of abstraction can be plotted. This concept of levels of abstraction for graphics is somewhat analogous to the levels of abstraction in language introduced by Korzybski\(^2\) and later popularized as the ladder of abstraction by Hayakawa.\(^3\) And just as we can make only rather broad distinctions when we speak of abstraction in diction, so also will we have to confine ourselves to only the more obvious differences when we consider graphics.

**A CLASSIFICATION SCHEME**

On the basis of this general understanding of levels of abstraction, I suggest the classification scheme shown below in Figure 1.

![Classification Scheme for Graphics](image)

**Figure 1:** A Classification Scheme for Graphics on the Basis of Subject and the Level of Abstraction

In this scheme, abstraction is to be interpreted as an ordinal variable whose value changes more or less continuously, while the
subject, with its column open, is only a nominal variable. In fact, Figure 1 can be viewed as a conflation of several separate abstraction continua, one for each subject category. Since the subjects themselves vary in abstraction, in that a quantity is more abstract than an object, the corresponding abstraction continua of their graphics also vary somewhat in range, with more abstract subjects confined to relatively more abstract graphics.

Neither the subject categories, nor the classes of graphics are meant to be exhaustive; rather, only those most commonly used by technical writing students are included to illustrate the general principles governing the categorization scheme. Furthermore, the scheme tends to exaggerate the distinctness of subject categories. A building, for example, is certainly an object, and so can be illustrated in a photograph, drawing, or diagram, but it obviously also includes areas, which can be illustrated in floor plans, a particular subclass of maps; its construction is a process, which can be illustrated in flow charts; and so on. Similarly, many special kinds of graphics, such as statistical maps, are hybrids that illustrate more than one subject simultaneously.

McKim and Doblin have also proposed abstraction ladders for graphics, but because these do not capture the dependency of class of graphic on the subject of the graphic, their pedagogic applications to technical writing are somewhat limited.

**ABSTRACTION AND ENCODING**

Figure 1 can first be used to show how levels of abstraction relate to the choice of graphic in a single subject column. The claim is that in encoding a graphic, abstraction is one variable the technical writer should consider. The range of choices is probably widest and certainly most obvious in the abstraction continuum for objects. Photographs, listed at a low level of abstraction, emphasize the particular and the surface, and are mimetic. Drawings are usually at a higher level of abstraction, but within this category there is a range of abstraction from the extremely mimetic drawings, such as architectural renderings, which obviously belong near the same level of abstraction as photographs, to the stylized drawings that are only arbitrarily distinguishable from diagrams.

Generally, though, the transition from photographs to drawings is characterized by the gradual removal of surface detail, the emphasis of structure, and perhaps the depiction of
the more generic. The kind of abstraction introduced depends both on the object being presented and on the purpose of the graphic. For example, as in Figure 2, one may choose to draw an object, rather than to photograph it, simply to remove irrelevant surface detail, while still illustrating the particular, or one may choose to draw it to remove surface detail and thereby to illustrate the generic, as in Figure 3.
Diagrams are at a relatively high level of abstraction; they are frequently generic, they emphasize structure, and they may use symbols and various graphic conventions. And again there is considerable variation in degrees of abstraction; in other words, the continuum of abstraction does not end abruptly, but rather continues through the category of diagrams. Some diagrams, like Figure 4, while isolating structure, still contain relatively mimetic elements, while others, like Figure 5, rely almost totally on non-mimetic symbols and conventions.

Figure 4: Relatively Mimetic Diagram of a House with a Heat Exchanger

Figure 5: Non-mimetic Diagram. Schematic of a Multivibrator Circuit
The abstraction "continuum" for illustrations of quantities, on the other hand, is discontinuous and much less obvious. In most cases, the writer must first choose between presenting data in a table or in a graph. Tables appear at the lowest level of abstraction in Figure 1 because they present quantities as numbers, and not as points, lengths, or areas; because even though they do categorize data, they do not explicitly show the structure of the data; and because the data is always particular and never generic. In other words, tables are closest to the "concrete" data.

All graphs are derived from tables, show relationships or structure within data, and depend, more or less, on symbolization in presentation; they differ in the kinds of relationships they are designed to show and in the complexity of the symbolization systems used to show these relationships. Bar graphs and pie charts convert numerical values to equivalent lengths or areas to illustrate the relative magnitude of quantities; the relationships shown and the conventions governing encoding are quite simple.

Line graphs, on the other hand, can reveal much more complex relationships within data. In fact, these graphs are frequently used to discover the structure inherent in the data; it is usually the shape of the curve formed by the points corresponding to the numbers in the underlying table that is important, rather than these numbers themselves. We can then think of the numbers or data as being the "surface" and the curves as being the "structure." Also, just as surface anomalies are eliminated as we move from drawings to diagrams, so the curves in a line graph are "smoothed" to eliminate surface irregularities in order to present the essential relationships. This is particularly true of graphs that present experimental results. Finally, the "characteristic" curves, such as those illustrating well-established scientific laws, are almost totally generic; normally they don't even show scale.

**ABSTRACTION AND DECODING**

In addition to serving as a basis for comparisons of graphics within subject columns, Figure 1 can also be used to generalize across subjects about graphics at comparable levels of abstraction. In particular, it can be used to discuss the related issues of decoding difficulty, audience adaptation, and the kind of support the linguistic text has to provide for interpreting a graphic. Since graphics at low levels of abstraction use mimetic
means of representation, they are accessible to the widest audience. At the same time, because they portray the particular and the surface, they generally include a great deal of detail, and the linguistic text may have to provide cues for selecting the most relevant features of that detail.

Because graphics at high levels of abstraction portray the generic and isolate structure, there is much less need for the linguistic text to direct the audience in selecting information or extracting relationships. However, the use of symbols and specialized graphic conventions to show these relationships or structures may restrict the audience to which these abstract graphics are accessible. Other factors remaining the same, then, as we move from photographs to diagrams, and from tables to specialized graphs, the potential audience narrows. This general tendency toward decoding difficulty is tempered, though, by education and general familiarity with particular conventions. Standard maps, for example, certainly use symbols and quite complex conventions, but they are so much a part of the general cultural experience that their almost universal readability can probably be assumed. When a graphic does include symbols and conventions with which the audience is probably not familiar, the linguistic text must, of course, explicate them.

ABSTRACTION AND THE HISTORY OF GRAPHICS

The history of graphics reveals a general evolution toward greater abstraction as symbol and convention systems were introduced. In the development of maps, for example, pictorial elements were gradually replaced by conventional symbols, and electrical schematics evolved from quite mimetic drawings of all the components, to graphics in which less familiar components were drawn and better known ones were replaced by symbols, to graphics in which all components were replaced by symbols. Similarly, tables preceded bar graphs and line graphs by nearly two hundred years, even though the latter were introduced almost simultaneously in 1786. In tracing the history of the visual language of geology, Rudwick also emphasizes the increasing "degrees of abstraction and formalization and the incorporation of greater theoretical loading into the forms of illustration," and his diagram summarizing this development is conceptually very similar to the scheme shown in Figure 1.

Within this century, there has emerged a plethora of very abstract kinds of graphics which are usually learned along with the technical vocabulary of the disciplines. As a result,
particularly when writing for the less expert audience, the adaptation and explication of the graphic "language" poses at least as serious problems as does the adaptation of jargon.

CONCLUSION

I have tried to emphasize that choice, and sometimes very subtle choice, is important in using graphics. While we know very little about the precise variables governing these choices, it seems that abstraction is one of these variables. As McKim has suggested, the "ability to move from one graphic language to another, along the dimension of abstract-to-concrete, is probably the most useful kind of graphic-language flexibility." The classification scheme shown in Figure 1, based on the subject of a graphic and its relative level of abstraction, can be used to unify the technical writing instructor's discussion of the use of graphics in technical discourse. The vertical dimension facilitates discussions of the graphic choices available within a subject category, while the horizontal dimension allows comparisons of graphics across subject categories.

NOTES


4 An ordinal variable can only be defined in terms of sequence, such as from low to high, but not in terms of standard units of measurement. Nominal variables are category labels: the categories are logically different or distinct from each other.


7 It should be noted that the representation of a number as a point is a kind of mapping and that there is, in addition, a very important difference between a point and its picture and between a line and its picture. While this "picture" is visible, and so may seem more concrete, it is, in fact, a symbol.


12 Rudwick, p. 178.

13 McKim, p. 127.
GETTING A HANDLE ON GRAPHICS

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INTRODUCTION

One of the difficult aspects of teaching graphics in technical writing is the lack of concepts and terminology for discussing them. Textbooks tend to point out the different kinds of graphics available rather than discussing their functions; they are often seen as decorative devices intended to generate reader interest or as secondary parts of the text used only to emphasize points already made verbally. Some ways of talking about how graphics work as a part of a text are needed so that students can be taught how to use them more successfully.

PRESENTATION OF CONCEPTS AND PROPOSITIONS

The first point that should be made in teaching graphics is that it is the purpose of the document as a whole to transmit certain concepts to the reader. These concepts are not necessarily the same thing as the exact words and graphics of a paper. In his article on mental imagery, Zenon W. Pylyshyn points out that "Both pictures and sentences must be interpreted before they become conceptual contents . . . because there are an indefinite number of both pictures and sentences which are cognitively equivalent" (p. 7). Pylyshyn goes on to say that concepts can be held which have no direct language equivalent: if the underlying concept is one difficult to put into words, it may be made more available or explicit through graphic material.

A beginning discussion of concepts will help students to realize that graphics may be an important means of transmitting information and so need to be given serious consideration from the beginning of the writing of a paper. But the idea of
concepts must be made more explicit if students are to be able to
generate their own graphics; there must be a way of pinning down
those concepts that the students wish to express. Such can be
done by thinking of the content of a text in terms of
"propositional knowledge." A proposition, as Pylyshyn defines
it, is "what a string of words may assert." It is either true or
false, it "may be asserted by any number of strings of words, in
any language and in any modality" and "it may involve no words of
any kind" (p. 6). "Propositional knowledge" as I will discuss it
here is like the "concept" in that it is also composed of that
which words or pictures assert or express; but it is made up of
more specific information than is the concept. If the
propositions are formulated into verbal statements, they can be
used to guide what is to be said and shown in a text.

To clarify the application of the "concept" and
"propositional knowledge" to graphics, let us assume that part of
a student's paper seems to need graphic support. Let us say
that this subject is the emergency core-cooling system of a
nuclear power plant. The concept and propositions might be
worked out this way:

Teacher: What point do you wish to make about it?
Student: That it is very complex. (Concept)
T: Why so?
S: It uses a great many steam pipes. (Proposition)
S: It uses many valves. (Proposition)
S: It uses several heat exchangers. (Proposition)
S: The flow of water through it has several possible paths.
(Proposition)
S: The flow is controlled by a remote electronic console.
(Proposition)

Now the student has tangible items to use in a graphic and thus
knows what to put in or to leave out. These propositional
components, even if unexpressed verbally in the text, will be
explicit parts of the graphic item. It, in turn, will express
the implicit concept of complexity, an important idea which would
be given in the written text.

Concepts might be as simple as showing how something looks,
with propositions made up of measurements, or they might be as
difficult as an artist's concept of beauty or serenity that one
would be unable to break down into a set of verbalized
propositions; the ability to express concepts composed of hard-to-verbalize propositions is one of the most useful attributes of graphic materials.

SUCCESSIVE AND SIMULTANEOUS PRESENTATIONS

In a technical writing paper using graphics, knowledge is transmitted to the reader in two ways—in sequence, in the sentences of the text, and all-at-once, in the graphics. In the discussion of their model for cognitive abilities, Das, Kirby, and Jarman term these two models "successive" and "simultaneous." Grammatical structure, they say, depends on the "sequential relationships within sentence structure" of the syntactical components; graphic aids fall within their definition of "simultaneous" transmission, in which "any portion of the result is at once surveyable without dependence upon its position in the whole." Simultaneous transmission is necessary, they say, "In order for the human organism to grasp systems of relationships" (p. 89). A picture of a human face is a good example of graphic material whose worth depends on its catching the relationship of a series of features, as the recognition of the face lies not in the individual features but in their combination—information that comes to the viewer all at once.

When we add the concept of the simultaneous transmission of information, especially that of relationships, to the idea of overall concepts and specific propositions, the composition and use of graphic aids become clearer. When the concept involved is one whose importance lies in the relationship of the propositional material used or for any other reason the concept to be transmitted dictates that the "whole" of the propositions be given at once, graphic materials should be used. When concepts are difficult to explain verbally, not using graphics is comparable to omitting an important part of a written text.

CATEGORIES OF GRAPHICS

If the student is encouraged to think about and use graphics from the point of view of concepts and relationships, the many specific kinds of graphics can be fitted into some broad categories; I have found three that seem to cover what graphics intend to show to the reader—objects, abstractions, and relationships. These three categories are not mutually exclusive but rather reflect the primary intent of the writer.
In the first category--objects--it is the writer's intention to give the physical appearance of the object with emphasis dictated by the particular concepts or propositions to be explained. Figure 1, as an example, shows the simple physical appearance of a trilobite, a now-extinct sea animal.

![Figure 1: Trilobite](image)

The second category--abstractions--is particularly valuable in that it gives a writer-generated view of something that cannot be seen, either because it is inaccessible to the human eye or because it does not in fact exist as an object. Examples of abstractions are various chemical molecules as they are pictured or representations of the passage of time. A particularly interesting kind of abstraction is the scientific model, which is made up of data (propositions) that are combined to create a concept. Figure 2 shows one of the best known, a model of the atom.

![Figure 2: Atom](image)

This category of graphics can be used to begin a discussion of the function of scientific models, which in some cases seem to function metaphorically, with certain meaningful ambiguities; such discussions help to emphasize the importance of graphics.
The third category--relationships--deals with perhaps the most common type of graphics. The function of this category is to show the relationship between quantities such as sales per year or production per day. When material is plotted on a graph, a relationship between two quantities may be seen that is not apparent in the separate figures. Thus, trends and cause/effect relationships may become clear that would be difficult to find or to explain fully in the verbal text. Only when sufficient data are plotted on the graph does the relationship emerge because the relationship is a product of groups of figures or quantities rather than individual bits of data. Sequential language, which can handle only one thing at a time, cannot adequately represent a relationship which exists only if the data are seen all at once. Figure 3 is an example of a simple graph showing a relationship.

![Graph Showing Relationship](image)

**Figure 3: Graph Showing Relationship**

**STATIC AND DYNAMIC GRAPHICS**

Depending on the needs of the document, graphics may also be a part of a series; in such a case, it is not the function of one graphic to convey all information; rather, it should be conveyed
in a series of images which themselves have a beginning and end. In this way graphics may be dynamic rather than static, giving a sense of motion or growth. Thus, the dynamic graphic tends to become more complex as it develops, showing components, their relationship, and finally all of those things at once.

Perhaps the most common use of dynamic graphics is in the process paper, particularly when the process involves assembling an object out of several components. In such a case the writer must maintain a consistent visual point of view, presenting the object from the same angle or side, and if the point of view changes, the reader must be informed. Graphics that give the fullest or three dimensional view of the object should be used so that the reader is not forced to integrate different views of the object while at the same time attending to the dynamics of the process, the main purpose of the series of graphics. Figure 4 shows a dynamic series of graphics, the assembling of a bird house. It would be accompanied by a text explaining the materials needed and the details of the process itself.

CONCLUSION

The most important point in teaching graphics is to explain them as a contributing part of the text; to do so, it is necessary to give students a tangible concept of what graphics do.
and how they do it. This explanation will in turn yield terminology to be used in discussing and planning graphics. Then, the use of graphics can be made a part of the process of writing, and graphics will themselves become an integral part of the student's rhetorical tools.

Since, the use of graphics can be made a part of the process of writing, and graphics will themselves become an integral part of the student's rhetorical tools.

NOTES


INTRODUCTION

English teachers usually became that because they are adept at playing with words, tinkering with prose. They know there are different ways to express material in different contexts. They know how to choose appropriate expression. But sometimes they don't transfer this sense of play, flexibility, and choice to other instruments for transferring information, like mathematics and graphics. The same game, however, applies. Appropriate equations, drawings, and tables are matters of choice among options. They fit a context.

This article provides some advice for technical writing teachers about how to equip students to choose the right graphic form of presentation. Other articles in this anthology, and chapters on visuals in technical and business writing texts, provide descriptions of the forms and grammar of graphics. Here we move into rhetoric. This article offers suggestions toward a rhetoric of visuals: how to choose the best graphic form to persuade the reader and accomplish a given purpose.

THE COMMUNICATIONS MODEL (REVISITED)

The communications model in Figure 1 is undoubtedly familiar. It's pretty simple, and it's static. We could get fancier to show interaction and change over time. But this model does identify the major forces in communication--forces well recognized as impacting on the choice of words in a presentation.
Let's see how these same forces affect the choice of visuals. Then we'll suggest tactics for discussing visual rhetoric in the classroom.

**Audience**

As with writing, the audience's demands determine what is appropriate visual expression. The code in which the visual is expressed must match the audience's understanding, for example, of the conventions of X and Y axes in a graph. In addition, the form of the visual must match the reader's expectation and need for rapid assimilation of information.

A photograph may show 10,000 ants in a colony. The general interest reader may be appealed to, with either delight or terror, by such a photograph. An ant collector, however, might prefer to see a detailed photograph or drawing of only one ant in a field guide. An entomologist might look for an anatomical drawing of one part of the ant or statistics on ant longevity or reproductive capacity. A visual may show extreme detail—10,000 ants, 15 plots of money over time, 75 miles, 103 elements and their atomic weights and numbers, whatever. The form, then, and degree of detail must be carefully selected to inform and persuade but not overwhelm the reader.

Finally, visuals, like words, have connotations that must be reckoned with. A Philadelphia college recently redid its organizational chart because the faculty bridled under the connotations of the traditional one. The original chart, in standard block form, showed the president in a box on his own line at the top, with lines down to a second level of vice presidents, the dean of academic affairs, and the dean of students. The third level boxes held directors of programs; below them came boxes with the names of departments. Faculty were
simply subsumed in departmental boxes. In the new form, administrative relationships are expressed in a series of concentric half-circles. The president appears in a circle in the center of the diagram. But the faculty appear in the outer circle, as it were, ringing in the president and deans and giving shape to the whole enterprise. The label "faculty" also appears prominently in a circle at the top of the diagram. The reality of reporting relationships underlying both charts remains the same. But the display of these relationships in the new chart is more pleasing--and persuasive--to the faculty.

Material

Some information is more appropriately expressed in visuals than in words. The operation of a nuclear reactor can be shown well, at least in a general way, through a diagram. But explanations of government policy concerning reactor development require words. Information that, cast in sentences, shows a great deal of redundancy can often be streamlined into a table:

The first assignment, due March 2, will be a description of a process. The second assignment is due March 15. It is an abstract of the final report. The third assignment, due April 1, is the draft of the final report. The final report, which is the fourth assignment, is due on April 30.

<table>
<thead>
<tr>
<th>assignment</th>
<th>due</th>
<th>description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>March 2</td>
<td>description of a process</td>
</tr>
<tr>
<td>2</td>
<td>March 15</td>
<td>abstract of final report</td>
</tr>
<tr>
<td>3</td>
<td>April 1</td>
<td>draft of final report</td>
</tr>
<tr>
<td>4</td>
<td>April 30</td>
<td>final report</td>
</tr>
</tbody>
</table>

Note, by the way, how the information stands out in the table better than in the narrative description. The table provides an automatic check list for those who must follow these instructions.

Often, visually-minded authors begin to write by assembling their visuals. The text then becomes a way of providing continuity to these, particularly in a highly technical document. But the visuals used in the original data gathering--field drawings, printouts from laboratory instruments, computer plots,
preliminary sketches--may have to be further massaged and interpreted to highlight the material of importance. In this interpretive phase, some of the visual material may be condensed from several plots to one or into words.

Authors of only mildly technical documents aimed at popular audiences often write the text first and look for illustrations that will enhance the words. In this application visuals become "aids" to the text; in more technical presentations, the words are often verbal aids to the visuals.

Purpose

Any decision to use visuals must be made within the constraints of money (visuals are often expensive), time, and the writer's skills (or access to those with the necessary skills). That said, visuals do perform essential functions. Four come readily to mind:

- to emphasize a point
- to inform and clarify
- to enhance continuity
- to heighten interest.

The interrelationship of these purposes can probably best be seen if we look at one document in detail.

The Man-Made Fiber Producers Association recently developed a brochure demonstrating that the industry is efficient in its use of energy and calling for continued priority within the overall petrochemical industry in any future allocation of raw materials. The brochure aims to convince both general consumers and government officials of the industry's importance and commitment to energy conservation. It is a polished presentation, handsomely designed and executed. Its 16 pages alternate a page of text with a page of visuals. Let's see how visuals are used for each of the four purposes.

First, the controlling idea of "one percent"--the man-made fiber industry uses only about one percent of the nation's oil and natural gas--is reinforced visually throughout the brochure by a small red block that first appears on the cover. The brochure is printed in black and white; the only color is the red highlight in the block. The red block appears again inside the cover. That entire page, we are told, represents 100% of the nation's total energy supplies; the block is relatively small. The block is seen once more in a further breaking out of the total of energy supplies (Fig. 2), is repeated in miniature as a
series of bullets to emphasize points in the summary, and caps the argument visually by appearing at the same location inside the back cover as on the front cover (Fig. 3). The red block, then, emphasizes visually the controlling theme of the brochure: the industry uses only a tiny portion of the nation’s supplies.

Figure 2: Facing Pages that Emphasize the Small Amount of Energy Used in the Manufacture of Fibers. The small block in the lower right corner (red in the original) is repeated throughout the brochure. The text also argues the case strongly for energy allocations to the industry.

Figure 3: Final Pages of the Brochure Using the Same Red Block to Reinforce Summary Points
Second, visuals are used to provide substantiating information to support the theme and a secondary theme: with this small amount of energy the industry produces an abundance of goods. A table (Fig. 4) argues the advantages of man-made over natural fibers. A photograph (Fig. 5) and accompanying text show what 20 gallons of petrochemical raw materials can produce. A chart (Fig. 6) demonstrates that price increases for man-made fiber products are considerably below increases for other items.

Figure 4: A Table Displaying the Prevalence of Man-made Fibers in Apparel, Home Furnishings, and Industrial Textiles

Each form suits different information and the variety of forms builds visual interest. The table emphasizes discrete units with a score column that shows man-made fibers as the clear winners. The photograph builds drama and has immediate impact; you don't need to read to understand abundance. The chart shows a trend over time better than, say, a table listing prices per year. The table would require interpretation. The line shows comparative change at a glance.
Figure 5: A Photograph Supports a List of How Many Man-Made Fiber Products Twenty Gallons of Petrochemical Raw Materials Can Produce

Supports a List of Fiber Products
Raw Materials Can Produce

Figure 6: A Chart Showing Price Increases Over Time for Several Commodities
Third, on Fig. 6, the curves for man-made fibers and apparel are drawn in red in contrast to the white (on gray background) for other items. The red here underlines the theme of low use of energy (and careful management of prices) of the industry, reiterates the message in the blocks, and enhances continuity.

Fourth, the visual approach of this brochure reinforces its purpose: to win the reader's support in a highly charged political situation. As befits a text aimed at a wide audience, the visuals are not technical. But they garner attention and draw the reader through the argument. They help make evidence obvious and immediately accessible. The general design of the brochure, too, lends credence to the appeal of an industry whose products are often judged on the basis of their design. It is a simple and effective presentation.

CLASSROOM INSTRUCTION IN GRAPHICS

The Man-Made Fiber Association brochure illustrates what is true of visuals in general: they fit the same rhetorical model as words. Given this condition, what are the implications for classroom instruction? The chief implication is that visuals deserve discussion throughout the term, not just as a set piece lecture late in the game. Discuss visuals as an option for communication in many forms of writing. The rest of this article offers a few specific tactics for incorporating this discussion into your classroom.

1. To heighten your own visual awareness, collect samples of both good and bad visual presentations and show these (in slides or transparencies) in class. Some good sources are the "Science Times" section (Tuesdays) in The New York Times, Business Week, the AIA [American Institute of Architects] Journal, Technology Review, and Scientific American. In addition, corporate annual reports are often good sources of visuals, along with brochures like the one we just analyzed.

2. Provide students with data that they can arrange in a diversity of visual forms. Ask them to design the visual that meets a particular rhetorical situation. For example, give them the statistics for the last 5 years of a local baseball, football, or soccer team: rosters, player performances, team performance, gate receipts, schedules, coaches' records, etc. Ask them to pick out pertinent information and display it in different ways to meet situations you set up for them. For example:
Situation 1

writer: PR dept. of the team
occasion: newspaper ad/ team program
material: schedule for one month
audience: general

(Fig. 7 shows one arrangement with home games shaded.)

<table>
<thead>
<tr>
<th>APRIL</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th>1</th>
<th>2</th>
</tr>
</thead>
<tbody>
<tr>
<td>SUNDAY</td>
<td>MONDAY</td>
<td>TUES</td>
<td>WED</td>
<td>THURS</td>
<td>FRI</td>
<td>SAT</td>
</tr>
<tr>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
<td>8</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td>N.Y.</td>
<td>N.Y.</td>
<td>N.Y.</td>
<td>N.Y.</td>
<td>10</td>
<td>11</td>
</tr>
<tr>
<td>10</td>
<td>SF</td>
<td>SF</td>
<td>SF</td>
<td>SF</td>
<td>12</td>
<td>13</td>
</tr>
<tr>
<td></td>
<td>ATL</td>
<td>CHI</td>
<td>CHI</td>
<td>CHI</td>
<td>ATL</td>
<td>CHI</td>
</tr>
<tr>
<td>17</td>
<td>1:35 p</td>
<td>7:35 p</td>
<td>7:35 p</td>
<td>7:35 p</td>
<td>18</td>
<td>19</td>
</tr>
<tr>
<td></td>
<td>SF</td>
<td>CHI</td>
<td>CHI</td>
<td>CHI</td>
<td>ATL</td>
<td>CHI</td>
</tr>
<tr>
<td>24</td>
<td>N.Y.</td>
<td>N.Y.</td>
<td>N.Y.</td>
<td>N.Y.</td>
<td>25</td>
<td>26</td>
</tr>
<tr>
<td></td>
<td>ATL</td>
<td>ATL</td>
<td>ATL</td>
<td>ATL</td>
<td>27</td>
<td>28</td>
</tr>
<tr>
<td>24</td>
<td>2:35 p</td>
<td>7:40 p</td>
<td>8:00 p</td>
<td>8:00 p</td>
<td>N.Y.</td>
<td>N.Y.</td>
</tr>
</tbody>
</table>

Figure 7: A Baseball Schedule
(Used by permission of the Philadelphia Phillies)

Situation 2

writer: player X's agent
audience: general manager of team
purpose: to argue for a more lucrative contract
occasion: contract time
material: player x's statistics, perhaps some comparative statistics, X's salary expressed as a percent of receipts, etc.

(Try a table.)
Situation 3

writer: reporter for the local sports page

purpose: to predict team's performance in coming season

audience: newspaper readers

occasion: one of a series of weekly columns on different teams

material: (much is possible: graph of team record plotted vs. other teams, table of leading hitters'/kickers'/passers' statistics, etc.)

You can obviously expand the stories. You can mix in some bad years (as usually happens) and see how students work around those numbers. You can expand the exercises to include some prose as well.

Various agricultural year books and statistical abstracts, like the Statistical Abstracts of the United States (an annual publication), are rich mines of raw data waiting for you to use.

3. As an in-class exercise, you might ask students to work through a description of a process or an object, either by themselves on paper or at the blackboard. Have them begin with a visual, which they then annotate. Again, give them the rhetorical context for their description. Some likely topics:

- a game (for a player, an ardent supporter, a non-enthusiast--change the audience)
- the registration process at your institution (using a flowchart)
- directions for getting from A to B (map vs. list)
- troubleshooting some problem (flat tire, etc.)

4. Check rough drafts of visuals when you look at the drafts of student reports. Make sure the visuals are more than mere decoration or stuffing and that students realize they need
to document the source of visuals as they do the source of information verbally presented.

Your goal in dealing with graphics should be to encourage students to recognize opportunities for using them and then exploit these opportunities. Moreover, students should see that graphic forms, like words, need to be adjusted to the audience and purpose of a presentation as well as to the material being presented. You and the students should play with different arrangements in class and in assignments and examine models of visuals that go right and wrong, just as you examine the feasibility of different verbal solutions to communications problems.

NOTES


2 A copy of this brochure may be obtained from the Man-Made Fiber Producers Association, Inc., 1150 Seventeenth Street NW, Washington, D. C. 20036. Visuals from the brochure are reproduced here with the kind permission of the Association.
DEVELOPING A HEURISTIC APPROACH TO GRAPHICS

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INTRODUCTION

The increasing emphasis on the visual dimension of written communication suggests that technical writing teachers must find efficient methods to teach effective use of graphics in designing documents. While texts provide useful prescriptive guidelines for producing clear graphics, what is missing is a heuristic approach for teaching graphics that will achieve three goals: (1) to help students recognize graphics as an essential consideration in pre-writing analysis, (2) to develop exercises that require analysis of graphics as they are used in published materials; (3) to develop realistic report situations requiring students to perceive when graphics are necessary, what graphics are appropriate, and why these are appropriate, given the audience, content, and purpose of the document.

HELPING STUDENTS RECOGNIZE GRAPHICS AS AN ESSENTIAL CONSIDERATION IN THE PRE-WRITING ANALYSIS

Technical writing teachers often believe that graphics cannot be included in the early weeks of the semester. Audience, organization, style, and tone are believed to be--and with justification--the concepts that must be understood first. Because graphics is often included about mid-term, it is often included only tangentially in document analysis. The following evaluation report case, introduced the second week of class, concomitantly achieves a number of goals. Students learn (1) to set up an informal report, (2) to write a summary, (3) to write an introduction, (4) to include a table and supporting discussion.
You are staff assistant to the director of the freshman curriculum director, Dr. Paul Hackman. He has asked you to work with the freshman academic committee to recommend class supplies for all freshmen. The committee wants to choose the best kind of folders for freshmen to use during their first year when they are taking mostly standard, required courses. These folders must be durable, and students must be able to add papers easily. Each folder must hold at least 50 sheets securely at all times without coming apart when dropped. However, cost should also be considered, as freshmen will have to buy 5-12 of these each semester their first year. The folders must hold standard size paper. Depending on the course, they will be used to keep lab reports, research paper notes, freshman composition journals, class notes, and research papers. In short, the folders will be handled extensively each semester, as they will be submitted to instructors and then returned several times each semester.

Choose three kinds of folders to evaluate. Analyze each according to the criteria for selection, and then decide which to recommend to the committee and to Dr. Hackman.

Be sure to send copies to the chairman of the committee, Dr. Blake Hardin, and to the Vice-President for Student Affairs, Dr. Guy Young. The report itself will be addressed to Dr. Hackman.

Items to include in the report:

- Summary--State your recommendation, then the basis for your recommendation.
- Standards and Specifications: List the standards for evaluation. Be sure all standards use parallel phrasing.
- Method of evaluation--Tell how you evaluated or rated each folder.
- Results--Give the results of your evaluation in a table.
- Discussion--Discuss your results, explaining why each device received the rating it did.
- Conclusion--Restate which folder was determined to be best.
Below is one student's response to this case.

MEMORANDUM

TO: Dr. Paul Hackman
FROM: Lydia S. Groce
SUBJECT: National Folder Recommended for Freshman
DIST: Dr. Guy Young
Dr. Blake Hardin

A committee on academic affairs has been assigned the task of determining the best kind of folder for freshmen to use. The folders must meet several specifications:

- they must last for a period of at least one semester;
- they must hold at least 50 sheets securely;
- they must be durable;
- they must be able to hold continually added pages of lecture notes;
- the cost must be kept to a minimum since 5-12 folders will be needed by each student.

The purpose of this report is to evaluate three different types of folders and to determine which folder is best suited for the freshman's needs.

SUMMARY

Standards and specifications were best met by the National folder. The National folder was made of a strong, water-resistant pressboard. This composition provided durability and protection to the folder's contents. The three-ring binder allowed organization of notes, additions, and easy access. The two pockets created flexibility for material storage and organization. The size of the folder is approximately 10" x 12" x 1". This size permits convenient handling while still allowing normal size handouts to be included and protected. The cost of the folder was somewhat higher than the other two options. However, the reuse value of the folder compensated for the high initial cost.

STANDARDS AND SPECIFICATIONS

The freshman committee established the following guidelines for evaluating the folders considered:

1. Durability
   - The folders must last for at least one semester. They will be handled constantly during the semester.

2. Access
   - There should be easy access to the notes. Additions to the collection must be simple and made within a period not to exceed 30 seconds.

3. Organization
   - Adequate provisions must be present for handouts and lecture notes.

4. Protection
   - The contents of the folder must be protected against the environment. The folder must be able to withstand being dropped without damaging the folder or its contents.

5. Size
   - Dimensions should not exceed 10" x 12" x 1½".

6. Cost
   - The cost will not exceed $2.00 per folder.
METHODS OF EVALUATION

Each folder was evaluated according to the required standards. Tests were designed to determine how well the folders met the committee's performance expectations. Folders were rated on a three-point scale: low, average, and high. Ratings were calculated by assigning point values to the scale.

RESULTS OF THE EVALUATION

Low = 1 point Average = 2 points High = 3 points

<table>
<thead>
<tr>
<th>Folders Considered</th>
<th>Duo Tang</th>
<th>National</th>
<th>Smead</th>
</tr>
</thead>
<tbody>
<tr>
<td>Durability</td>
<td>1</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>Access</td>
<td>2</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Organization</td>
<td>2</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>Protection</td>
<td>1</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>Size</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Cost</td>
<td>3</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Total Points</td>
<td>11</td>
<td>15</td>
<td>13</td>
</tr>
</tbody>
</table>

DISCUSSION

Tests were conducted using the six criteria. Points were assigned based on the test results and value judgments. The following evaluations describe briefly the evaluations:

(1) Duo Tang made of very light weight cardboard; has 2 pockets, fasteners (3 clips); available in 8 colors; costs $.49 each.

(2) National made of water-resistant pressboard; has 2 pockets, 3-ring binder (1" diameter); available in 4 colors; costs $1.85 each.

(3) Smead made of plastic-coated cardboard; has no pockets; has 2-hole brads; available in 8 colors; costs $.105 each.

To test for durability, the folder was dropped from a height of five feet. Access was tested by timing various situations, including finding existing notes and adding notes to the folder. The length of time for either process was limited to 30 seconds. Adequate provision for handouts and lecture notes was also evaluated. This was done on the basis of ease of access and organizational efficiency. Protection of the contents was also determined. Eight-ounces of water was sprinkled on the folder to simulate rain. Three sides of the folder were exposed to the water. By using this test, damage from rain could be estimated. The size of the folder was not allowed to exceed 10" x 12" x 1½" because larger folders would be too bulky, and smaller folders would not protect the edges of normal-size paper. The cost was not allowed to exceed $2.00 per folder.

CONCLUSION

We recommend that the National pressboard-type folder be used by the freshmen class. The National folder out-performed the other folders on the tests and may well be servicable for an entire year, thus further justifying its cost.
Note that this first controlled report assignment requires students to "think graphics" sooner, even though they have not yet been assigned the graphics chapter in the text. In addition, the table is an integral, necessary part of the evaluation. From their initial exposure to audience analysis during the first week of class, students can see how audience considerations are reflected in the summary, the introduction, and in the organization and format of the report. Students are also introduced to the role of headings and effective layout. As students begin the assignment, you may wish them to read the graphic section on "Tables" in their text to become familiar with methods for developing clear, logical tables.

This assignment also allows the opportunity to introduce a pre-writing analysis guide which includes graphics as a consideration in report design. Therefore, from the beginning report assignment in the course, students understand that graphics is a normal consideration in planning. For every assignment during the semester, students should complete an analysis sheet like the one below before they begin writing.

DOCUMENT ANALYSIS WORK SHEET

Kind of Document: Subject:

AUDIENCE:

Primary Reader--Person to whom the document is addressed:
educational/technical level:
position--job title and responsibilities:
attitude toward the document subject:

Secondary Reader--Others who may read the document and use it:
educational/technical level:
position and responsibilities:
attitude toward the subject:

PURPOSE

What is your purpose in writing this document? State it clearly.
What goal(s) do you hope to achieve with your readers?

DOCUMENT CONTEXT

What is the context in which the document will be received?
How long will the information be applicable or useful?
Will visual aids be necessary? What kind(s)?
Why are these graphics the best choice?
What kind of layout (format) will best meet the needs of your content, audience, and visual aids?
A good plan is to gear your syllabus to include assignments that will more than likely require some type of graphic. As the following assignments illustrate, graphics, taught with a heuristic emphasis, can be integrated with analytical report problems to show how graphics can augment analysis.

PROVIDING STUDENTS WITH EXERCISES THAT REQUIRE ANALYSIS OF GRAPHICS AS THEY ARE ACTUALLY USED

Corporate annual reports, business periodicals geared to general readers, and many kinds of government publications are excellent, easily accessible sources of graphics--both good and bad. Graphics in these kinds of publications can provide a source of thoughtful analysis of the following questions, which form the basis for a graphics heuristic:

1. Are the graphics effective? (Is the idea they are conveying clear?)

2. Do the graphics contribute to the overall effectiveness of the document?

3. How often are graphics conventions (like those given in our text) actually followed?

4. What kinds of graphics are used in what types of publications?

5. How are the graphics used? Do they replace written discourse, or do they supplement it? Is one technique better than the other?

6. Are the graphics suitable for the intended audience?

7. What variations of standard graphic types do you find? Are they effective? Or, are they merely creative marketeering?

8. Could any creative variations be redrawn to clarify the information?

9. What role do color and typography play in graphic effectiveness?
Below are three suggested assignments for applying this heuristic.

Assignment 1

After assigning the graphics chapters in the text, find several pages (from government publications or Business Week, for example) that feature a variety of graphics. Make transparencies of these pages when possible. In a class discussion, have students analyze and determine the effectiveness of these graphics by using the nine questions as a guide. You will find that students will not always agree on the effectiveness of the examples, a situation you can use to illustrate the value of anticipating audience reaction in designing graphics.

Assignment 2

Have students choose several issues of a periodical—such as Fortune or any other periodical that uses graphics regularly—and write a report, like the evaluation report, analyzing the graphics according to the nine questions. Students should develop tables to support their analysis. Here's an example:

<table>
<thead>
<tr>
<th>Issue</th>
<th>Number and Type</th>
<th></th>
<th>Creative</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>date</td>
<td>Graphs</td>
<td>Circle</td>
<td>Combinations</td>
<td>Visuals</td>
</tr>
<tr>
<td>date</td>
<td>Tables</td>
<td>line</td>
<td>bar</td>
<td>(Photos)</td>
</tr>
</tbody>
</table>

Table 1: Number & Type of Graphics Used in Forbes

Table 2: Effectiveness of Graphics Used in Forbes

Standards for Determining Effectiveness:

* Clarity  *Lack of Distortion  *Visual Appeal  *Comprehension Aid

1 = poor  2 = fair  3 = good  4 = excellent

<table>
<thead>
<tr>
<th>Issue</th>
<th>Graphs</th>
<th>Circle</th>
<th>Combinations</th>
<th>Creative</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>date</td>
<td>Tables</td>
<td>line</td>
<td>bar</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

34
Discussion

Because this report is similar to the evaluation report, it should begin with an introduction and summary before the table. The discussion and conclusion sections follow. In the discussion, many students will want to focus on certain kinds of graphics they have found. You may wish to encourage them to photocopy, clip, and include (as figures) any particularly interesting graphics they have found. Students can also be encouraged to redraw graphics they consider distorted or ineffective. Creative visuals always elicit students' comments.

Assignment 3

Ask your library for out-of-date copies of corporate reports, or consider ordering a collection of annual reports from a wide range of organizations. Then, select reports that contain a number of graphics. Give each student a different corporate report to analyze by using the nine questions. In this assignment, as in assignment 2, students can develop tables followed by support discussion. If you include this analysis report about mid-semester, you may also want students to analyze the report for style, readability, layout, as well as graphics. The purpose of the report should be to analyze the overall effectiveness of the report.

Perhaps the greatest value of these three assignments lies in their lack of proscriptive emphasis. While students should definitely read the text material on graphics, the teaching emphasis in discussing the text material can be on how and when standard conventions or "rules" for graphics are actually used and how the conventions achieve clarity. Grading these evaluation reports should center on how closely and sensitively students analyze the use of the graphics they examine.

Assignments which analyze use of actual graphics underscore the conclusions of the Document Design Center in Washington, D. C.:

As a general statement, graphic designers are guided more by aesthetic and professional judgment than by scientifically verified principles. . . . . The prevailing attitude among practitioners can be characterized as being more concerned with creativity than with the intellectual or analytical
processes. Design is not constrained by rigidly defined parameters of language, but only by the creative energy available to the designer for visually communicating ideas. A number of widely accepted graphic design principles, while not derived scientifically, have grown out of the experiences of many years of practice. These focus on such aspects of typography as the overall effects of type on a page, the technical/mechanical processes of creating artwork for reproduction, and comparative examples of specific types of page layouts.2

In short, your students will often conclude from their analyses that many creative graphics are both good and original; but some that are original are not good, and some that are good are not original! They will also find that many graphics that ignore standard conventions (like warnings against putting too much information on a graphic and making sure that labels are used sufficiently) are unclear and therefore ineffective in conveying information. At the same time, however, students should always be encouraged to determine why any graphic is effective or ineffective.

Assignment 4 focuses on another type of analysis which uses graphics. In this assignment, students must analyze raw data, extricate and organize pertinent information, discuss their analysis, and support it with a suitable graphic.

DEVELOPING REALISTIC REPORT SITUATIONS THAT REQUIRE STUDENTS TO PERCEIVE THE NEED FOR GRAPHICS

Assignment 4

Because business and industry rely on computer-generated data, reports often originate from problems an employee will spot on printouts. To help students learn the value of graphics as an aid to analyzing and interpreting raw data, the following resources can be developed. Since all departments keep enrollment figures (by year and semester) for all courses taught, you can develop a sheet of data, for any year, that looks like this:

36
19 Academic Year
Course Enrollment: Department of English

<table>
<thead>
<tr>
<th>Courses</th>
<th>Terms</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Fall</td>
</tr>
<tr>
<td>103</td>
<td>Sections</td>
</tr>
<tr>
<td>104</td>
<td></td>
</tr>
<tr>
<td>210</td>
<td></td>
</tr>
<tr>
<td>212</td>
<td></td>
</tr>
<tr>
<td>301</td>
<td></td>
</tr>
<tr>
<td>341</td>
<td></td>
</tr>
<tr>
<td>etc.</td>
<td></td>
</tr>
</tbody>
</table>

After compiling four or five years of data, you can develop a report case problem like this one:

The chair of the English department has asked you (a faculty assistant) to analyze enrollment trends in the department during the past five years. With data from 1977, 1978, 1979, 1980, and 1981, analyze changes in enrollment patterns in 100-level, 200-level, 300- and 400-level courses, and graduate courses. The chair also wants to know what percentage of total enrollment each year was attributed to each level. Write a report to the chair that answers these questions.

First of all, the case can be modified, and the same data can be used for several different case questions: (1) analysis of enrollment in writing courses and in literature courses to show shifts in enrollment patterns; (2) analysis of lower-level enrollments as compared to upper-level enrollments; (3) analysis of all courses to determine the most popular and the most unpopular courses. In designing the report, the student must first extricate (classify) the required data. A table is the most obvious way to group needed data. Then, in demarcating trends, the student must decide what supporting graphics to use—bar graphs, line graphs, pie graphs, divided bar graphs, or perhaps pictographs.

An interesting question to pose after this assignment is as follows:
Assume the English department chair asked you to present your findings to the entire English faculty during a regular faculty meeting. In your presentation, what graphics would you use? How would you develop each graphic aid if you wanted it to be visible to faculty members sitting 30 feet away? Could you use the same kind of graphics you used in your written report? Why or why not?

This question provides an excellent means for students to consider the kinds of graphics best suited for oral presentations and to discover that graphics that are suitable for written reports are often not suitable for oral presentations.

CONCLUSION

Including graphics considerations from the beginning of the course and incorporating graphics as a part of pre-writing audience and purpose analysis helps students see graphics as an integral, standard element to be considered in the total document design process. Later in the semester, graphics conventions can be studied more closely, but preferably within a realistic context, such as periodicals or corporate reports. Heuristic exercises thus incorporate standard text material, but in doing so, they go beyond the study of graphics as adherence to conventions. Because empirical studies do not provide clear-cut standards for graphics design and use, the central focus of our teaching should be on finding how graphics can be used to achieve or to enhance the purpose and meaning of a document, and how, and why, graphics may fail to achieve these goals. Graphics instruction can sharpen students' analytical skills by helping them discover the proper use and combination of both visual and written communication.
NOTES


A LITTLE RHETORIC OF GRAPHS AND CHARTS:  
SOME GUIDELINES FOR TECHNICAL WRITING TEACHERS

SARAH K. BURTON  
North Carolina State University

INTRODUCTION

Most of us who teach technical communication in two- or four-year colleges have one thing in common—a traditional, literary English academic background. We therefore feel comfortable discussing the syntactic and semantic principles of written and spoken English and feel competent to evaluate the texts of the "technical" documents submitted by our students. But most of us have had no formal training in that other and no-less-important "language" of technical writing—graphics.

For many of us, what we know about graphics we have gleaned from standard technical writing textbooks. Yet even the best of these provide few yardsticks for evaluating graphics.

In this article I discuss five of the criteria I use in teaching and evaluating graphs and charts:

1. Is the graph or chart appropriate to the material, its purpose, and its audience?

2. Have degrees of print size and of line width and shading or cross-hatching been used to direct the reader's attention to important information?

3. Has the graph or chart been kept as simple and uncluttered as possible?

4. Has the graph or chart established a clear context for the data?

5. Has white space been used judiciously?
DISCUSSION

Is the graph or chart appropriate to the material, its purpose, and its audience?

Choosing the arrangement of the marks and lines, the overall design, and the type of graph or chart to be used is a matter of syntax and semantics and is the first decision that the preparer of a graph or chart must make. For example, virtually all data that can be plotted as an arithmetic line graph or curve can also be plotted as a column chart. Common wisdom tells us that curves are used to show trends, rates of growth or change; that is, curves emphasize continuous or contiguous data, the pattern of a series of data as a whole. Of course, more than one curve can be used, within reasonable limits, to compare several series of data. Common wisdom also tells us that columns, plotted as discrete, discontinuous data points, are best used to compare quantities of an individual item, or a group of items, over time.

But neither common wisdom nor chapters from any of the better technical-writing texts can tell us the best way to plot the following rather simple data:

Age-Specific Immunization: 1979 Campaign

<table>
<thead>
<tr>
<th>Age</th>
<th>No. Immunized</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>111</td>
</tr>
<tr>
<td>1</td>
<td>109</td>
</tr>
<tr>
<td>2</td>
<td>124</td>
</tr>
<tr>
<td>3</td>
<td>146</td>
</tr>
<tr>
<td>4</td>
<td>143</td>
</tr>
<tr>
<td>5 - 9</td>
<td>761</td>
</tr>
<tr>
<td>10 - 14</td>
<td>731</td>
</tr>
<tr>
<td>15 - 19</td>
<td>397</td>
</tr>
<tr>
<td>20 - 24</td>
<td>169</td>
</tr>
<tr>
<td>25 - 29</td>
<td>131</td>
</tr>
<tr>
<td>30 - 34</td>
<td>119</td>
</tr>
<tr>
<td>35 - 39</td>
<td>106</td>
</tr>
<tr>
<td>40 - 44</td>
<td>115</td>
</tr>
<tr>
<td>45 - 49</td>
<td>106</td>
</tr>
<tr>
<td>40 &amp; over</td>
<td>310</td>
</tr>
<tr>
<td></td>
<td>3578</td>
</tr>
</tbody>
</table>

Before we can consider plotting the data, whatever type of graph we decide upon, we must first decide how to make all the
units along any one axis equal. Unless the units are equal, the graph or chart is meaningless.

Since this data constitutes a frequency distribution, I would have had my students consult a good, standard statistical handbook for guidance in plotting distribution and equalizing the data. From such a reference tool, they would learn that the figures for ages 0-4 should be added--to obtain the number for a five-year unit, the most common unit for their data. They would also learn that the figure for 40 and over must be averaged--again in five-year units--according to average life expectancy or according to some other standard practice. They would also note what practices were followed in the course of manipulating their data. Further, they would see that such data are normally plotted as histograms or bell curves, depending on the purpose. My evaluation of this graph or chart would include, then, not only the equalization of the units, but also the decision not to use an arithmetic line graph.

Even more troublesome, perhaps, are graphs and charts that in one form are ideal for lay audiences, but that in some slightly modified form are inappropriate. One such graph, a surface graph or silhouetted curve (see Figure 1), often appears in newspapers and is particularly suited to lay audiences.

![Surface Graph or Silhouette Curve](image-url)
The shading below emphasizes the curve while reducing the emphases on the actual data points. Yet, while single-surface graphs are useful for presentation of information to lay audiences, multiple surfaces or banded charts (see Figure 2) are not.

These charts, as well as subdivided-column charts, are designed to compare the trends of the components of a whole. Even though subdivided-column charts are easier to read than banded curves, both types are hard to read because they lack a common base line for the upper components.

Figure 2: Multiple Surface as Banded Chart

Still another syntactical consideration is the choice of scale. When the arithmetic scale on the vertical axis is too large to be practical, the axis may have to be broken (Figure 3), or a logarithmic scale may have to be used.
A broken axis is fairly easy to read, but reading a semi-logarithmic graph requires some degree of expertise and cannot adequately be discussed in this brief article.

My final remarks in this section concern the syntax and semantics of the first choice of many to present almost any information—pie charts. The following guidelines will solve most problems students have with pie charts:

- As a rule, restrict pie charts to dollar amounts or percentages.
- Use pie charts only for displaying approximate, never finely discriminated, data.
- Don't slice the pie into too many pieces—usually no more than 5—or else the reader will not be able to differentiate the sizes of each piece.
- Begin slicing at the 12 o'clock position; arrange the slices counterclockwise, in decreasing order of wedge size.
- Don't compare pies, especially pies of different diameters.

Have degrees of print size and line width and shading or cross-hatching been used to direct the reader's attention to important information?

Just as the various degrees of heading in a text quickly lead us into its content, print size and line width ought to be used to indicate the relative importance of the information conveyed by the various labels and lines. As illustrated in Figure 4, the hierarchy of print size from largest to smallest is as follows: title, subtitle (if any), curve identity, scale legend and amounts, and source (or footnote).

![NET CHANGE](image)

Source: End of Year Reports

Figure 4: Recommended Hierarchy of Print Sizes and Line Widths
Curves bear the most information, and should therefore be the thickest lines on the graph—three or four times the thickness of the axes is a good rule of thumb. The grid serves merely as a reference guide, and when deemed necessary, should be kept as light as possible. I also remind my students not to use color to differentiate between curves or columns in any report that will be photocopied for distribution.

Has the graph or chart been kept as simple and uncluttered as possible?

Just as reducing excessive verbiage improves readability in texts, removing such clutter as boxes around curve identities and removing an excessive number of scale amounts can greatly improve the readability of a graph or chart. The title, while containing precise information, should be kept as concise as the method of presentation will allow. (See Figures 5 and 6.) The KISS principle applies to graphs and charts as well as to text. The following rule of thumb applies: If a line or mark carries no valid information, get rid of the line or mark.

![Figure 5: Cluttered Graph](image-url)
Has the graph or chart established a clear context for the data?

The point at which the horizontal and vertical axes intersect is the zero-point or origin of the graph or chart. From this point are referenced all data values. Whether to save space or purposefully to bias information, vertical axes are often cut off substantially above the origin. (The most common examples I know of are the cost-of-living index graphs that appear in newspapers and news magazines each month.) Whatever the reason, failing to indicate the origin, often called "the fallacy of the suppressed zero," misleads the audience. Imposing a false horizontal axis above the origin can literally make molehill-size changes in data appear mountainous. (See Figures 7 and 8.)

My all-time favorite example of the fallacy of the suppressed zero is shown in Figure 9. Graphs and charts are meant to be read at a glance, but a glance at this column chart indicates to the reader that the projected '80-'81 enrollment will be only a quarter of that for '71-'72. Only a much closer look tells us that our first impression is wrong. The numbers may not have lied, but the chart certainly has. Taking material out of context can be as misleading and untruthful in a graph or chart as in a text.
Figure 7: Graph with Origin Shown

Figure 8: Graph with Origin Suppressed
Has white space been used judiciously?

Since graphs and charts should transfer information in a moment's glance, information-bearing lines and marks must be clearly and easily discerned. In addition to weighting the thickness of lines and curves, preparers of charts and graphs must make effective use of white space. I caution my students to do the following:

- Shade all columns.
- Weight all curves.
- Make the shaded columns wider than the white spaces between the columns.

In Figure 10, we can see the problems resulting from a failure to take such precautions. The graph is a study in optical illusions. The information-bearing bars are almost impossible to
discern, at a glance, from true blank or white space. (The truly disheartening fact about this figure is that it is used as a model in a textbook.)

![Chart 5: Branch Store Sales by Departments, January, 1980. Source: Primary](image)

**Figure 10: Bar Graph in which Space between Bars Is the Same Width as the Bars, Resulting in Optical Illusion**

**CONCLUSION**

As I end this brief commentary, I am reminded of an event that took place when I first put graphics formally into my technical-writing syllabus. Visual aids were assigned as part of the final report. One student turned in a well-prepared chart: it was neatly done and looked splendid in its four-color glory. Unfortunately, it failed to make any point whatsoever. When the chart received an F, he came to me in a state of bewilderment.

"I don't understand," he said. "The chart is beautiful."

"It doesn't have anything to do with the data," I replied.
"Oh," he said, "I thought all we had to do was show that we could make a professional-looking graphic."

I have never forgotten that incident, and, because of it, I always begin and conclude the graphics portion of my classes with three reminders:

1. A graph or chart must support, enhance, dramatize, or simplify the information being presented, or it has no excuse for being.

2. The information on the graph or chart must be clearly, easily, and quickly discernible, or the graph or chart is virtually worthless.

3. The graph or chart must be suitable not only to the material, the purpose, and the audience, but also to the method of presentation.

I also remind my students that the principles they have learned about good technical writing hold true for the language of graphics as well and that, though a picture may be worth even a zillion words, every graphic must be clearly labeled and titled and must be explained in the accompanying text.

Since we teachers are comfortable with the rhetoric of the written and spoken word, with the terminology, syntax, and semantics, perhaps the easiest way to discuss and evaluate graphs and charts is to use the same rhetoric and the same terminology to as great an extent as possible. This discussion has been designed to help you do just that.
NOTES

1 By syntax, I mean the way in which the lines and marks are arranged; by semantics, I mean the denotative and connotative meanings of the lines and marks, and the meanings of their arrangement.


3 Conventionally, time is always plotted on the horizontal axis.

4 Students, for example, have a habit of running axes from 0 to 100 even though all the data points may be between 40 and 70. Be prepared.

5 Data from Weekly Epidemiological Record, no. 2 (13 January 1978).

6 Reproduced with permission from the Fort Wayne [Illinois] News Sentinel.


ACKNOWLEDGEMENTS

Thanks are due Dr. Joel Whitman, Director of Educational Media, University of Alabama; the University of Toronto Press; and A. J. MacGregor, author of Graphics Simplified: How to Plan and Prepare Effective Charts, Graphs, Illustrations, and Other Visual Aids (1979). (This little book is a handy, succinct reference. The University of Toronto Press has generously supplied copies of Graphics Simplified whenever I have presented graphics workshops to teachers of technical writing. This article grew out of those workshops.)
A PRIMER FOR TEACHING COMPUTER GRAPHICS

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INTRODUCTION

The computer's primary purpose has been, and is, the rapid manipulation of large amounts of information. In the past the output of the manipulations was given as lists of numbers. The numbers were frequently organized by hand and shown in the form of graphs, charts, or drawings. This operation, tedious as it was, was deemed necessary for the interpretation of the output. The advent of computer graphics allowed a user to choose data output, or the immediate generation of an appropriate analog output (graph, chart, or drawing). Computer graphics also allowed for the entry of any data, obtained from experiments, other computers, or other means, for the acquisition of graphical output.

Traditional graphics (paper and pencil or pen) depended for their effectiveness on the skill and intelligence of the producer. Computer graphics depends on intelligence of two persons: the programmer creating the software and the user of the system. Individual artistic skill is replaced by the computer hardware and peripherals.

Computer graphics has well defined advantages over manual techniques, as well as some limitations. Criteria for comparison are quality, flexibility, speed, and cost. Our comparison will assume that the user of computer graphics is not a programmer capable of changing software (an English teacher perhaps) and that the computer equipment and drafter is in the moderate price range.
The quality of computer graphics is consistent, with control existing at most over paper and pens. Lettering, relative size, and location of elements are fixed by the software and hardware. For manual drawing of graphs the major limitation on quality is the ability of the individual, although availability of hardware (lettering sets, press-on lines and letters) is also a parameter.

The flexibility criterion best shows the differences of the two modes. The drafter can choose from an infinite variety of representational styles while the computer is limited to output programmed for it. If a system does not include log-log graphs, virtually nothing short of reprogramming will change it. The computer shows its advantage when changes on a graph are required. If either an error is to be corrected or a different style of representation is deemed better, the manually drawn graph, except in the cases of the most minor changes, must be completely redrawn. Even for the poorest computer system, the change can be made in minutes and the graph redrawn. On better systems, a variety of representations may be viewed on a screen before the final drawing is made.

The computer is much quicker than any drafter. A study at Texas A & M by Groom, Hartman, and Wilkel showed that students are ten times faster on the computer than on the drawing board. This speed considered, the computer becomes cost effective. Adequate graphics can be produced by systems costing less than $2,000 with a maintenance cost of $200/year. An entry clerk can be hired for less than half the cost of a drafter. Hence, for even moderate use, computer-generated graphs become quite cheap.

The manual drawing of a graph is in the control of one person, who makes all decisions and renders the final product. Computer generation of graphs involves the interactions of two individuals. The programmer decides, within the parameters of the system, what a user would want and writes appropriate software. The user then interacts with the software to produce the best graph. The remote interaction would be difficult were it not for the rather standardized requirements of technical communication and the flexibility of a good system.

DEMONSTRATION AND DISCUSSION

Three output devices have been chosen to demonstrate capabilities and shortcomings of computer graphics: a plotter, a dot matrix printer, and a terminal. All three devices can be
driven by a main frame system, a mini-computer, or a microcomputer. The software package chosen for demonstration meets minimum requirements for production of graphics to be used in teaching a technical writing course.

The most general requirement for programs is that they be able to draw line graphs, bar graphs, and pie charts. More specific requirements include the following:

1. Entry of title and axis labels
2. Control over tic spacing and labeling
3. Multiple graph production with variety of shading, line type and data symbols
4. User friendly prompts
5. Ease of change of parameters
6. Variability of size and proportions of output graph.

Since the computer here acts only as a tool, all criteria for evaluating graphs remain conventional. The following examples of how data can be treated by the computer show the capabilities of some computer graphics systems.

Example 1

The cost of owning a car has been broken down into depreciation and maintenance (including insurance) as follows:

<table>
<thead>
<tr>
<th>Age of Car (Years)</th>
<th>Depreciation (Dollars)</th>
<th>Maintenance (Dollars)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1400</td>
<td>570</td>
</tr>
<tr>
<td>2</td>
<td>1000</td>
<td>560</td>
</tr>
<tr>
<td>3</td>
<td>700</td>
<td>550</td>
</tr>
<tr>
<td>4</td>
<td>500</td>
<td>610</td>
</tr>
<tr>
<td>5</td>
<td>400</td>
<td>670</td>
</tr>
<tr>
<td>6</td>
<td>300</td>
<td>880</td>
</tr>
<tr>
<td>7</td>
<td>200</td>
<td>920</td>
</tr>
</tbody>
</table>

The data can be shown by a comparative bar graph, Figure 1. The data can also be shown as a stacking graph, Figure 2, with horizontal reference lines added for ease of data identification. Two simple operations are required to change Figure 1 to Figure 2. The decision to highlight trends in depreciation and maintenance, Figure 1, or total cost, Figure 2, can be made after graphs are viewed.
Figure 1: Comparative Bar Graph

Figure 2: Stacking Graph
The decision for horizontal lines can also be made and then the lines deleted if they do not seem warranted. The density of shading can also be controlled. Although these figures have been reduced to fit the pages of this anthology, the degree of legibility of labels is typical of dot matrix printers.

Example 2

The number of students in various curricula at Anywhere State College in 1980 and 1981 is as follows:

<table>
<thead>
<tr>
<th>Curriculum</th>
<th>1980</th>
<th>1981</th>
</tr>
</thead>
<tbody>
<tr>
<td>Liberal Arts</td>
<td>502</td>
<td>323</td>
</tr>
<tr>
<td>Business</td>
<td>351</td>
<td>473</td>
</tr>
<tr>
<td>Nursing</td>
<td>308</td>
<td>310</td>
</tr>
<tr>
<td>Science</td>
<td>183</td>
<td>192</td>
</tr>
<tr>
<td>Social Science</td>
<td>95</td>
<td>73</td>
</tr>
</tbody>
</table>

The data can be represented as a comparative bar graph shown in Figure 3 or as pie charts shown in Figure 4.

![Figure 3: Comparative Bar Graph](image-url)
While the bar graph (Figure 3) shows the trend in each curriculum, it does not show the percentage of students in each curriculum. The pie charts (Figure 4) show the percentages clearly, but year to year comparison is more difficult. Again, both graphs can be generated and viewed with minor changes before
a decision as to preference is made. In addition, percentages or actual numbers may be used in the pie chart.

Example 3

Professor X has run a series of tests and has recorded data for stress concentration factors for flat bars with holes in them. Professor X wants to show that work by Professors Y and Z, fellow researchers, verifies his findings. The data is as follows:

<table>
<thead>
<tr>
<th>r/d</th>
<th>Stress Concentration Factor (K)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Prof. X</td>
</tr>
<tr>
<td>0.1</td>
<td>1.80</td>
</tr>
<tr>
<td>0.2</td>
<td>1.62</td>
</tr>
<tr>
<td>0.3</td>
<td>1.50</td>
</tr>
<tr>
<td>0.4</td>
<td>1.44</td>
</tr>
<tr>
<td>0.5</td>
<td>1.40</td>
</tr>
<tr>
<td>0.6</td>
<td>1.37</td>
</tr>
</tbody>
</table>

Three separate curves on one graph can show the data (Figure 5).

Figure 5: Line Graph
While the choice of solid line for the principle data does highlight that data, the corroborating data of Prof. Y and Z is distracting. The data points alone are important to support Prof. X's research. Prof. X's curve with Y and Z's data can be represented by connecting only the primary data, as shown in Figure 6.

The graphs given so far have been produced using a Tektronix² 4662 plotter with a modified Tektronix "Data Graphing" software package. For this program script size and font cannot be varied. The size of the graph can be controlled, as can the shading and point and line symbols. The key is automatically printed. In Figures 5 and 6 the diagram has been added using a "Slidemaker" package.

For contrast, a comparative bar graph has been plotted using an Apple³ computer with an Integral Data Systems⁴ printer. This is shown in Figure 7. Figure 8 has been printed on a Digital⁵ Decwriter II printer without graphics capability. Quite obviously, terminals like this are not intended for graphics.
Figure 7: Apple Computer with Integral Data System.
The CRT shows the columns in different colors,
but the system has no other means of differentiating columns.

Figure 8: Printer Without Graphics Capability
HARDWARE

Computer graphics can be accomplished by means of any mainframe, mini- or micro-computer. Generally, the larger the computer the higher the cost, the more rapid the production, and the greater the versatility. The quality of the output is controlled by the peripheral drawing device and supplies. Since businesses are very interested in graphs, a wide variety of software exists for all sorts of combinations of computers and plotters/printers.

The output device dictates the quality of the graph. Plotters generally start at $1000 and range to "the higher brackets." Plotters, essentially pen and paper, with one or both elements capable of moving, give the highest resolution.

Hard copy units, with somewhat lower quality, form the next level of the peripheral spectrum. They reproduce everything that appears on the screen on paper. Size control is generally not available. Dot matrix printers with graphics options (firmware) are in the lowest price level. An excellent discussion of peripherals appears in Foley and Von Dam's book on interactive computer graphics. Some similar information also appears in Giloi, Prince, and Ryan. While these books are written primarily for engineers and computer specialists, introductory chapters are jargon free and offer an introduction to a broad spectrum of systems. The discussion of the interaction of various parts of a computer graphics system is particularly recommended to non-technical readers.

SOFTWARE

Since computerized graphing was mainly developed for the business community, the prompts in the programs are user-friendly (plain English). In addition, most software allows quick and easy modification of graph components. The menu of a software package lists all units of the program available to the user. A typical menu is given in Figure 9.

Activation of the appropriate key allows the user to enter that part of the program. A very useful feature of this menu is that a "free run" may be done in order to quickly scan examples demonstrating capabilities of the system.
IMPLEMENTATION IN COURSE

The incorporation of computer graphics into a technical writing course requires lead time. Since technical writing courses are generally taught in schools with engineering or technology curricula, the presence of a computer is certain, and a plotter, virtually certain. The problem then becomes access to the computer and plotter and acquisition of, or access to, an appropriate software package. Should access to an existing system be denied, implementation requires a minimum outlay of $2,000.

The lead time is required not only for political reasons, but also for faculty familiarization with the system's capabilities. They must be prepared to teach students how to use the system, to provide a manual or guide if the software is not user-friendly, and to base judgement of students' output on their knowledge of the limitations of the software.

While this chapter has focused on graphs, students can also be encouraged to use the computer for other diagrams and drawings. The same warnings apply: students and faculty must be aware of system limitations.
NOTES


2Tektronix, Inc., Beaverton, OR 97077

3Apple Computer, Inc. Cupertino, CA 95014

4Integral Data Systems, Milford, NH 03055

5Digital Equipment Corp., Maynard, MA 01754


10C. Eng and G. Laroff, 4051 Data Graphing and Presentation Demo, Tektronix, Inc.
TEACHING GRAPHICS IN TECHNICAL WRITING CLASSES: AN ANNOTATED SELECTIVE BIBLIOGRAPHY

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INTRODUCTION

The following annotated bibliography is designed to familiarize technical writing teachers with selected secondary material related to graphics. The bibliography's primary purpose is to acquaint traditional English teachers with a subject not usually found in their training curriculum and to assist them in designing effective classroom presentations.

The bibliography is divided into four sections: textbooks; graphs, tables, diagrams, and charts; photography; and classroom applications. The section which deals with technical writing textbooks is devoted only to their chapters on graphics or visual aids.

TEXTBOOKS


The chapter is divided into two sections: layout and visual aids. Layout, as it should be, is treated as a visual aid. The authors discuss white space, margins, line spacing, paragraph spacing, and headings. The section on visual aids covers design, placement of charts, graphs, and diagrams.

Fears introduces the student to tables, bar graphs, circle graphs, line graphs, organizational charts, flow charts, pictures, and drawings. The illustrations which accompany each area are clear and understandable. This chapter is a good place to start for the teacher who needs a basic review of visuals very common in technical documents.


Hirschhorn's chapter discusses the usual tables, graphs, etc., but understandably, as the book's title suggests, the content of most illustrations and examples are more technically and scientifically oriented than many technical writing texts. Hirschhorn also discusses line drawings, sketches, and photographs, which are valuable aids but are not discussed in many texts. Adding to the technical theme of the chapter is a section on control panel language which could be useful to a student desiring a career as a technical writer or industrial designer.


Kolin introduces maps, pictographs, organizational charts, and drawings in addition to flowcharts and graphs. The section on photography may be helpful to the teacher in designing a classroom presentation on the subject. Probably the most beneficial segment of this chapter to the teacher as well as the student is the glossary that concludes the chapter. Included are the most commonly used general terms associated with graphics with which the teacher should be familiar.

Weisman, Herman M. "Graphic Presentation in Technical Writing." In his Basic Technical Writing. 4th ed. Columbus: Merrill, 1980, 177-212.

Weisman begins with a brief history of technical illustrations, citing that the ancient Egyptians were among the
first to use an illustration to explain a technical process. Diagrams, both schematic and layout, are discussed in addition to the basic graph, chart, and table. The illustrations which accompany the diagrams in particular are well chosen and serve as nice examples. The use of cartoons, a topic left out of most textbooks, is included here. He illustrates how highly technical matter can be demonstrated by cartoons and how they are very helpful in attracting the interests of young readers.

GRAPHS, TABLES, DIAGRAMS, AND CHARTS


This is a very in-depth survey of charts and their mechanics. There are checklists and examples for almost every design. The glossary and bibliography may also be useful.


Hanna gives editing advice for visuals in order to limit reader confusion and insure clarity. The teacher will find these hints extremely helpful in instructing placement of visuals, size, format, proper typeface, titles, and content.


Graphics Simplified was written specifically with the teacher of graphics in mind. The book introduces and prepares the teacher, otherwise not knowledgeable in the field of graphics, to prepare teaching material. Charts and graphs are discussed in detail with good examples in the first two chapters. The remainder of the book deals with media specifications and illustrations—interesting, but probably not useful to the teacher who is instructing the uses of graphics in reports and documents.

Chapters on pictorial charts, including a discussion of symbols, are nice additions to the usual instructions on graphs, charts, and tables. Perhaps the most beneficial chapter of this book to the teacher is one dealing with audience analysis. Major categories discussed are audience size, level, rank, background, exposure, and bias. This chapter would not only be useful to the student preparing visuals for a particular audience, but also could assist the teacher in designing example visuals for the student audience.


This pocket guide to graphics has an excellent glossary. It offers a good overview of graphics from the standpoint of production mechanics. There is also a section on photography that may be helpful.


Selby's book is one in a series of self-teaching guides from John Wiley and Sons. The emphasis here is placed on the interpretation of graphs and tables rather than their actual construction. Chapters are divided into frames with each chapter building on its predecessor. One may want to take the author's advice and read the introductory chapter, then refer to the chapter which best suits your needs.


An excellent reference to any term or process related to the graphic arts. Pictures and illustrations accompany most of the terms.
PHOTOGRAPHY


This step-by-step introduction to photography is particularly helpful to the novice. Eisenstaedt's guide contains discussions on mechanics and devotes sections to lighting, special effects, and photo essay--among others.


This pocket guide features color pictures to demonstrate points of discussion.


This pocket guide is a must for the teacher interested in photography. The guide contains easy to understand instructions for taking the photograph as well as developing it. The visuals, which illustrate most discussions, are excellently done and serve well to assist the beginner in understanding the basic concepts of photography.


The chapters on the darkroom and basic equipment are detailed and informative. This is good introduction for the student or teacher.

CLASSROOM APPLICATIONS


Andrews describes how the student of technical writing, probably already accustomed to visuals accompanying the written document, may benefit from the presentation of the writing process through the use of visuals. Flowcharts are shown as examples of what seems to be a very logical idea. Motivation,
information, signage, and aesthetics are discussed as purposes for this means of classroom presentation.


How the brain perceives visual data through mental images and word strings called "propositional knowledge" is discussed here. Helpful to teachers is the idea that visuals serve as integral parts of a text," and along with metaphorical language can introduce the student to a "third way of thinking."


Practical methods of teaching visual aids are the topics here. A section devoted to drawings, maps, tables, graphs, charts, and photographs. Under each example is a discussion of its purpose. Also attached is a list of assignments designed to familiarize the student with several types of graphic presentation.