Using Graphics Effectively

Office of Inspector General
Office of Evaluation and Inspections

Table of Contents

Introduction

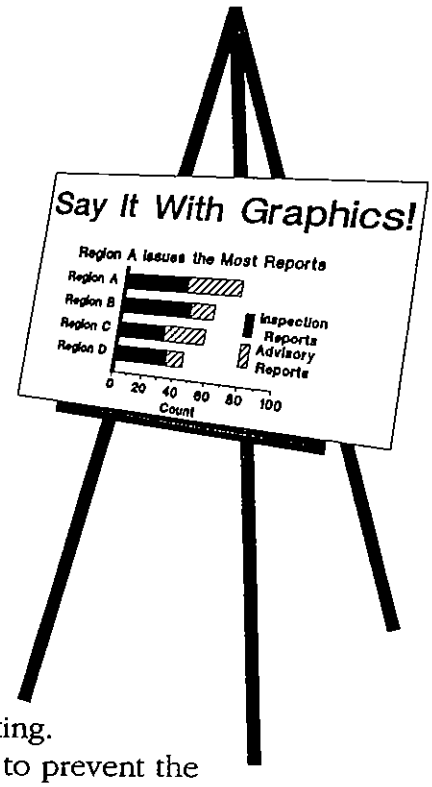
Graphics are valuable tools which can be used to increase the effectiveness of our reports or briefings. However, as with any tools, they must be used carefully and judiciously. A graphic's message should flow from the narrative and present information to decision makers as simply as possible. We must pay considerable attention to the purpose, message, and clarity of all graphics. Creating and using graphics is as much an art as it is a learned skill and often requires a lot of trial and error. Hopefully, this technical assistance guide will 1) provide an understanding of graphics fundamentals, 2) increase the effectiveness of your graphics, and 3) minimize graphics errors.

Unlike the first seven guides which were professionally typeset and printed, this guide was produced solely with OEI regional office resources. This was done to illustrate the utility of WordPerfect and commercially available graphics programs. All graphics were constructed using graphics programs such as Arts and Letters Editor, DrawPerfect and Harvard Graphics. These graphics were imported into WordPerfect and the document printed with a laserjet printer using typefaces available from Digital Typeface Corporation.

Development of this guide has been a collaborative effort involving many different people within OEI. Using preliminary work by Michael Hendricks of MH Associates, Kevin Golladay in the Dallas office authored this guide with assistance from other Dallas regional staff. Other OEI contributors were Bill Moran who provided overall direction for the guide, Dave Wright who provided editorial review, and regional and headquarters staff who provided draft review and comments.

The Power of Graphics

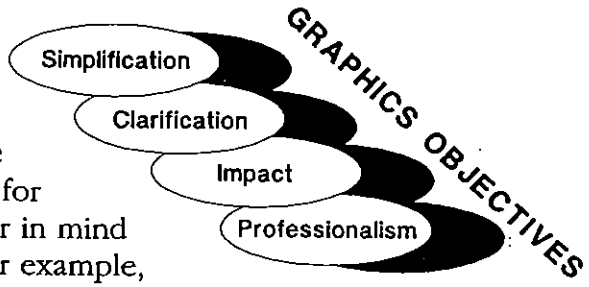
The primary goals of our reports or briefings are to present findings, make recommendations, and persuade decision makers to accept them. Thus, our reports or briefings must provide information which is easily understood and convincing. The problem facing each OEI project team is finding ways to accomplish this goal. In large measure, achieving this goal is affected by the inspection findings, the organization and flow of the report, the project team's writing style, the audience, and the project team's ability to formulate a convincing logical argument.



Graphics serve as a tool to aid us in accomplishing our written or oral presentation goals. Whether it is to enhance a report or presentation, or to help find hidden meanings in a mass of inspection data, graphics are beneficial. Graphics can efficiently communicate one or more ideas and will often drive a point home more quickly and convincingly than if we tried to describe our point orally or, particularly, in writing. Highlighting important information with graphics helps to prevent the audience or reader from missing or misinterpreting the message. Even if we only use graphics for our own inspection analysis, the different perspectives on data can be invaluable.

Since our memories and thoughts are largely pictorial, we often remember an image long after we have forgotten prose. Studies prove that we remember approximately 30 percent of what we see and only 10 percent of what we read. Defined as the simultaneous presentation of words, numbers, and images, a graphic can truly be worth a thousand words.

Graphics are useful because they can be used to achieve many general objectives in our reports or briefings, each serving to enhance our presentation of inspection results. Acknowledging these objectives helps to determine when and for what purpose graphics are needed. Bear in mind that these objectives are interrelated. For example, whenever a point is simplified with the use of a graphic, the point is also clarified.



Simplification

While we have a lot to say in our reports or briefings, our audiences often do not have the time or inclination to examine and synthesize this information. Consequently, we must present our audience with a digest or simplification adequate to sufficiently comprehend the message. Graphics can break up a complex message into its components while maintaining the quality of the whole. Such graphics are especially effective as a complement to the narrative. Additionally, graphics can be used to convey a lot of information while taking up only a small amount of space in the report. Since we work very hard to keep our reports brief, graphics are excellent tools for achieving brevity while still providing the reader with a significant amount of information which can be digested quickly.

Clarification

Audiences require information which leaves little doubt of the intended message. Without clear messages, audiences may be confused. Considering the complexity of the material often dealt with in inspections, narrative text of complex relationships alone may 1) obscure the point, 2) present excessive ambiguity, or 3) intimidate the audience. Graphics can often make narrative material clearer.

Impact

Our reports or briefings are just a small part of the volume of information our audience must deal with daily. Nothing is more boring to a policy maker than reports consisting solely of narrative. Policy makers are bombarded with too much narrative information to review and understand it all. Anything which may capture their attention and influence them to review a report will help. Graphics can be very beneficial in this regard. Graphics provide an alternative to tedious text and also serve to break up narrative in a way that provides the reader a refreshing break. Audiences often focus on and remember more a report or presentation which uses graphics effectively. Consequently, the addition of graphics may increase the report's or briefing's impact.

Professionalism

Graphics contribute to the credibility of a report or briefing for many reasons. Graphics present information in a precise and accurate manner. Often people are more likely to accept the validity of data in graphics over the same data in a narrative format. Narrative information often contains conditions, provisos, and explanations. It is far more difficult to "hedge" the meaning of a graphic's message.

As computer technology has allowed the incorporation of more and more visuals into presentations and written documents, expectations of audiences have risen. Audiences are beginning to expect sophisticated presentations and are likely to be bored by one consisting solely of words. A great orator like Winston Churchill or a great writer like Shakespeare could rivet an audience with only words; most of us need the help graphics offer.

Graphics Traps

When creating and using graphics, you should avoid several traps:

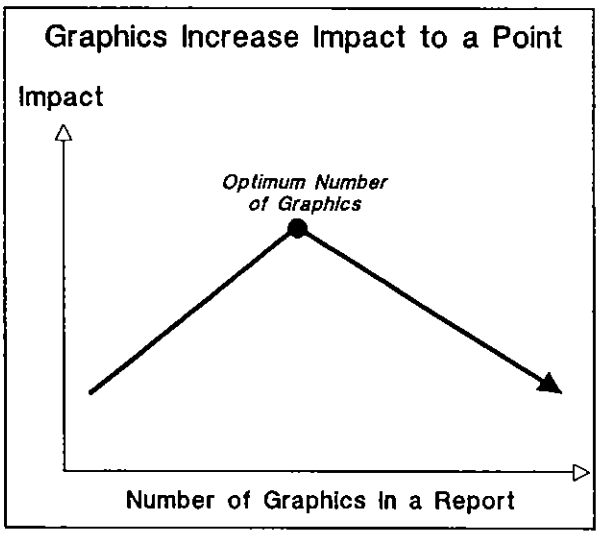
- *Sensory Overload*
- *Artistry Gone Wrong*
- *Missing Attribution*
- *Distortion*
- *Inconsistency*

Sensory Overload

Sensory overload occurs when too much information on a graphic confuses the reader. To avoid this, decide in advance which point you are trying to make, and then graph only those data which will emphasize the point. Graphics are usually best when they deliver one message per graphic in the most efficient way possible. Further, remember you don't have to use every feature available in a graphics program. Too many font styles, line widths, shading patterns, colors, etc. may confuse the reader.

The number of graphics used should also be considered. The quantity of graphics increases the efficient communication of information and interest of the reader ***only up to a point*** (the optimum point). Beyond this point, as Figure 1 shows, additional graphics have a negative rather than a positive effect and they likely increase reader confusion. Remember, if we emphasize too many of the messages in our report with graphics, the result may be that we emphasize very little. Stated more succinctly, "to emphasize everything is to emphasize nothing."

Figure 1



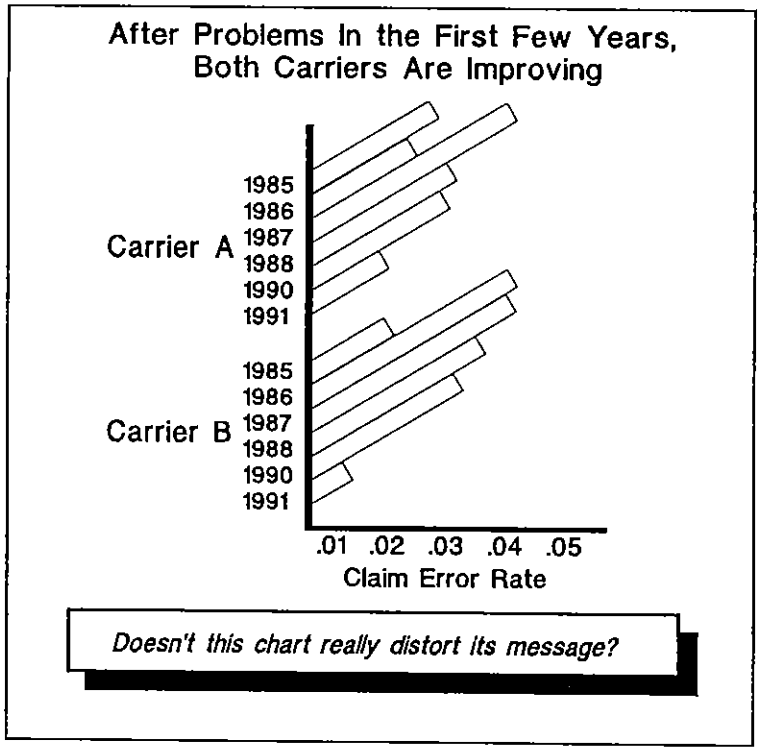
The number and complexity of graphics are dependent on the nature of the data and the sophistication of the audience. Some reports can benefit from many graphs

which augment the presentation of information while others should use very few or none. Determining the point at which graphics become confusing is difficult, primarily because a report's audiences vary in sophistication and graphics acceptance. Consequently, what may be beneficial to one audience may not be to another. Determining when to stop including graphics and whether a graphic is well designed are left to the common sense of the project and report review teams.

Artistry Gone Wrong

Another common trap occurs when we get so wrapped up in the artistry of a graphic that we lose sight of the analytic and presentation objectives. Figure 2 is an example of artistry gone wrong. A horizontal bar chart slants upward in such a way as to defy interpretation.

Figure 2



The person constructing the graphic might justify the distortion on the grounds that it matches an upward movement of prior graphs in the report and "catches the reader's eye." Unfortunately, this is a very weak justification for lessening the clarity of the graphic. Keep in mind that artistry is ***not*** a trap if it makes the graphic more effective by attracting and maintaining the reader's interest without obscuring the objectives of the graphic.

Missing Attribution

Each graphic within a report should clearly indicate the source of the information depicted even if the source of information is our own inspection data. While the text of the report might clearly indicate or allude to the source, readers may not have read

the narrative. Attribution is easily accomplished by including a footnote within the graphic. Failure to adequately specify a graphic's source can weaken or even negate its purpose. Further, failure to specify the source might cause the reader to question the validity or importance of other information within the report.

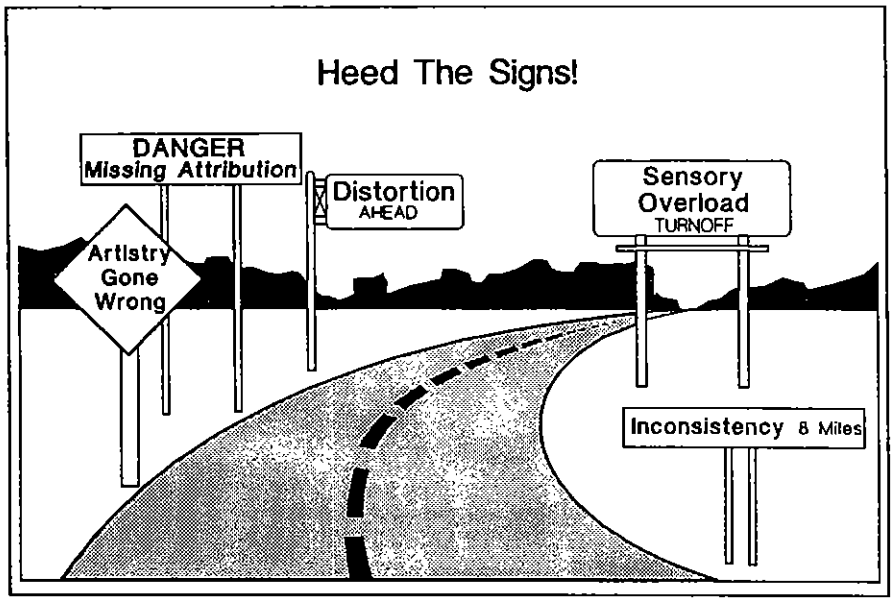
Distortion

You've heard the one about "lies, damned lies, and statistics." Well, the difficulty with statistics and graphics is one of awareness; you may not even know your graphic is lying or, more typically, distorting and complicating an idea. Software packages encourage you to "play" with data, not to understand it. Just because your package has a horizontal cluster bar chart format does not mean you should stick any data in the blanks and be done with it. You must first determine if the horizontal bar chart accurately reflects the "true" meaning of the data.

Inconsistency

Throughout an inspection report or presentation, a certain level of graphics consistency is critical. Graphics techniques should be the same in similar graphics. For example, equivalent graphics components (headings, axes labels, footnotes, data point labels) should all be the same size and font style from graphic to graphic (e.g., don't use a 12 point sans-serif title on one graphic and a 14 point serif title on another). Keep such items as shading patterns, line thicknesses, use of borders around graphics, and overall graphics sizes as equivalent as possible. If deviations are required, have a clear purpose for them. A lack of consistency will detract from the quality of a report or presentation. When inconsistencies exist, the reader may begin to question if inconsistencies also exist in the actual message of the graphic or report. Remember, above all, heed the warning signs and do no harm to a report or presentation with graphics. (See Figure 3.)

Figure 3



Steps to Effective Graphics

Because of the different uses and objectives of graphics, inspections staff must be able to use them effectively. Our graphical competence, like our written and verbal literacy, affects how persuasively we convey our important messages. This Guide presents seven steps for using graphics effectively:

1. *Determine the message*
2. *Decide what kind of graphics can be used to convey the message*
3. *Select the graphics type which best conveys the message*
4. *Construct the graphic*
5. *Check the graphic for accuracy*
6. *Pilot-test and revise the graphic, if necessary*
7. *Insert the final graphic into the report or briefing*

Additionally, this Guide discusses some differences between graphics which are better suited for written reports and those better suited for oral briefings. As we will see, graphics which strengthen a written report may actually weaken an oral briefing, so we must tailor our graphics to our medium.

Despite conventional wisdom, the most important tool for developing effective graphics is not the computer. The most important tool is our brain. The computer is a marvelous tool to translate our good ideas into striking reality, but only if we first have good ideas to translate. Simply because a computer generated a graphic does not mean the graphic will present a clear and analytically correct message. For this reason, the most important steps for creating and using graphics occur before ever touching the computer keyboard.

Before we discuss the steps to effective graphics, you may be wondering how to determine whether your report or briefing even needs graphics. As discussed previously, the fact is most reports or briefings could benefit from some graphics use. However, the question of what information, if any, in a report should be graphed depends on the nature of the information to be presented. Ideally, the most important messages in the report and information which could clarify an important point are likely candidates. What is often difficult is determining which are the most important points. Graphics options could easily be discussed or solicited during the inspection's story conference.

Step #1: Determine the message

The first step, and in many ways the most critical, is to determine our message. What exactly do we want to say? Or, more accurately, what do we want the viewer to learn? If we cannot state our message, we cannot even begin to design our graphic. Conversely, once we determine our message, excellent designs for our graphic often become obvious.

We can best clarify our message by writing it in one sentence. For example, "performance improved steadily until the 1987 legislative changes," "most complaints come from first-time beneficiaries," and "more experienced administrative law judges are more willing to grant extensions." Since each message implies certain types of graphics, knowing our message makes it possible to design graphics alternatives to text.

Having developed a compact message sentence, we can make it the actual title for the graphic. This will convey more information than the dry, uninformative alternatives of "Performance Over Time," "Sources of Complaints," or, worst of all, "Administrative Law Judge Experience and Willingness to Grant Extensions."

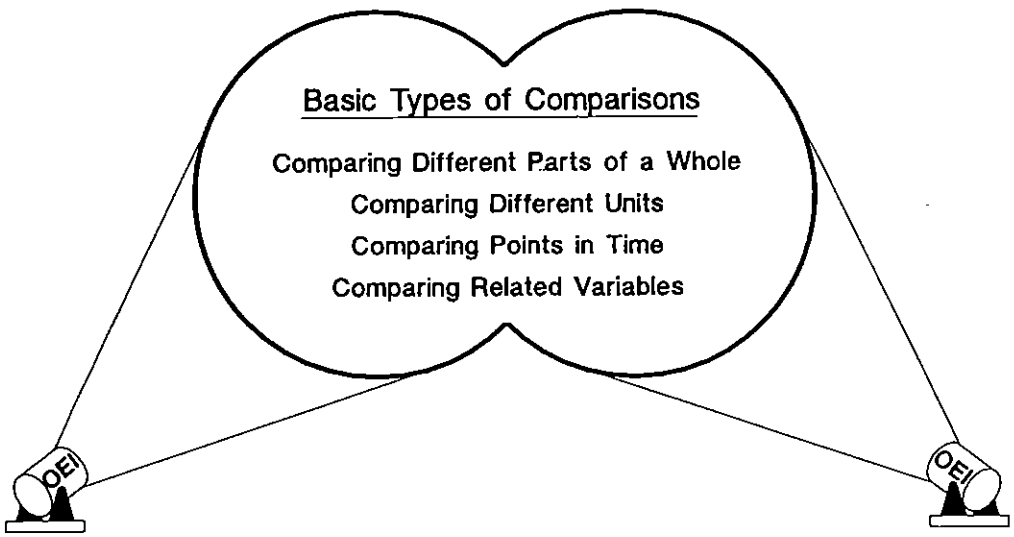
Step #2: Decide what graphics can be used to convey the message

An integral part of most types of graphics involves making comparisons. These types of graphics compose the bulk of traditional graphics (e.g., pie, bar, line) and will be referred to as "comparison graphics."

Several other types of graphics do not neatly fit under the category of comparison graphics or simply do not make comparisons using quantitative data. These types of graphics might serve such purposes as the expression of concepts or events (e.g., flow charts) or are simply intended to interest or affect the audience (e.g., pictorials). These types of graphics will be referred to as "specialized graphics."

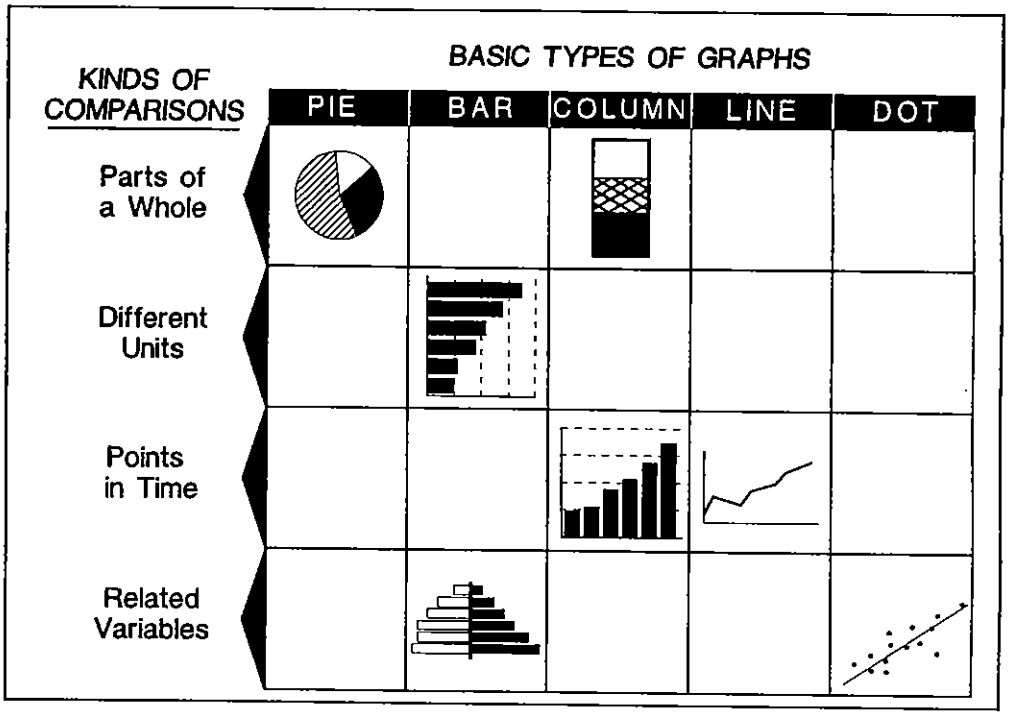
• Comparison Graphics

Technical Assistance Guide #5, Analyzing the Information Gathered, reminds us that comparisons are the essence of any analysis. Without comparisons, we may have a description, but we will not have an analysis. The question remains, "Compared to what?" Determining the proper comparison(s) is always one of the critical decisions of any analysis plan. For the purposes of this Guide, however, once this decision has been made and the analyses conducted, it may be obvious which types of graphics best present the comparison. There are basically four comparisons.



These comparisons imply certain types of graphics. Figure 4 depicts the most basic types of charts used when making different types of comparisons (a more complete discussion of graphics options is provided in a later section entitled Types of Graphics).

Figure 4



While these are the four main types of comparisons, we can create even more possibilities if we combine types or add new elements. The important point, however, is to realize that each message sentence implies a specific type of graphical comparison. Recognizing this fact and identifying the proper comparison for our message are critical steps in developing the most appropriate and effective graphics.

The following are a few key words to look for in the message to help identify the type of comparison.

Parts of the Whole:	*Percentage*	*Sum*
	Total	*Share*
	Ratio	*Proportion*
	Contribution	
Different Units:	*More than*	*Ranks*
	Range	*Fall into*
	Less than	*Higher*
	Equal to	*Lower*
	Better	*Worse*
	Frequency	*Distribution*
	How many	*How often*

Points in Time:	*Change*	*Decline*
	Decrease	*Grow*
	Increase	*Now/then*
	Rise	*Fluctuate*
	Fall	
Related Variables:	*Related to*	*Changes*
	Increases with	*Decreases with*
	Varies	

• Specialized Graphics

As discussed, some graphics serve a purpose other than strictly comparison. These graphics usually describe or explain something, visually affect the reader, or enhance comparison graphics. For example, flow charts are excellent vehicles to describe processes. On the other hand, pictorials and photographs can be very effective in catching the reader's eye and impressing a visual image on the reader.

Specialized graphics often require far more creativity than comparison graphics and few rules apply to many of these types of graphics. The limits are often defined only by good taste and accuracy. Creating some specialized graphics requires an "I will do whatever it takes, use whatever program it takes, and take whatever time it takes to create the graphic" attitude. As an example, to create a flow chart depicting a process, use a specially designed flow charting program (e.g., Easy Flow). If the flow chart is simple enough, some presentation graphics programs (e.g., Freelance or DrawPerfect) or drawing programs (e.g., Arts and Letters Editor) may prove adequate. However, since these programs were not specifically intended for flow charting, expect to spend considerable time and effort constructing the graphic.

Step #3: Select the graphics type which best conveys the message

We can often present our message in several ways; one of our most critical decisions is to select which graphic is best for our specific purposes. There is no simple formula for making this decision. The decision requires a careful blend of substantive, statistical, and artistic sensitivities.

We can, however, apply some useful criteria to each possibility:

- Which graphic is most accurate? Which one best conveys our message and only our message without distorting the truth?
- Which graphic is simplest? Which one conveys the greatest number of ideas in the shortest time with the least ink in the smallest space?
- Which graphic is clearest? Which one lets us most easily and readily see the message by emphasizing the data?
- Which graphic is most visually and artistically attractive?

In some instances, we may not be able to choose between two equally good graphics. Consequently, we can simply develop both concepts further and decide between the two after pilot testing each one on outside viewers. Remember, do not consider a graphic in isolation. It should contribute to the unity and balance of the report.

The story conference presents a good opportunity to brainstorm about not only how to write the information gathered during an inspection, but how to present it visually as well. Groups can often come up with better graphics ideas than an individual.

Step #4: Construct the graphic

Having selected the graphic to present our message, the next step is to construct the graphic. At the time this manual was prepared, OEI had no requirements dictating what graphics software must be used. However, DrawPerfect is suggested for many types of comparison graphics because of its compatibility with WordPerfect. (See Appendix B for a discussion of compatibility.)

Regardless of the graphics program selected, there are points which should be considered to ensure quality graphics. First, we must understand graphics basics. If you are new to graphics, you may be unfamiliar with some of the basic elements of graphics. Second, the type of graphics chosen must coincide with the capabilities of the graphics software (see section entitled "Graphics Software"). Finally, consider some basic tips on good graphics design (see section entitled "Graphics Tips"). Just because software can produce a graphic does not ensure the graphic's usefulness.

Step #5: Check the graphic for accuracy

After constructing the graphic and before others see it, sit down and carefully examine the graphic. Check the spelling, punctuation, capitalization, and overall appearance; most importantly, check for numeric accuracy! It is ironic how much time some people spend analyzing data and then fail to spend time making sure the right numbers actually make their way into the graphic. The time spent reviewing the graphic could save you embarrassment or loss of credibility.

Step #6: Pilot-test and revise the graphic, if necessary

Once we construct a graphic, does it convey our message as well as we hope? The only way to find out is to show the graphic to people unfamiliar with our findings. If possible, show them to people very much like the policy makers and program administrators who will be the audiences for our reports and briefings.

It is generally better to show copies of the graphic, rather than the originals. While an original looks better, in reality, most will receive a copy. One good strategy is to show a copy without the message title and ask "What does this graphic say to you?" Then show a copy with the title and ask, "Is this the message you saw?"

Based on viewers' reactions, we can 1) accept the graphic, 2) revise it as needed or 3) eliminate it from our report or briefing. While we may have spent countless hours developing a graphic, we should not allow that effort to cloud our viewpoint when reacting to graphics criticism. There is little to be gained by defending the purpose

of the graphic in the hopes of convincing the reader of the graphic's merit. Your investment in the graphic is insignificant in relation to the quality of your inspection report. If the criticism is valid, determine if the graphic can be salvaged by making changes. If not, drop it and attribute it to a lesson in trial and error.

Step #7: Insert the final graphic into the report or briefing

Perhaps the best way to think of graphics are as visual paragraphs. Like narrative paragraphs, each graphic should present a clear message, have each component (legend, labels, etc.) support this message, and be internally coherent. Also, as with all other paragraphs, the graphic should be integrated into the report or briefing at the appropriate place.

The best place follows immediately after the graphic's message is first mentioned in the text or during the briefing. When a person reads or hears, "As Figure x shows...," she wants to see Figure x then, not two paragraphs later or on the next page. This means that written reports may have some blank spaces at the end of some pages. This is not ideal, but it is better than forcing the reader to stop reading the message in order to search for a graphic.

Logistically, we develop written reports with WordPerfect and one or more graphics software programs (e.g., DrawPerfect). While WordPerfect provides a means to insert our graphics directly into our text, this step must be done carefully. Consideration must be given to achieving the best quality (especially for final reports). Specifically, if the graphic imported into WordPerfect does not appear equivalent to the same graphic printed directly from the graphics program to the printer (e.g., shading patterns distorted or fonts changed), you may consider "cutting and pasting" the better looking graphic into the final report.

WordPerfect offers two methods of incorporating graphics into the document. (See Appendix A for an example of how to import and manipulate graphics in WordPerfect.) Either you can physically retrieve and store the graphic within the document or you can specify the location of the graphic (graphic on disk option). If the graphic on disk option is specified, WordPerfect does not physically incorporate the graphic but rather, merges the graphic for printing purposes only.

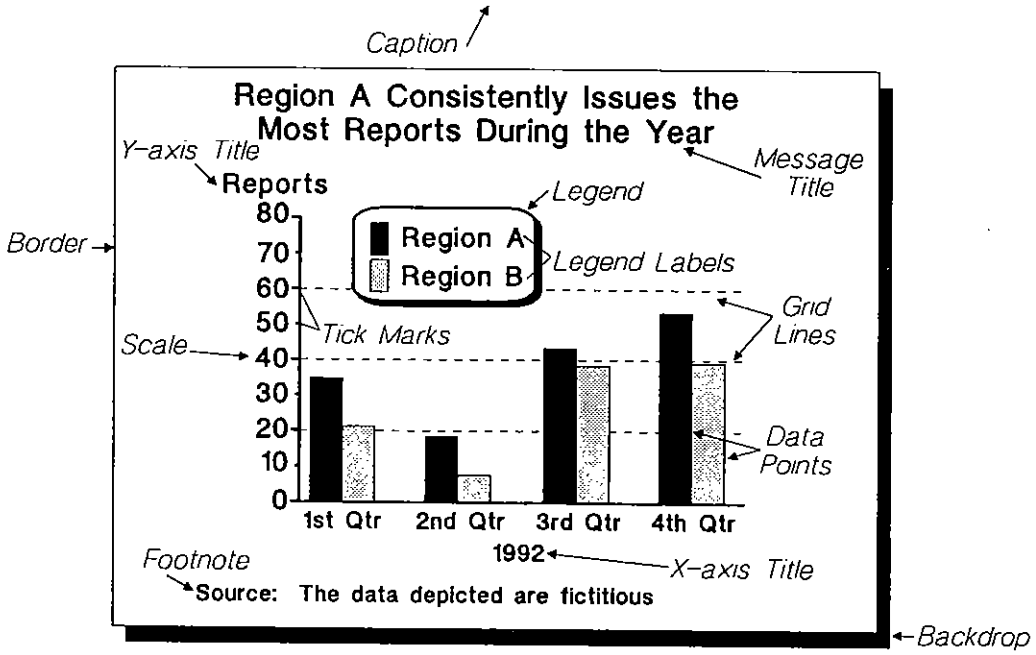
Each file imported into WordPerfect makes the file much bigger. Thus to make the document more manageable (smaller size file and less likelihood of encountering memory conflicts), use 1) the graphic on disk option or 2) do not import graphics into the document until you are ready for the final printing. You can create empty boxes and add the graphics file name later.

Remember to factor into the graph's construction the possibility that the graphic will be smaller or larger when imported into WordPerfect. Consequently, ensure that all text is readable and the graphic's size is acceptable.

Graphics Elements

Like a scientist who studies the basic building blocks of nature, we too must understand the basics of graphics construction to ensure that we create an accurate graphic. Although there are many types of graphics, certain elements are consistent throughout most. Figure 5 shows many of the basic elements.

Figure 5



Title

Graphics should almost always have a title. This title should specifically state the graphic's message. Usually this message is emphatic and unambiguous. For example, the title "Medicare Costs and Services," although accurate, leaves the reader wondering just what the author thought was the important message. However, the title "Medicare Costs and Services Continue to Rise" tells the reader immediately that the graphic is meant to emphasize the fact that both costs and services are rising.

Axes

Two types of variables are connected with most graphics: an independent variable and a dependent variable. In some graphics programs, these are referred to as the category and the value, respectively. The graphics program automatically assigns each variable you enter to the appropriate axis and plots the points. Which variable goes on which axis is determined by the type of graphic you instruct the graphics program to create. For illustration, column, line, high-low, and area charts mark the independent variables (categories) along the horizontal axis (X-axis). The dependent variables (values) are marked along the vertical (Y-axis). A bar chart reverses this

relationship, measuring the independent variables along the vertical axis and the dependent variables along the horizontal axis. The pie chart and the scatter chart have their own methods of expressing this relationship (see "Types of Graphics" in the next section).

Data Points

Pairs of related numbers (e.g., a person's income over several years) are known as data points. Each pair is one data point in that the plotting of that pair produces one point on the chart. The group of data points required to plot one line, or one set of bars or columns, on a chart is called a series.

Grid Lines and Tick Marks

Grid lines and tick marks help determine data values in the plot area. Tick marks associate a label with a position on a scale. Grid lines are useful for determining exact data values. However, grid lines and tick marks should be used sparingly to avoid cluttering the graphic.

Footnotes

Footnotes add useful comments such as the data source or explanatory statements. A reader or an audience is more likely to accept the validity of a graphic's data if they are aware of the data source.

Sizing and Positioning Labels

To be informative, a graphic must be labeled with words, numbers, and other symbols. To be effective, these labels should be kept to a minimum and their size and typeface should be consistent. There is a hierarchy to labeling: size, weight, and shading are proportional to the label's importance. The title, in the largest letters used on the graphic, should be centered at the top. If a subtitle is needed, to qualify or support the title, it is placed beneath the title in smaller or lighter letters. Labels for lines, bars, and segments are next in importance, followed by the horizontal and vertical grid labels and the axis titles. Preferably, axis titles should be printed horizontally. The X-axis title is centered below the axis; the one for the Y-axis should either be centered on the axis or placed just above it. The units of measurement on the value axis should be clearly identified (e.g., millions of dollars). Footnotes should be in the smallest lettering used.

Borders

Your graphic should stand out from any surrounding text. Whether this is accomplished with borders or the judicious use of white space, the more the graphic is distinguished from its background, the greater the impact. The border or white space acts like a frame on a painting. It keeps the viewer's attention focused on the material inside of it.

Fonts

Most people never think much about the fonts used in a document or graphic. Some are simply not consciously aware of the influence and persuasive qualities of type. The size, weight, shape, and structure of a typeface can either engage or repel an audience or reader. Typography is the art of selecting and positioning fonts to carry particular meaning and should be considered in report and briefing graphics, where every word carries a lot of weight.

Fonts are defined by the shape of the letters. There are basically two main font types — serif (e.g., Times Roman and Dutch) and sans-serif (e.g., Swiss and Helvetica). Serifs are those little crosslines at the ends of letter strokes, designed to help readers follow lines of type across the page. The serifs form a path along the baseline the type rests on, drawing our eyes through dense areas of text. We are use to reading serif type in books and newspapers.

Sans-serif fonts lack the little crosslines. For years, we have read sans-serif type signs, graphics, and headlines. Sans-serif appears to be the font of choice for brief, important messages while serifs are the choice if considerable text is required.

Especially in briefing charts, serif fonts can look rather awkward and unfinished in the typical text slide or chart. However, serif fonts are preferred in the following situations:

- When you must include quite a bit of text on graphics (however, lots of text should be avoided on briefing charts).
- If you have a need for large capital letters or numbers as a design element. The serif type can evoke authority and classical design of the printed page.

Be sure to give sans-serif fonts plenty of room to display their form (space between letters and words) and create a spatial balance. Steer clear of setting more than one or two words of sans-serif type in all-uppercase, because it isn't easy to read or separate into individual words.

Types of Graphics

There are many graphics options to consider. Many choices are listed in the table below and described more fully in the following pages.

COMPARISON GRAPHICS

Comparing different parts of a whole

Pie	Shows parts of a whole (e.g., ratios) at a given point in time.
Sliding Bar	Compares different parts of a whole, provided the whole has no more than two segments.
100-% Column	Shows the relationship of a segment to the whole.
Pie-Bar	The bar provides further detail on the composition of one slice.
100-% Area	Shows the distribution. Each band is proportional to its contribution to the sum of the bands.

Comparing different units

Bar (Horizontal)	Ranks many similar items or shows trends over many time periods.
Segmented Bar (Horizontal)	Each segment indicates the value of an individual item while the length of the whole bar shows the total.
Clustered Bar (Horizontal)	Compares multiple items.
Deviation Bar (Horizontal)	Shows positive and negative values.
Range Bar	Displays fluctuation extremes by plotting a bar from an item's low value to its high value.
Histogram	Shows frequency distributions for two or more series.
Small Multiples	Compares different units using meaningful symbols such as circles varying in the extent of being filled.

Comparing different points in time

Single Line	Shows fluctuations in data over time or sharp trends/changes over time for frequency, range, and distribution comparisons.
Multiple Line	Compares multiple series fluctuations or trends.
Area	Shows cumulative totals and changes in volume over time.
Column (Vertical Bar)	Illustrates changes or growth over time.
Deviation Column	Shows positive and negative values.
Range Column (high-low chart)	Especially effective at showing fluctuating ranges over time.

continued

Comparing different points in time	*(continued)*
Stacked Column (segmented vertical bar)	Allows comparison of individual segments between bars and comparison of the full heights of bars.
Historical Timeline	Compares events at different points in time.
Comparing relationships between multiple variables	
Scatterplot	Compares time periods or individual items to establish correlations.
Paired Bar	Shows correlations between different series using the same x-axis, such as claims volume versus cost of carrier operations.
Bubble	Shows relationships among three variables.

SPECIALIZED GRAPHICS	
Flow Chart	Shows a series of activities, procedures, operations, events, ideas, etc.
Time Chart	Presents work schedules or plans.
Map	Presents information for a geographic location(s).
Text Chart	Highlights brief narrative (usually bullet text).
Table	Presents analytic data in rows and columns.
Pictorial	Displays information through pictures. Often used to interest the audience and highlight a message.
Pictograph	Enhances comparison graphics with symbols or images.

Comparison Graphics

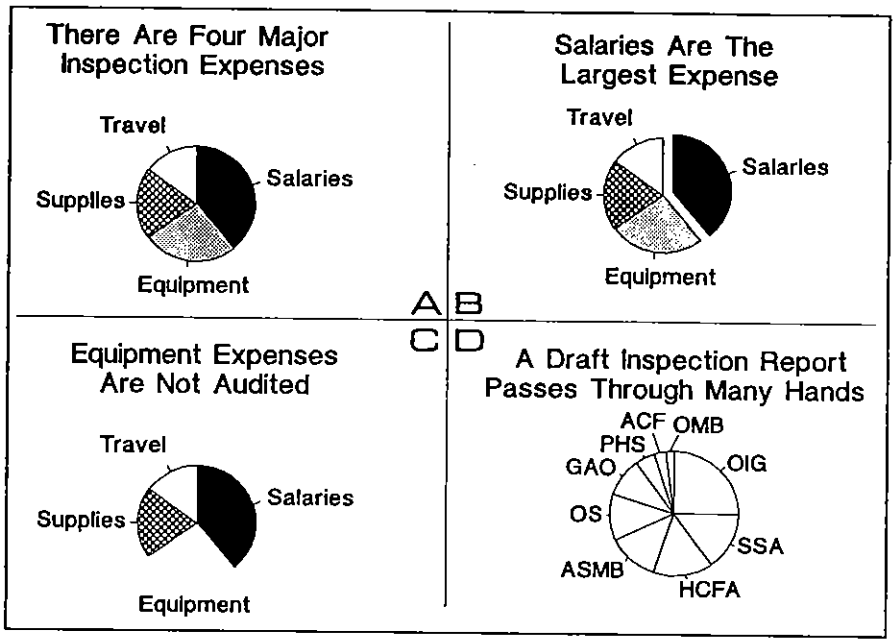
Comparing Different Parts of a Whole

• Pie Chart

Pie charts are the most common way to compare different parts of a whole. Some people consider it easy to compare the relative size of segments because they all emanate from the same point. This is especially true if the graphic is constructed with segments rotating around the pie in order of size.

Figure 6 shows that a pie can be "intact" (A) or "exploded" (B) to emphasize one or more slices (salaries), that a slice can be omitted (C) to stress its absence (equipment expenses), and that many slices (D) can represent a splintered situation (organizations reviewing an inspection report and how long it takes to get comments back). This last pie can be effective occasionally, but it should be used deliberately, since it is usually best to display at most 5-6 slices.

Figure 6

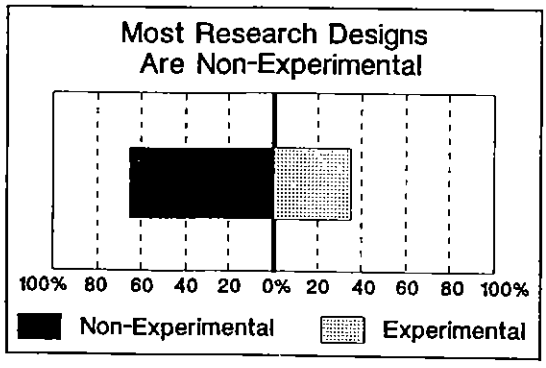


Some people dislike pie charts and argue that they should be used as little as possible. These people point out that to "decode" the relationships among different slices requires a viewer to compare either different angles where the slices meet or different areas of the pie-shaped sections, neither of which is an easy task for some people.

• Sliding Bar Chart

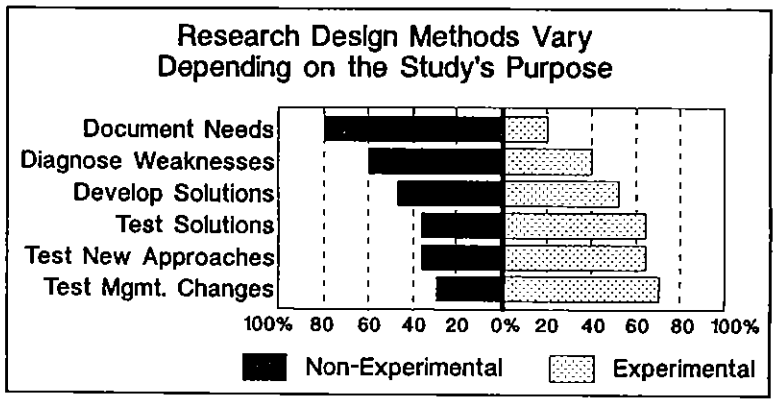
A sliding bar chart is another way to compare different parts of a whole, provided the whole has only two segments. This chart is created by dividing the graphic into two sides, each representing one condition or the other, and by displaying a bar which "slides" across the mid-point rather than being anchored to an X- or Y-axis. The proportion of the bar which rests inside each half of the chart illustrates the relative division of the whole. Figure 7 shows that 65 percent of all research studies used non-experimental methods, while 35 percent used experimental methods.

Figure 7



In the same way, sliding bar charts become considerably more interesting and useful when more bars are added. Figure 8 shows that Figure 7's 65-35 percent balance of research designs varies depending on the purpose of the study. Studies to document needs are heavily non-experimental (80 percent), while studies to test management changes were experimental (70 percent). Studies for other purposes show intermediate mixes of research designs. Comparing the positions of the different bars provides an immediate and intuitive grasp of the way each study's purpose "tilts" its research orientation.

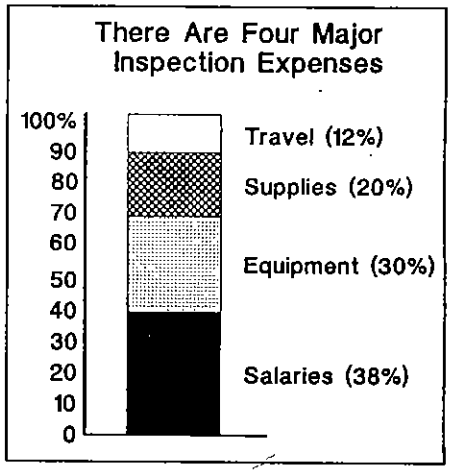
Figure 8



• 100-percent Column Chart

In 100-percent column charts, also called 100-percent segmented bar charts, the values for the segments of each bar are in percentages and add up to 100 percent. The 100-percent column chart is essentially the same pie filling re-baked into a rectangular pan. (See Figure 9.) Several 100-percent columns can better portray the movement of time than a series of pies. People readily associate vertical bars with time series data. The arrangement of vertical bars moving from left to right corresponds better with the onward movement of time. A 100-percent column chart is decoded by judging the height of each section; studies have shown that we are more accurate at this task than we are at different angles or different areas. In other words, a pie and a 100-percent column chart both encode the same information, but a viewer can more accurately decode the column chart, especially if several columns are used. Additionally, we can help the decoding process by presenting the largest segments in order from the bottom of a column chart and clockwise starting at noon on a pie chart.

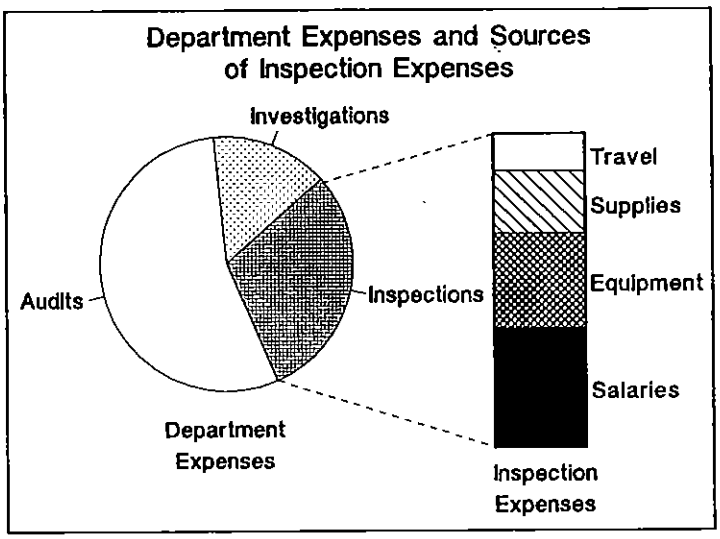
Figure 9



• Pie-Bar Chart

The pie-bar chart combines a pie chart with a 100-percent column. (See Figure 10.) A single slice of the pie is sub-divided into parts in the form of a 100-percent segmented bar chart. This pairing is popular for displaying any data where one data set is further broken down into its components. Components should be ordered from the largest to the smallest. The slice which is broken down can be intact as shown in Figure 10 or exploded from the other slices.

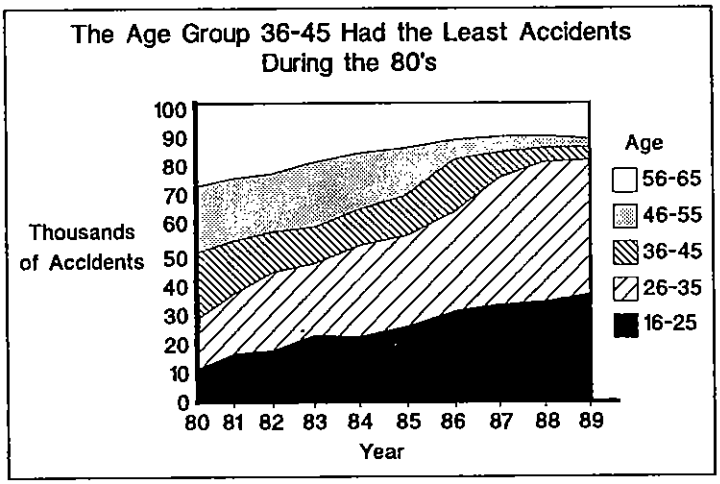
Figure 10



• 100-percent Area Chart

100-percent area charts show component comparisons, usually in conjunction with time series data. (See Figure 11.) The band representing the values for each period is merged into one broad, sweeping band, giving a sense of the whole. In contrast to the pie or bar charts, the shape of each area is usually very irregular and makes it difficult to compare bands with any exactness.

Figure 11

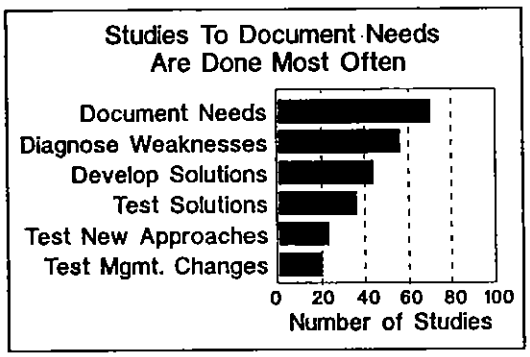


Comparing Different Units

• Bar Chart

To compare the relative contribution of different units to the total score, we use the graphics discussed above. However, to compare the absolute scores for each unit, bar charts are most common. Figure 12 shows that 1) these bars are horizontal to avoid suggesting a time dimension and 2) bars should typically be ordered.

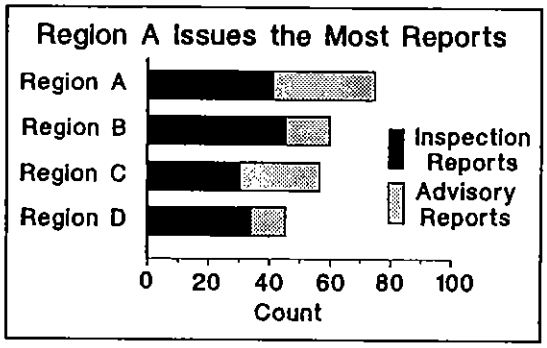
Figure 12



• Segmented Bar Chart

Segmented bar charts (sometimes called stacked bars) divide a bar into multiple parts. (See Figure 13.) Each segment indicates the value of an item while the length of the whole bar shows the total. Using this type of chart one can compare both individual segments between bars and compare the full lengths of the bars. Segmented bar charts can be formatted similarly to 100 percent column charts; each whole bar would then be of equal length and segments would represent percentage relationships.

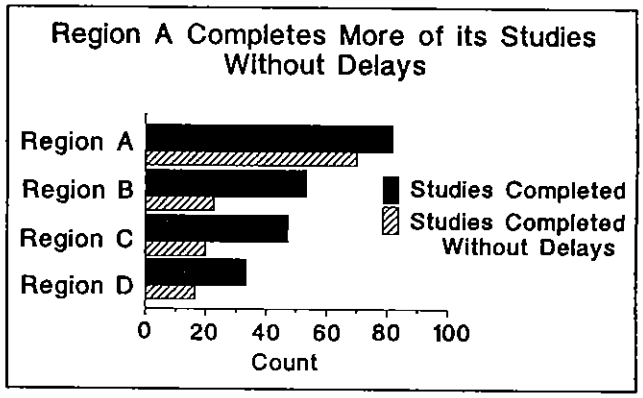
Figure 13



• Clustered Bar Chart

Like the segmented bar chart, clustered bar charts, sometimes called grouped bar charts, compare related sets of items. (See Figure 14.) This type of chart focuses attention on comparisons within each group rather than between groups. One disadvantage of this chart is that it must often be drawn in a large vertical size in order to make each individual bar a reasonable width if there are many groups. The number of bars in a group should be kept to four or less.

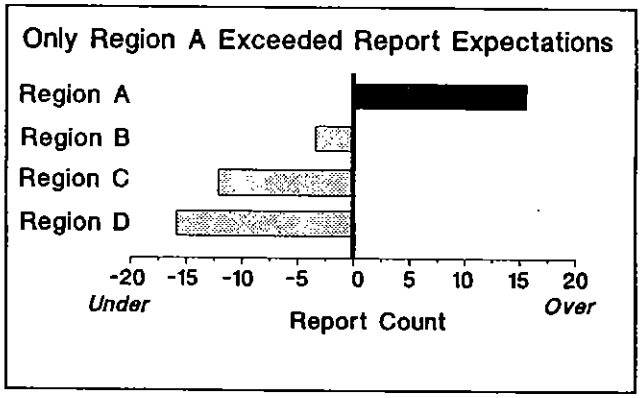
Figure 14



• Deviation Bar Chart

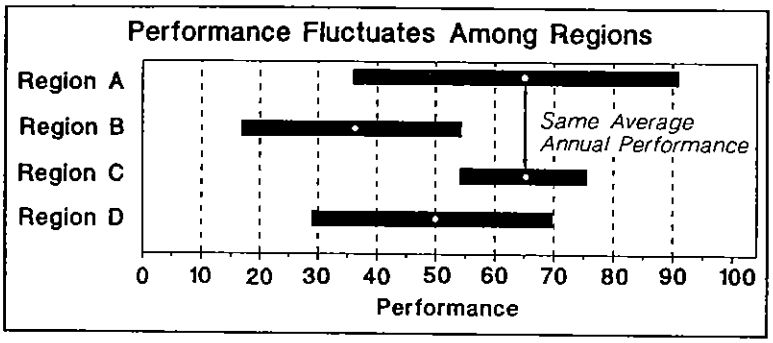
Deviation bar charts use the same raw data as a typical bar chart. However, the starting point for each bar is a single meaningful number such as 1) the overall mean score of all units, 2) the overall expected score across all units, 3) a minimum level of acceptable performance, or 4) zero. (See Figure 15.) With this new score as the starting point, some units will now have positive scores (or "residuals") while other units will have negative scores. The deviation of these residuals around the new starting point shows which units are above or below.

Figure 15



• Range Bar Chart

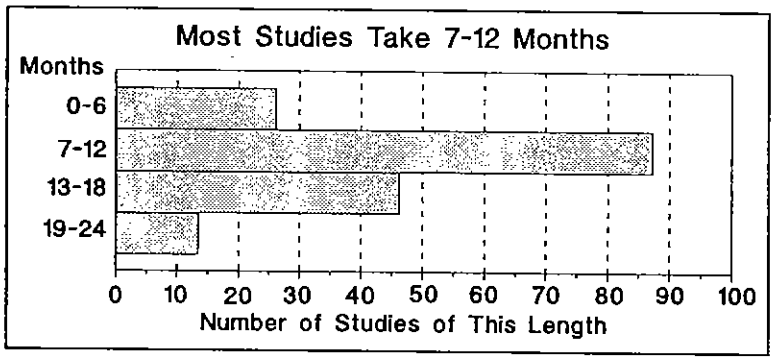
Figure 16



Range bar charts, unlike standard bar charts which show average or cumulative performance, show the variability of that performance. Figure 16 presents the performance ranges for four regions over the past ten years. Performance is simply the percentage of regions rated below the specified region. Note that two regions (A and C) have exactly the same average annual performance, but they have widely differing variabilities. This important finding would be hidden on a typical bar chart of performance.

• Histogram

Figure 17

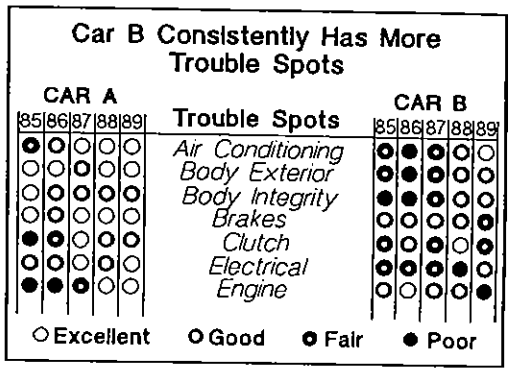


Histograms are especially effective for showing frequency distributions of data points among continuous segments. Basically, the histogram is just a bar or column chart with no spaces between bars or columns. The distinction between bar charts and histograms is based on the distinction between qualitative and quantitative variables. The values of qualitative variables vary in kind but not degree and hence are not measurements. For example, Region A in Figure 6 is a qualitative variable; while the regions were numbered A, B, C, and D they could equally well have been labeled with numeric values (1, 2, 3, etc.), but these values are only convenient codes. In contrast, values on a quantitative variable result from an actual measurement with some sort of "yardstick." For example, "months" to complete a study in Figure 17 is a quantitative variable. A good test for whether a variable should be regarded as qualitative or quantitative is whether you can identify a unit of measure (months, dollars, etc.). The width of each bar represents a single interval in the continuous range of numeric intervals along the vertical axis (bar histogram) or horizontal axis (column histogram). Figure 17 presents the number of studies taking different amounts of time to finish. Note that the overall distribution might change considerably if different size segments were used (e.g., increasing segments from 4 to 24 — one per month). When creating histograms, it is usually helpful to experiment with different-sized segments.

• Small Multiples

Small multiples are an especially powerful way to compare different units. Figure 18 presents the familiar Consumer Reports frequency-of-repair information for two fictitious automobiles for a six-year period. This graphic uses one simple symbol (circle) repeated many different times. Once a viewer learns the meaning of the small multiple, interpreting the graphic across repair dimensions, years, and different car models is easy.

Figure 18

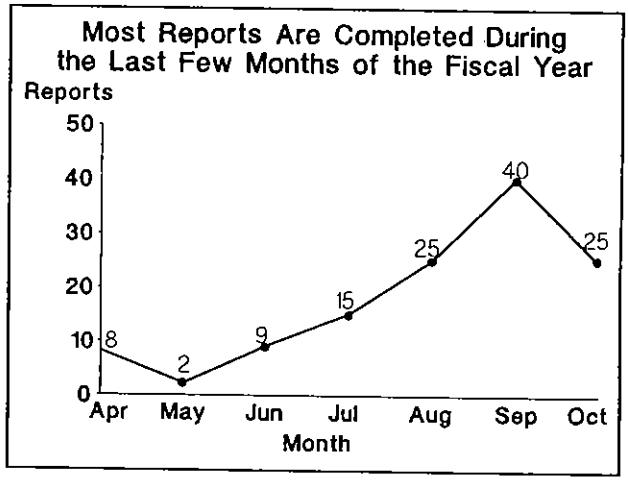


Comparing Different Points in Time

• Single Line Chart

The graphics discussed so far show data for one point in time, but often we need to display longitudinal patterns over time. (See Figure 19.) Line charts are the most popular graphic for these comparisons. Line charts are especially effective for presenting a large number of values in a compact space. For example, if we had data on the number of reports completed over the last five years by month, we could plot that data in a line chart. A bar chart, on the other hand, would either need to be very wide or have 60 very thin bars.

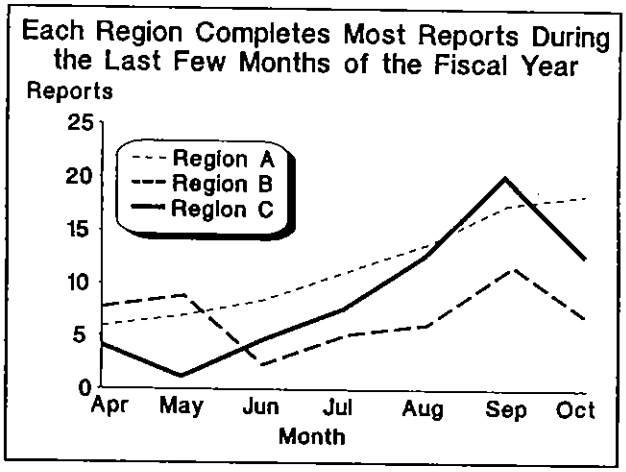
Figure 19



• Multiple Line Chart

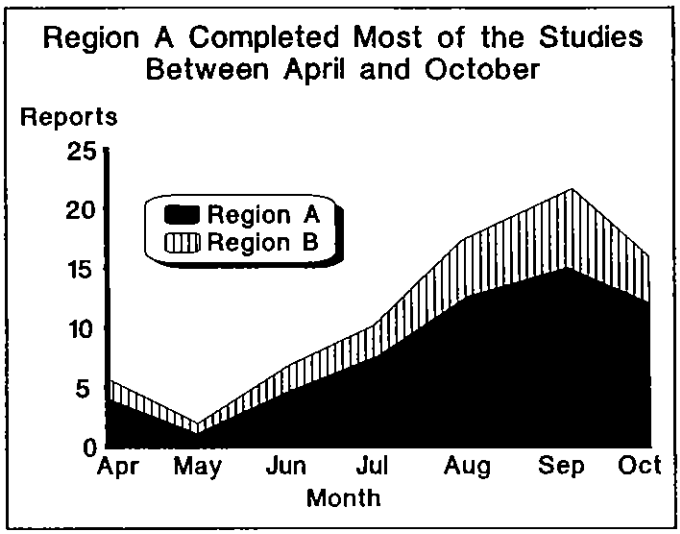
Like single line charts, multiple line charts are useful for displaying data over time. The only difference is that multiple line charts compare the change over time for more than one item, where each line represents an item. (See Figure 20.) More than 3-4 lines begin to clutter the graphic. Straight or curved lines can be fitted to the data points to make the overall trends more obvious.

Figure 20



• Area Chart

Figure 21

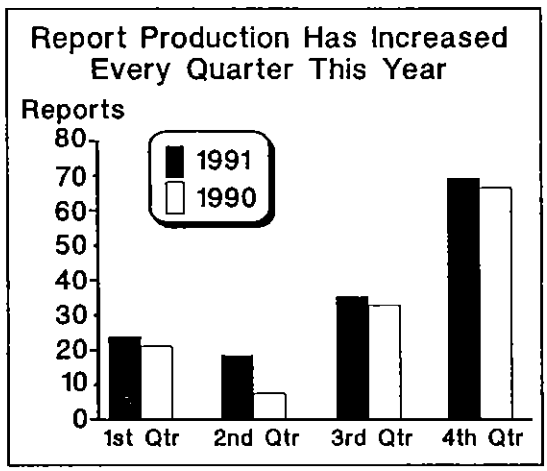


Area charts, also called mountain or surface charts, are essentially line charts with the areas below each line filled in. The areas emphasize the sheer volume of the scores, although in practice it can be difficult to interpret the different shaded areas. Suppose you are graphing two series of numbers (A and B). In a line chart, like Figure 20, the line for each series may cross over other lines, making it difficult to comprehend. But in an area chart, area B could be physically stacked on top of area A. You can think of this stacking as pouring grains of sand. The first layer is one color of sand, the second another color, and so forth.

There are two types of area charts: cumulative and stacked. A cumulative area chart is like a multiple-line chart with the areas beneath each line shaded. Each line is measured from the baseline. A stacked area chart also shows several data sets, but each area is measured from the last area (Figure 21). The areas do not share a common baseline. Because the areas in stacked area charts do not share a baseline, the order of the areas can radically affect the look and meaning of the chart.

• Column Chart

Figure 22

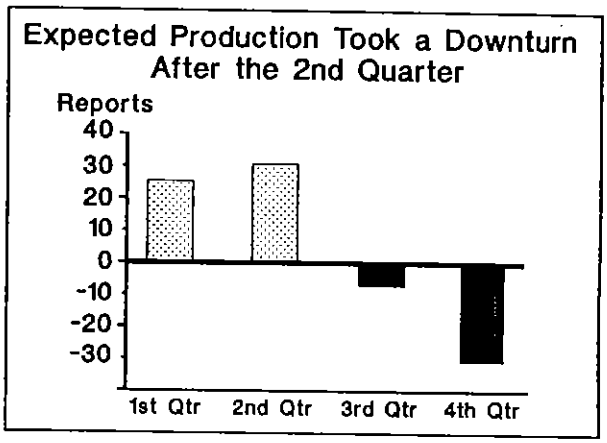


Column charts, also called vertical bar charts, are best used to show the change of a single item over time. Each period of time has its own column. As you can see in Figure 22, the taller the column, the greater the value of the item. Because of their design, column charts emphasize levels of magnitude. Differences from one time period to another are easy to spot. Figure 22 has multiple items (two bars per group) and is often referred to as a clustered vertical bar chart. Figure 22 could easily have included more than two items per group, but like line charts, should be limited to only a few. More than two or three sets of columns per time period can make the graphic difficult to understand.

• Deviation Column Chart

Deviation column charts, like deviation bar charts, vary around a meaningful starting point. But, whereas deviation bar charts compare performance among different units, deviation column charts are especially effective at showing the variability of performance of one unit over time. Figure 23 shows the number of reports completed during the specified quarter in excess or short of the expected amount (the expected amount is the baseline from which the actual production is compared). This type of chart clearly shows the last half of the year did not live up to expectations.

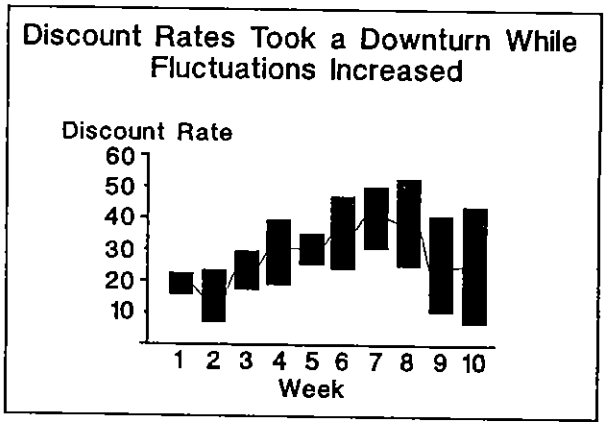
Figure 23



• Range Column Chart

Range column charts, often called High-Low charts, like range bar charts, are especially effective at showing fluctuating ranges, but in this instance the fluctuations are over time. This particular graphic is often used to display a stock market's daily highs and lows. Figure 24 depicts not only the discount rate ranges for a ten-week period, it also clearly shows the trend. Figure 24 includes a line which represents the average rate at the close of business each day during the week. The addition of the line emphasizes the changes in the average.

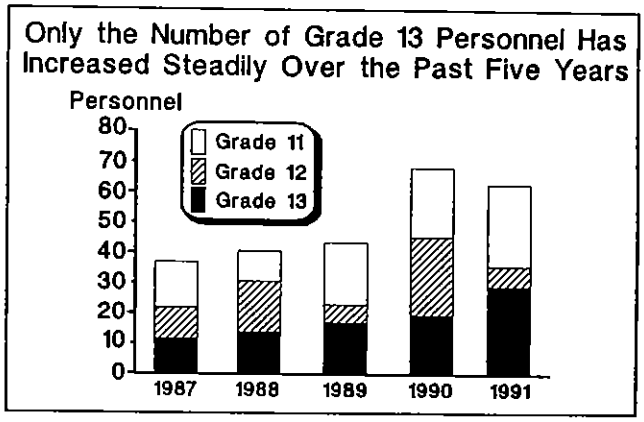
Figure 24



• Stacked Column Chart

Stacked column charts, while common, are also controversial. Figure 25 shows that for stacked columns with only three segments, a viewer can judge fairly easily the size of each separate segment. However, with more segments, the interpretation becomes increasingly difficult. Like mountain charts, stacked column charts should be used very carefully.

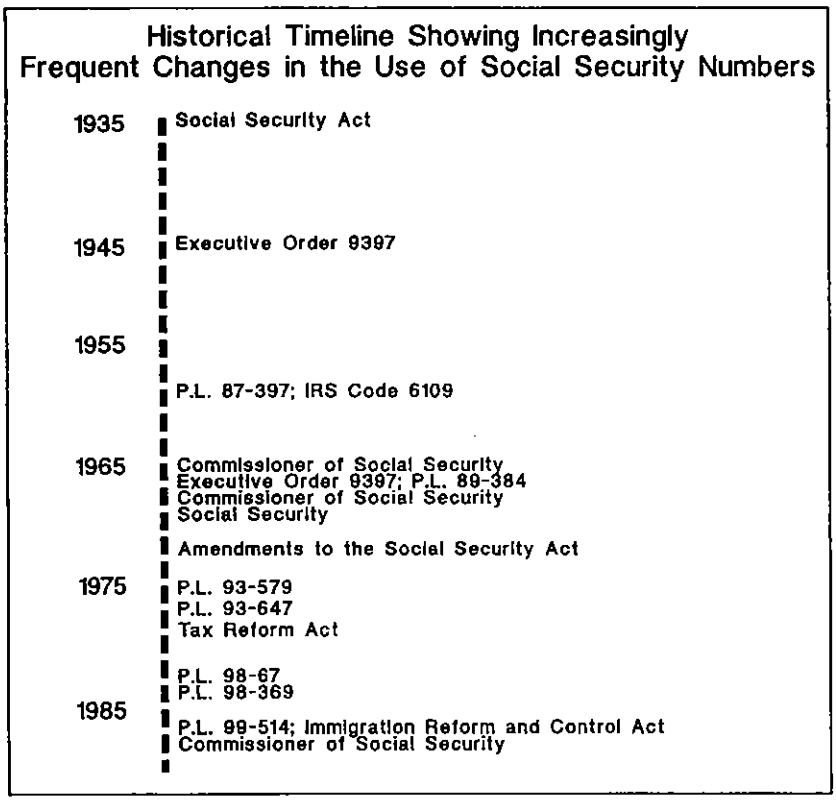
Figure 25



• Historical Timeline Chart

An historical timeline is another option for comparing different points in time. Figure 26 reproduces part of a timeline from Technical Assistance Guide #1 — Focusing the Inspection. By pinpointing each change in the use of Social Security numbers, this timeline reveals a pattern of increasingly frequent changes. Similar timelines can not only enhance our findings but can help clarify our analyses.

Figure 26

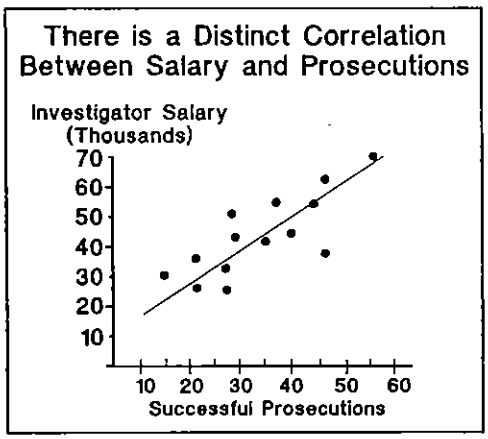


Comparing Relationships Between Multiple Variables

• Scatterplot

Scatterplots, also called scattergrams or dot charts, are the most common way to show the correlation or inter-relationship between two separate variables. (See Figure 27.) This is the familiar X-Y plot from basic research methods, with one variable plotted along the X-axis and the other plotted along the Y-axis. Markers represent each data set plotted. The more widely dispersed the points, the less correlation between the data. When markers begin to form a line, a correlation exists between data. The more the markers cluster around a line, the greater the correlation that exists. (Figure 27 emphasizes that scatter-

Figure 27

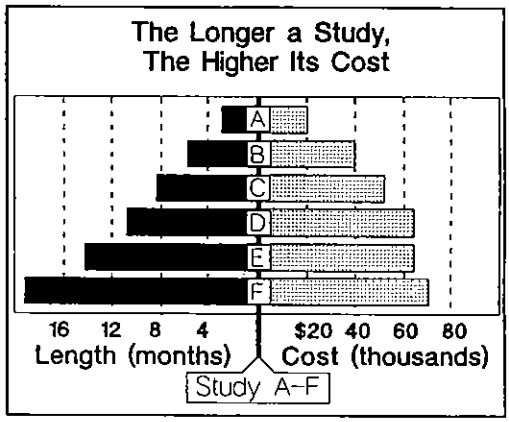


plots can hold a great many data points and that we can fit either a straight or curved line to reveal the overall relationship.) Scatterplots differ from most charts because both axes are numeric. Also, either or both of these axes can be linear or logarithmic. In previous charts discussed, an independent alpha variable is plotted against a dependent numeric variable. Because scatterplots are rather technical (i.e., require some statistical knowledge), they may be better suited for the appendix.

• Paired Bar Chart

Paired bar charts are an option for audiences who might be unfamiliar with scatterplots. When there are relatively few data pairs (<15), the scores on the "independent" variables can be ordered down the left side of the graphic and the scores on the "dependent" variable can be correspondingly ordered down the right side. If the two variables are positively correlated (Figure 28), the two patterns will be almost mirror images of each other. If they are negatively correlated, the patterns will again be mirror images, but with one pattern inverted. And if the two variables are basically uncorrelated, the two patterns will be different.

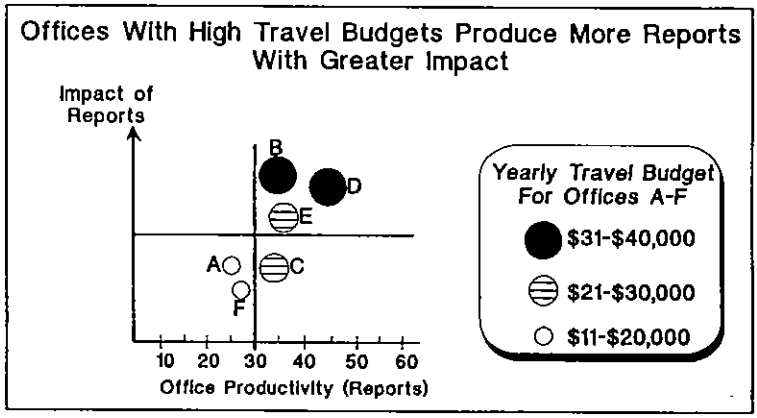
Figure 28



• Bubble Chart

If relationships between three variables need to be graphed, bubble charts are an alternative. Two of the variables position the bubble. The third variable changes the bubble's size which gives bubble charts their unique value. In Figure 29, office productivity (measured by reports produced) is plotted against the impact of the reports. The size of the bubble reflects the yearly budget for the specified office (A-F). For ease of interpretation, bubble charts can be divided into quadrants. In Figure 29, the upper right quadrant represents offices with the greatest productivity and impact. The appearance in this quadrant of the two offices with the greatest travel budgets shows that travel budgets can indicate office productivity and impact.

Figure 29



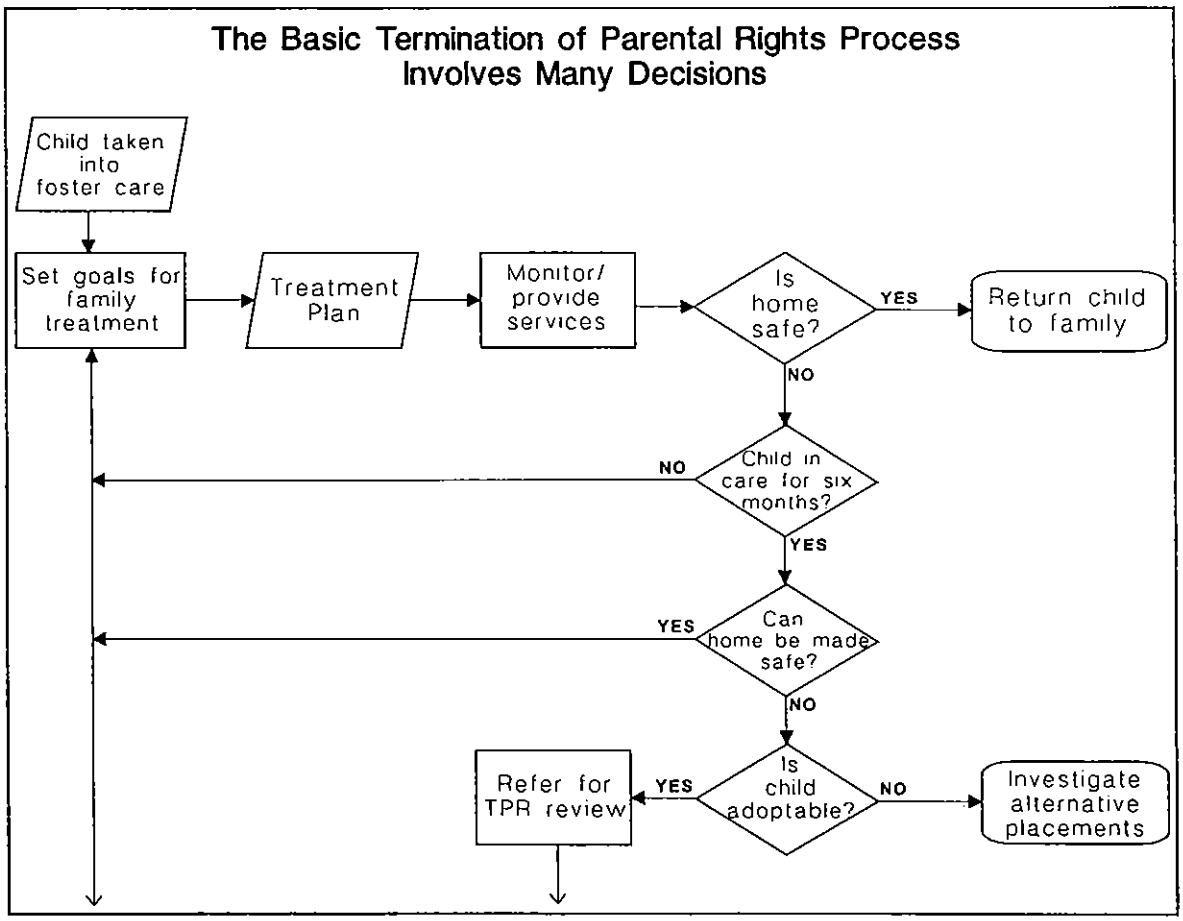
Specialized Graphics

Not all graphics indicate clear comparisons. These types of graphics are often intended to present information, emphasize a point, or entertain the reader or audience. Flow charts, time charts, maps, text charts, tables, and pictorials are common examples.

• Flow chart

A flow chart presents such information as a series of activities, procedures, operations, events, or other factors related to each other. (See Figure 30.) It shows the sequence or flow of these factors and any connections between factors. Flow charts are most helpful in achieving the objective of simplification. Flow charts can condense long and complex descriptions of a series of activities into a single chart that helps present information simply, clearly, and concisely. The flow chart also conveys the sense that steps or ideas have a systematic and coordinated relationship to each other and thus add coherence and unity to the presentation of information.

Figure 30



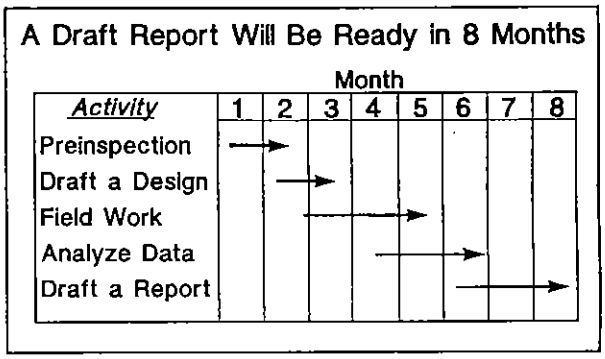
Many different formats are possible with flow charts since they are not bound by many of the more rigid rules accompanying many of the graphics forms described thus far. For this reason, they will test your ingenuity. Flow charts require a keen understanding of the process you wish to chart.

• Time Chart

A time chart shows a timetable for carrying out a series of activities, procedures, or tasks. The time chart is very effective in conveying concisely and clearly a good deal of detailed information regarding what is often a complex schedule of activities. The time chart includes a list of each activity and the time scheduled from its start to its completion.

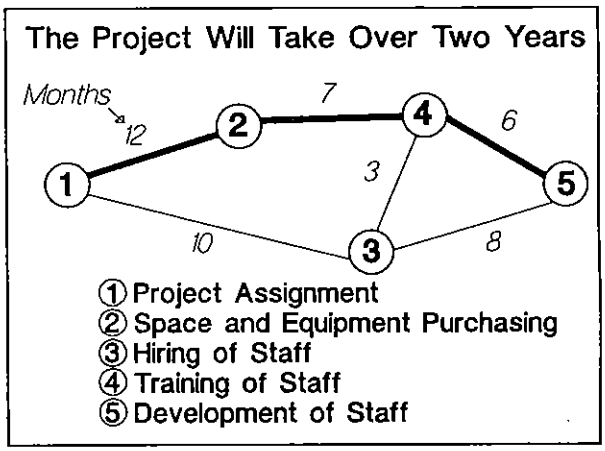
The most frequently utilized time charts fall into two groups. One group is known as Gantt or milestone charts. The other group is referred to as Pert charts, a more complex and technical kind of chart.

Figure 31



The Gantt chart (Figure 31) shows the beginning and end for each of a series of activities or events. Pert charts (Figure 32), on the other hand, are much more complex ways of depicting time schedules. The Pert chart shows the relationship among all the scheduled events and activities and how they are interdependent for completion of a project. It shows the maximum period of time which can be taken to complete each step in a total process and still finish within an overall time frame.

Figure 32

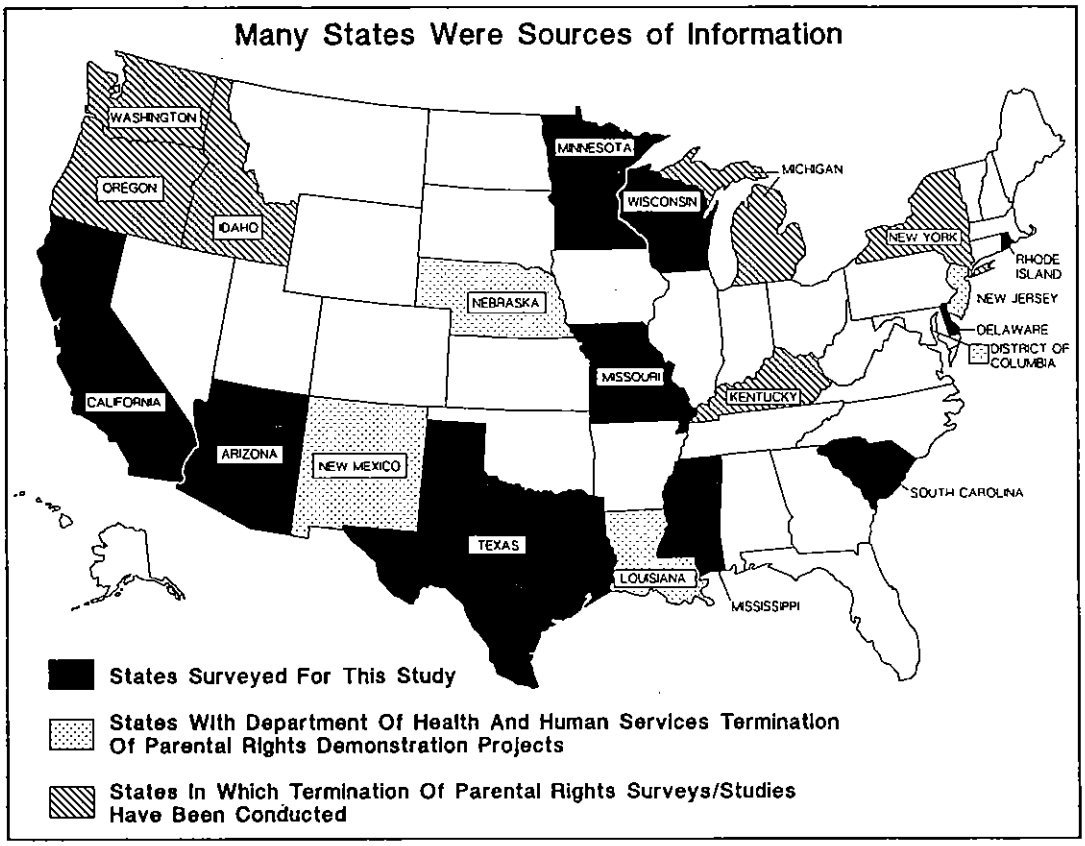


The Pert chart is composed of a series of circles joined by lines. In the chart depicted a circle represents an event. The line represents the activities which must take place for the event to happen, but does not tell what those activities are. It is necessary to annotate or include a legend to explain what the event is. The numbers on the lines represent the time elapsed. In the figure, it takes 12 months to go from event 1 to event 2. The heavy line represents what is known as the "critical path," which is determined by the path that takes the most time from the start to the finish.

• Map

Maps can compare differences between States. Usually this comparison in confined to one piece of information about the State. Maps have the distinct disadvantage of implying that geographically larger States are more important, that within each State there are no distinctions, and that conditions change abruptly at State borders. In fact, none of these are likely to be true in most cases. As a result, maps should be used carefully when emphasizing differences between States. However, as depicted in Figure 33, maps can be used very effectively to simply reinforce something about States. In this case, readers can quickly see which States were surveyed for a study, participated in demonstration projects, or already have been studied.

Figure 33



• Text Chart

Text charts present focused narrative. (See Figure 34.) In briefings the text usually consists of bullet headers. In reports the text can be short or long and is usually placed in the report to emphasize a significant point or describe something (e.g., a best practice). Text charts in reports are generally bordered. You may add a shadow effect to the border for impact.

Figure 34

OEI Objectives

October 1, 1990 - September 30, 1992

✓ *Develop a Quality Improvement Initiative*

✓ *Improve Evaluation Processes and Reports*

✓ *Increase OEI's Relevance to Decision Makers*

• Table

Tables display precise values with no interpretation, except in the arrangement of numbers in columns and rows. (See Figure 35.) Table charts are most useful in the body of reports when the number of data points is less than 20 or in the appendix if more than 20. Additionally, if the number of data points is small, the table could be combined very effectively with a comparison graphic which plots the data in the table.

Figure 35

Several Carriers Do Not Verify Credentials

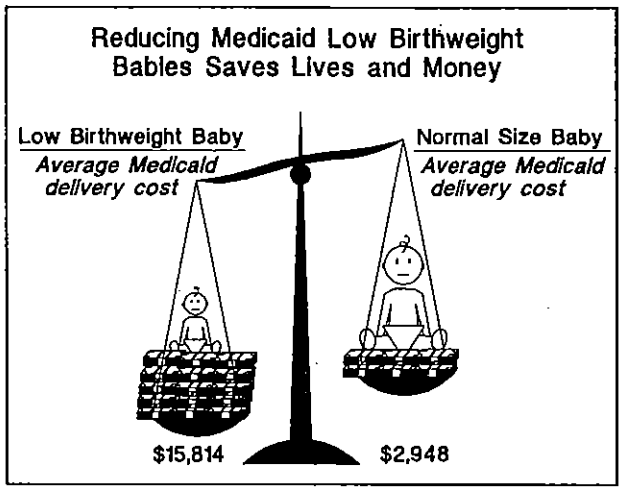
Provider	No Verification	
Medical Physician	6	16%
Osteopathic Physician	7	19%
Physician Assistant	11	30%
Dentist	8	22%
Chiropractor	6	16%
Psychologist	6	16%
Optometrist	7	19%
Podiatrist	6	16%
CRNA	2	5%

Prior to WordPerfect 5.1, we had to use either the text chart option of a presentation graphics program or simply used TABS in WordPerfect 5.0 to create a table. With WordPerfect 5.1 came a powerful feature for creating tables. Alt-F7 brings up a menu selection from which the table option (option 2) can be selected. Next, press option 1 to create a table. You are then asked to specify how many rows and columns are needed. After this selection the table is created. All that is left is to enter text or numbers in each row. Additionally, WordPerfect allows considerable options for formatting the table. For example, lines separating rows or columns can be thick, thin, or not present; rows and columns can be joined; fonts can be changed anywhere in the table; and selected rows or columns can be shaded.

• Pictorial

Pictorials encompass the representation of ideas or messages with the use of pictures. (See Figure 36.) Pictures can consist of electronic line art (e.g., clip art), photographs, or a combination. Creating such graphics are limited only by your imagination and the message you want to convey. Because of the serious nature of OEI work, pictorials should be used with great discretion (especially in reports).

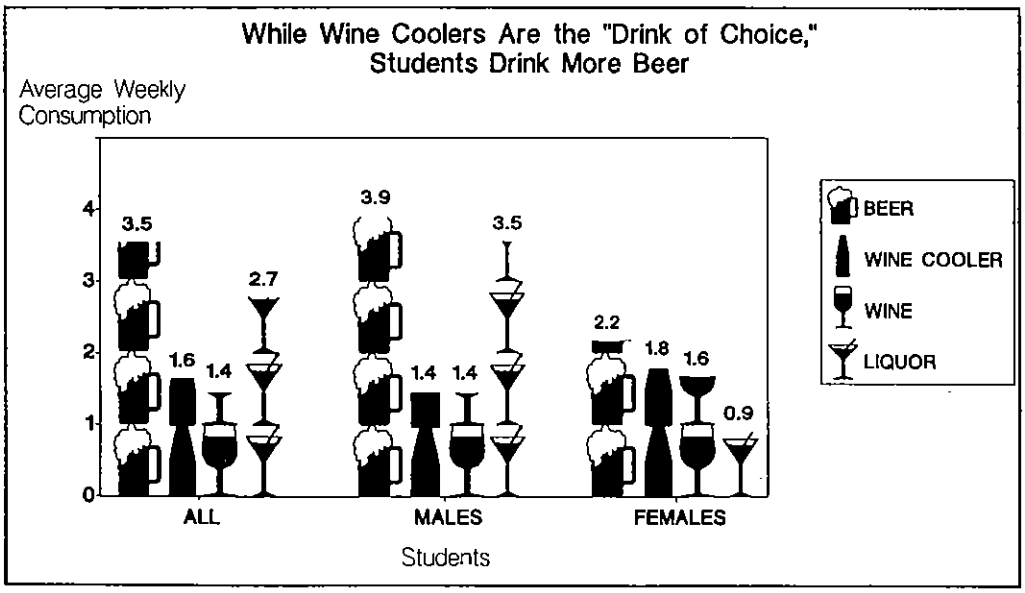
Figure 36



• Pictograph

Pictographs enhance comparison graphics. Instead of a rectangular column or bar, symbols or images are used instead. (See Figure 37.) The same size symbols can be stacked on top of each other to create the bar or one symbol can be sized to the length of the column. These types of charts are popular in many magazines. This is for good reason. The areas, lines, bars, and pies of comparison graphics are abstract shapes that show data relationships more clearly than numbers alone. But because they are abstract, they have an inherent weakness. Symbols and images make a visual link between the graphics bar, line, or pie and the topic. Because pictures and symbols have more emotional and persuasive power than numbers and abstract shapes, pictographs can have greater impact, especially in a briefing.

Figure 37



Graphics Tips: Principles for Good Graphics Design

While not exhaustive, the following tips are helpful for constructing effective graphics. Those who consider them will be well on their way to creating good graphics.

Remember that most of us will improve our graphics techniques largely through trial and error. We will try, evaluate the result, and try again. Through the process of trial and error, we will discover what works and what does not. Also, by scrutinizing the mistakes or successes of others, we can learn with less pain.

Each graphics software program has numerous options; these small touches often make the difference between an adequate graphic and an exceptional one. For this reason, we need to consider the following when constructing graphics:

General Tips on Graphics Design

- Do not omit any information from a graphic simply because the information is included in the accompanying text of the report; everything required to interpret the graphic should appear somewhere on the graphic.
- Avoid wrapping text around a graphic unless there is a clear purpose in doing so (e.g., the graphic is very small). Rarely would wrapping text be needed in an OEI report since graphics are usually limited in number and big enough to restrict the effective use of text wrapping around the graphic. While this guide makes considerable use of wrapping text, this was done with the purpose of limiting the amount of space taken up by a large number of graphics.
- Select shading patterns carefully. Your choices won't make a poorly designed graphic better, but they can detract from an otherwise good graphic. The wrong combination of patterns can create optical illusions that make most straight lines appear crooked. If the purpose of your graphic is to prove a point or influence a decision, bear in mind that a darker shade, or a brighter color, tends to stand out. For example, the portion of a pie chart you want to emphasize should be the darkest.
- Provide additional precision ***when necessary***. For many graphics, the viewer does not need precise values for the data points. However, sometimes more precision is needed. To add precision we can 1) add specific values for important data points, 2) provide a full data table with the graphic, and/or 3) provide a grid to enable the viewer to easily "look up" needed values.
- Clearly indicate when values rise above (or dip below) an important threshold. Three ways to highlight such a threshold are 1) adding a pointer/marker, 2) adding a reference line, or 3) shading the important part of the graph.

- Use paired graphics to explain more fully related findings. For example, rather than put multiple lines on the same graphic, splitting the information between paired graphics can make multiple trends easier to interpret.
- Do not use scales carelessly. Often several different scales can be used. However, avoid the temptation to choose scales which do not fairly depict the data portrayed. It would not be ethical to do so.
- Consider using two different vertical axes (two Y-axes) in the same graphic to compare two trends which could otherwise not be compared on one scale.
- Use properly spaced scales. Specifically, do not change the interval width arbitrarily. For example, it would be misleading to start a scale with intervals of 1 and when a certain point was reached the intervals change to 10. This will distort the graphic. Fortunately, most presentation graphics programs only allow the user to choose one scale per axis.
- Unless paired with a second, full-scale graphic, generally avoid using partial scale breaks in most cases. For example, you are graphing data and one bar is so much larger than the other bars that it is difficult to discern any trends with the other bars since they are so small. You might be tempted to simply slice a portion of the large bar away using a break so that the trends depicted by the smaller bars are more apparent.
- Incorporate the data themselves directly into the graphic if they will have impact. In this type of graphic, data points are replaced with the actual numeric values.
- Use adjusted or corrected raw data. Using unadjusted or uncorrected data may convey a misleading impression.
- Provide proper comparisons in order to put the data into the proper perspective. This simply means you should provide the reader enough information to make their own decisions. For example, you might be inclined to graph only data for two years which showed an increase in sanctions for a particular State. However, it would be more fair to graph a larger span of time if decreases occurred prior to or after these years. Additionally, the two year increase could have existed in several other States. If knowing this additionally information would affect the reader's interpretation of the information provided, it should be included.
- Do not use three-dimensional (3-D) graphics gratuitously. Adding a third dimension can often make a graphic more appealing and more likely to be viewed carefully. However, 3-D also distorts images and can give a viewer a false perception.
- Resist the temptation to overuse a graphics program's many options (e.g., font styles, shading patterns).

- Add color to graphics for important oral briefings (e.g., slides, transparencies, flip charts). However, color should rarely be used in inspection reports because readers will often read copies of the original report which are in black and white. If color is required, ensure when the color graphic is copied on a non-color copier that the graphic still portrays its message without distortion.

  Colors can be used to distinguish one category from another (in a pie chart), to symbolize reality (green for savings or red for losses in a deviation column chart), to emphasize certain data (segments of a deviation bar chart indicating unacceptable performance), to identify a recurring theme (each time staff have been added), or simply to enliven the graphic to make it more readable. Colors found in nature (light blue, yellow, gray) often work best, especially along with strong primary colors for emphasis. Remember that color graphics are expensive and take time to produce. Also, be aware that some people can't distinguish red or green very well.

- If the graphics program used produces a border, use WordPerfect's user-defined graphics option rather than the graphics figure option when importing such a graphic into WordPerfect (or change the options for the figure to include no border). Otherwise, you will get a double border surrounding the graphic.

- Save good graphics designs as templates. A template for major graphics types will save you time and help you create attractive, consistent graphics without having to make basic design decisions each time you create one. Many graphics programs already come with templates for selected types of graphics (e.g., DrawPerfect comes with 24 drawing templates you can use as models or as the basis for your own work). Some even include clip art.

- When you see a good graphic, copy and save it in a folder. This may come in handy one day when you need to graph similar types of data.

Tips for Specific Types of Graphics

• Pie Charts

Use percentage figures in developing the pie chart. While most presentation graphics programs can convert numbers to percentages, it is a good habit to use percentages.

The most important elements should start at the 12 o'clock position on the pie and progress clockwise, with each subsequent slice a lighter color or shade of grey. Avoid the moire effect by not using too many types of hatching patterns; various shades of grey are preferable. If you must use hatch patterns, stick to simple ones and avoid those which clash or create distortion.

Try to limit the number of pie slices per pie to six. If several slices are very small, they can be especially difficult to interpret. If you have too much data, eliminate the least important slices or combine the smallest slices into a single category labeled "Other."

Use a legend for annotating several pies on a page with common descriptions. This avoids repeating the labels on each pie and gives a cleaner look to the page.

- **Line Charts**

  Use multiple-line charts to compare the trends of several items. Distinguish lines by using different line styles or widths. Remember, more than three or four lines can make a graphic confusing, especially if the lines cross. One remedy discussed previously is to break your data up into two charts and place them both on the same page.

- **Area Charts**

  Consider other graphics options when stacked areas become jagged-looking and hard to interpret as a consequence of extreme swings in the data and the lack of a common baseline. Use a clustered bar chart if you want to compare data sets against a common baseline. Use a segmented bar chart if you want to stack areas in a different form.

  Place bands (filled in area) from bottom to top in a logical progression. One method is to place the bands in order of significance. Since the bottom band is easiest to interpret and is usually the darkest, the most significant band would be placed there. Another method, providing the easiest overall interpretation, is to place the most stable band on the bottom and work up through the less stable bands.

- **Deviation Bar Charts**

  Arrange the positive values in descending order and the negative in ascending order.

- **Segmented Bar Charts**

  Make sure the segments of a bar add up to a meaningful total (e.g., 100 percent of something). Use a clustered bar chart to display several items that are not parts of a meaningful whole.

- **Histograms**

  Choose the right numeric intervals when constructing a histogram. In general, choose at least five intervals and no more than 20. Too few or too many intervals will obscure the pattern of distribution.

- **Paired Bar Charts**

  Although the left and right axes of a paired bar chart can have separate scales, try to use the same scale for both. If you do use separate scales, try to scale them so that the longest left bar is close to the same length as the longest right bar.

- **Bubble Charts**

  Use no more than eight bubbles in a single chart for maximum effectiveness.

- **Text Charts**

  Use lowercase letters for readability.

  Use borders for a polished look.

  Use a minimum of words per line and a minimum number of lines per chart.

  Double space text if the text size is small.

  Use italics, not capitals, to emphasize a letter or word.

  Use text sizes no smaller than eight in reports and no smaller than 10 in slides or flip charts, to ensure readability.

Graphics for Oral Briefings

Graphics which are appropriate and helpful in a written report are not always appropriate or helpful for an oral briefing. In fact, using the same graphics as in a report can sometimes harm a briefing. The graphics in a written report are analogous to magazine advertisements. A viewer can study each graphic as long as necessary and even return time and again to check the details. But graphics for a briefing are more like billboards by the highway. A viewer has only one, brief chance to grasp the message as it flashes by.

One expert recommends that our briefings use graphics "twice as simple and four times as bold" as those we use in our reports. Briefings are not the time for graphics requiring careful, detailed study. We should simplify our graphics in briefings and refer the audience to more detailed graphics for additional information.

Planning for the Briefing

When planning a briefing, the first question may well be not "what visuals are needed?"; it may be "are any needed at all?" The answer may be no. There are, after all, some disadvantages to visuals; they 1) may take a lot of time and thought, 2) can divert attention away from what we are presenting, 3) may diminish flexibility, 4) may cost money, and 5) if the visuals are poorly done, the result can vary from audience confusion to dissatisfaction.

Having said that, it remains true that a picture is worth a thousand words. Most briefings are improved, and many are transformed, by good use of graphics. They instantly and vividly portray things which may be inefficient to convey verbally. For the audience, graphics save time, create interest, add impact, and most importantly, remain in the audience's memory long after the words have gone.

If you decide to use graphics for a briefing, think about them from the very start of your briefing preparation. Do not finish your briefing script and then say "Now where should a graphic go?" From the beginning, begin asking yourself "What message do I want to lodge in the minds of the audience?"

Briefing Chart Traps

• Using Too Many Words

It is easy to use too many words in a briefing chart. There is less danger if the graphic is used as a handout and the most danger if the graphic is a slide. Whether the words are used to identify parts of a graphic or describe information such as stages in a process, their intended task will fail if there are too many words. The audience is either 1) deterred from reading them or 2) fails to listen to the speaker because they are following the eye-words at the expense of the ear-words. Especially for a large audience, visuals (slides, transparencies, large flip charts, etc.) do not have to be self-explanatory and are often more effective if they cannot be fully understood until the speaker identifies and explains the picture. It is a support, not a substitute, for the presenter. The effect of the graphic is often increased if we bring it to life and breathe meaning into it as we take an audience through it. It is acceptable and often preferred to give visual information progressively, over a sequence of graphics, instead of trying to cram it all on one.

• Using Too Small Words

Another of the most common traps is not making the words big enough. It sounds too obvious to be worth mentioning, but it is one of the easiest traps in the world to fall into. The trouble is that presenters already know what the words are, so they can read them just fine. Moreover, they may wish the words were big enough because it is time consuming to redo a graphic, so they kid themselves the words are perfectly legible. On top of that, they may forget how far away the audience may be sitting. Especially with slides, the only safe course is to make the words as big as possible and to keep an active and lively suspicion that they are not big enough.

Choosing the Medium

In preparing for an oral briefing, we must determine if the material will assume final form as paper handouts, posterboard flip charts, overheads, slides, or screen projections. The choice of medium does impact graphics options.

• Paper Handouts and Overheads

By far the simplest and quickest visual to prepare is a handout which can be easily made into a transparency. Handouts can be in black and white or color. Handouts summarize the main points of your presentation. This is virtually done when you prepare the executive summary of the report. Usually, all that is left is to further simplify the executive summary and add simplified graphics emphasizing the important messages of the report.

A color printer could add impact to your handouts. However, if your office does not have a color printer (e.g., color laserjet) you will have to weigh the benefits of using color against the lead time and cost required to have a graphics shop prepare the handouts.

• Posterboard Flip Charts

Preparing flip charts are very similar to preparing color slides. However, since you do not have the printer capable of making large posterboard flip charts, consult the graphics shop. Copies of handouts are adequate to be given to the graphics shop. The shop will turn your black and white handouts into large colorful charts.

• Slides

Slides are very effective in a presentation to a large audience. Simplification is critical to good slides. Bullet your text, keeping the text to only a few words and no more than one line per bullet. Graphs should be simplified to include only that which is essential (e.g., the axes might not be needed).

Slides can be made by the graphics shop or you may choose to do them yourself. If you wish to do them yourself, you must use a software program which supports the slide maker device you will be using. If you do not own a slide maker device, ask around other HHS offices. Very likely, the Social Security Administration's regional training center will have one. If you create slides yourself, the cost can be insignificant. It generally involves only the purchase of slide film. However, the learning curve for using the device effectively may be large the first few times. Consequently, you may want to just let the graphics shop handle the production or if time is critical and money is no object, let a slide production service (many graphics shops in your city) produce them.

If you choose to create your own, the following points may assist you:

- Use a graphics program with a built-in slide-aspect ratio. This feature will automatically compensate for the differences between the width-to-height ratio of your screen and that of slides.
- Use solid fonts instead of outline ones. Outline text is less readable on a slide. Don't make your text too skinny. Slides aren't a good medium for minutiae. Keep headlines at 24 point size or larger. Never use a font smaller than 10 points in the body of the graphic used as a slide.
- Use thick lines. This is a corollary of thick fonts. You should stay away from the package's thinnest line widths and never use any line thinner than a 2-point rule.
- Use solid colors. Completely filled areas are easier to see than cross-hatched pattern fills.
- Leave plenty of room on the outside edges of your screen. The same line of text that fits precisely on your display screen may run over the edge on a slide. Wide margins will help avoid this problem.
- Use a dark background. Dark blue or black are the most popular because they mask imperfections in the projection screen or slide and permit a sharp contrast between elements. Use light, contrasting colors, such as yellow and white, for titles and other important text.

- Take advantage of overlaying techniques. Film recorders will let you place one object in front (or on top) of another. For instance, you can superimpose a bar chart on top of a clip art symbol. This technique, however, won't work well on vector devices such as plotters because the plotter ink smears as it overlays.

• Screen Projections

Screen projections involve the projecting of computer images through an overhead type device. This type of presentation is most effective with small audiences (10-20). Since the computer is used, the presentation can take on a considerable degree of automation and visual effects. You will need a projection device such as In Focus's LCD projection panel to interface with the computer. LCD panels function much like transparencies but offer the additional advantage of screen shows. The LCD panel sits on the overhead projector and is connected to the computer. The overhead projector then transfers the images to a screen using either CGA, EGA, or VGA resolutions depending on the computer and panel used.

To really take full advantage of the projection panel, you will need a graphics program containing a screen show utility. Most major presentation graphics programs contain a screen show feature (e.g., Harvard, Freelance, and DrawPerfect). As with any slide show, you will specify the order in which the slides are presented. Slides are nothing more than a graphics file. The slide show will use the files it creates and will generally accept raster (bit-mapped) files created by other programs. Scanned images are bit-mapped. Files created by screen capture programs are also bit-mapped. Screen capture programs are especially valuable when developing training programs. For example, if you wanted to include in your presentation a series of slides depicting the screens encountered while working in a software program, you could capture each of these screens and include them.

While technologies are getting better, many panels do not show color very well. If it is a color LCD, the colors are usually washed out. Noncolor panels generally project images using a blue or gray color scale. Additionally, CGA or even EGA resolutions are much more blurry and difficult to read than newer VGA panels. Because of these drawbacks, you will need to take special care creating slides to ensure color and shading changes on the panel do not result in the loss of clarity of slides. While the slide show may look great on your PC's monitor, the same may not be true of the projected image. Consequently, take special care. If the projection device does not support color, set graphics programs used to prepare slides to monochrome displays.

Graphics Software

Graphical software have become so powerful they require little effort to produce quality graphics in a short period of time. Graphics programs provide us with many predefined graphics formats (bars, pie, etc.) from which to choose. Thus, it is a simple matter to fill in the data screens with the requested information. Then, within seconds, you can display the results on your computer's screen or printer.

Graphics programs allow us to easily alter characteristics of a graphic to reveal other subtitles of the data. Most programs even allow us to change from one chart format to another at the touch of a button. This allows us to see options before we choose the chart which is best. But, what determines which graphic is best? This guide has attempted to provide information on use of graphics which might help you with this determination. If you have further questions, you might consult books on graphics basics like those referenced in the back of this manual. Interestingly, some answers may be no further away than the "help" key of your graphics package.

While graphics programs have proliferated, they have yet to be used as extensively as possible. The vast majority of OEI reports include few, if any, graphics. Additionally, presentations to OPDIVs are usually limited to black-and-white laser-printed hand-outs. Although the graphics shop can produce color slides and poster boards, they generally have been used only for important presentations, when the best impression was critical (e.g., the Secretary's briefings).

We should take advantage of the computer products available in our office in order to achieve the most effective inspection report possible. For our word processing needs, WordPerfect 5.1 is an excellent product offering many features. While it is deficient graphically (e.g., creates only simple graphics such as lines, boxes, text shading, column charts, of text charts), WordPerfect makes up for this by allowing you to import graphics created by other programs. While this may not be the most convenient situation, it does allow you to choose those graphics programs which best meet our needs given budget considerations.

For simplicity, graphics software can be classified into three basic categories: paint programs, draw programs, and presentation graphics programs. Although presentation graphics programs are most often used in our day-to-day work, the other program types are important because they can be used to enhance or modify charts. Let's briefly view differences in the individual programs.

Paint Programs

Paint programs are used to create pictures from scratch using freehand drawing or touch up scanned images (e.g., photographs). Inexpensive painting programs often provide little more than a simple electronic easel. You are given a blank pad (screen), a palette of shapes, patterns or colors, a brush, and some other artist tools. You simply use the brush by "dipping" it into a color or pattern and start spreading paint over the screen.

Paint programs, which generate pictures out of dots, are enhanced by the addition of user-selectable options to automate the drawing process. With these, the computer takes an active part in making the pictures. The main applications of a painting program are to 1) create symbols for pictographs (e.g., a company logo), 2) create pictures for image underlays, 3) edit graphics digitized by a page scanner, or 4) modify a graphic on a dot-by-dot basis. Paint programs store the information as bit map locations. (See Appendix B for further information.)

Although paint programs are valuable for such things as editing a scanned image or creating colorful illustrations for slides, they are rarely used in OEI. However, as scanners become widely available to inspection staff, their use may increase.

Draw Programs

Draw programs are more structured than painting programs, although you can often draw the same types of images with both. However, a draw program creates images as a combination of lines, circles, curves, and other geometric shapes rather than dots. Draw programs store information in the form of computer instructions.

Advanced drawing programs are designed for computer-aided design (CAD) or some types of artistic design (e.g., advertising). CAD programs are not really suited for presentation graphics purposes. On the other hand, artistic programs such as Arts and Letters Editor and Micrografx Designer, with their large collection of ready-made clip art, are useful if we need to create types of graphics not available in traditional presentation graphics programs. These programs, however, are much more difficult to use and very labor intensive. This is because we must construct the graphic entirely from scratch using symbols (e.g., lines, circles, squares) and available clip art.

Draw programs allow considerable control over all aspects of a drawing. For example, the program allows control of the exact size and placement of objects on the screen, providing a set of rulers marked off in whatever graduations you desire. The mentioned programs let you zoom in to make fine adjustments then zoom back out to finish the graphics picture.

Presentation Graphics Programs

Business presentation graphics programs are those which have the ability to automatically utilize data to produce statistical charts such as pie, bar, and line charts. These programs are what we use most often in OEI.

The flexibility that different presentation graphics packages provide varies. Most programs differ somewhat in the number, type, and appearance of graphics they can produce. However, all can create simple bar, line, and pie charts. Only more sophisticated programs create specialized charts such as exploded pie charts, histograms, scatter graphs, and many more. A few advanced presentation graphics programs (e.g., Microsoft Chart) are designed to create complex statistical charts, and plot such things as regression lines, modes, means, and moving trends.

Many presentation graphics programs now include simple to moderately sophisticated drawing functions and slide show presentation features. This means that you can add such things as arrows, clip art symbols, etc. to the graphic. Examples include Harvard Graphics, Freelance, and WordPerfect's own DrawPerfect. Because of the addition of drawing features and clip art libraries, the line between draw programs and presentation graphics programs has begun to blur.

If your graphics program has little control over graphics enhancing and modifying features such as 1) label size and positioning, 2) addition of subtitles, 3) chart positioning on a page, and 4) color palettes, the program (e.g., Lotus Spreadsheet version 2.1 or lower) is primarily for analytical work rather than presentation purposes. The more options a program provides, the more flexible it is, and hence, the more personalized the graphics can be.

Creating graphics are even simpler for those programs which can use a mouse (an electronic pointing device). For some presentation graphics programs and most draw programs, a pointing device, such as a mouse, is required. For those of you who have not used a mouse, you will find that you can navigate through menus and manipulate graphics features with a point-and-click technique.

Many presentation graphics programs may be available for your office use. DrawPerfect and Quattro Pro have been made available to each region. Other presentation graphics programs that some regions may have been using might include one or more of the following:

Microsoft Chart
Charisma
Lotus Graphwriter II
Microsoft PowerPoint
Harvard Graphics
Lotus Spreadsheet (version 2.3 or higher)
Lotus Freelance
Applause II
CA-Cricket Presents
Pixie

References for Further Reading

Envisioning Information; Edward R. Tufte; Graphics Press; Cheshire, CT; 1990.

Say It With Charts; Gene Zelazny; Dow Jones; Homewood, IL; 1985.

Statistical Graphics: Design Principles and Practices; Calvin F. Schmid; John Wiley; New York; 1983.

The Elements of Graphing Data; William S. Cleveland; Wadsworth; Monterey, CA; 1985.

The Visual Display of Quantitative Information; Edward R. Tufte; Graphics Press; Cheshire, CT; 1983.

Appendix A: Importing and Manipulating Graphics in WordPerfect

After creating graphics in your graphics package, the next step is to incorporate them into WordPerfect. The following are examples of steps involved in the process of importing graphics and changing them within WordPerfect to meet your needs.

As mentioned earlier, some programs (e.g., Drawperfect WPG extension) produce files that are directly importable (you do not have to change the file's format) into WordPerfect. Many other programs (e.g., Harvard Graphics and Lotus Freelance) produce files that must be converted (exported) by the graphics package as a file type WordPerfect will accept. It is generally best to export the file as a metafile (CGM extension); however, exporting to files with certain other extensions are acceptable (e.g., PCF, TIF or PIC). If you will be printing to a postscript printer, exporting the image as an encapsulated postscript file would generally be the best option (EPS extension).

Importing a Graphic

The steps shown below add a scanned image called logo.tif into WordPerfect. The file imported could just have easily have been any graphic file you selected to import.

Type: *ALT-F9 (Graphics Key)*
Select: *Option 1 (Figure)*
Select: *Option 1 (Create)*

Result: *Graphics definition screen*

Select: *Option 1 (Filename)*
Type: *LOGO.TIF*

Remember to include the file extension and path (sub-directory) when importing or specify, using Shift-F1, the default location of your graphics files. Otherwise, the file will not be found.

Figure A-1: *Graphics Definition Screen*

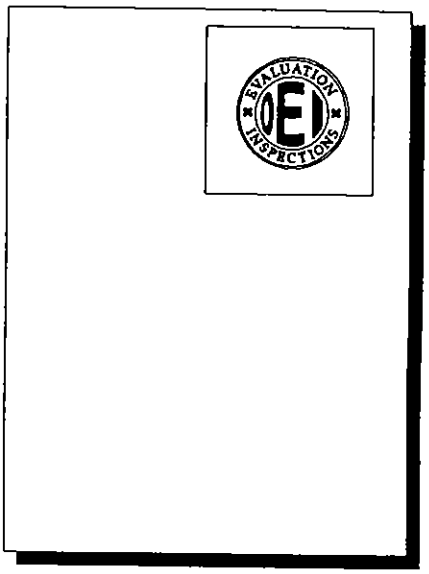
```
Definition: Figure
     1 - Filename                LOGO.TIFF
     2 - Contents                Graphic
     3 - Caption
     4 - Anchor Type             Paragraph
     5 - Vertical Position       0
     6 - Horizontal Position     Right
     7 - Size                    3.25" wide x 3.25" (high)
     8 - Wrap Text Around Box    Yes
     9 - Edit

Selection: 0
```

Select: *Option 4 (Anchor Type)*
Select: *Option 1 (Paragraph)*
Type: *(Return)*
Type: *(Return)*

This accepts all of the defaults. The result is a three and one-quarter inch square figure box placed in the upper right hand corner of the page. Use the WordPerfect view document command (Shift-F7)(6) to preview the box. The box should appear

Figure A-2



as in Figure A-2 (the image size and shape will differ depending on the file you select).

That's it, you've merged text and a graphic!

Had your cursor been anywhere other than the top of the page the figure would have been placed on the line where the cursor was. The default Horizontal position of a graphic is to the right. Most of the time we need to change the horizontal position (option 6) in the graphics definition screen to "center."

Another way of positioning graphics is to change the anchor type to "Page." Rather than the figure being placed at the vertical position of the cursor, the figure will be placed either at the top, the center or the bottom of the page. Another option allows you to specifiy the exact vertical position in inches (see below).

Moving a Figure Box

Suppose you want to change the location of the figure on the page. This can be done by 1) setting the anchor type to paragraph, blocking the figure and moving the graphic to the line where you want the figure to begin (or changing the vertical position "offset" location from the line where the figure is located), or 2) manipulating the options such as vertical and horizontal position when the anchor type is "Page." Using this figure, try the following to move its position after the "Page" vertical position is selected:

Type: *ALT-F9 (Graphics)*
Select: *Option 1 (Figure)*
Select: *Option 2 (Edit)*

Result: *Figure Number? 2 (or one number higher than the last box* created)

Type 1
Type: *(Return)*

Result: *The original Figure definition screen appears*

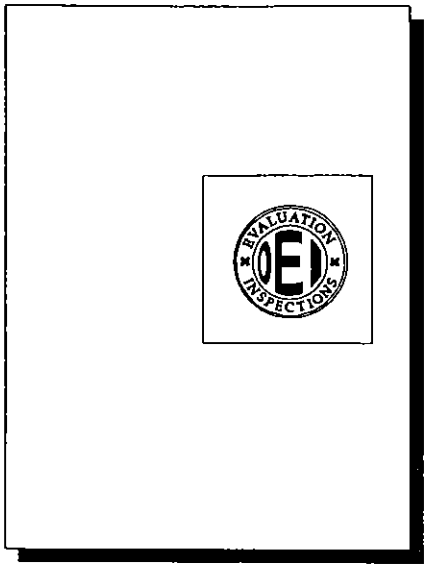
Select: *Option 4 (Anchor Type)*
Select: *Option 1 (Page)*

Result: *The anchor type is changed from paragraph to page*

• Lowering the Box on the Page

Select: *Option 5 (Vertical position)*

Figure A-3



Result: *You'll be offered the following options:*

Option 1 (Full Page)
Option 2 (Top)
Option 3 (Center)
Option 4 (Bottom)
Option 5 (Set Position)

Result: *Offset from top of page 1.16"*

Type: *3*
Type: *Return*

Result: *The graphics box is moved 3 inches down from the top of the page. (See Figure A-3)*

Type: *(Return)*
Type: *(Return)*

This returns you to the editing screen and you can use view document (Shift-F7)(6) to preview your page.

• Moving the Box to the Left

Type: *ALT-F9 (Graphics)*
Select: *Option 1 (Figure)*
Select: *Option 2 (Edit)*

Result: *Figure 2*

Type: *1*
Type: *(Return)*

Select: *Option 6 (Horizontal Position)*

Result: *You'll be offered the following choices:*

Option 1 (Margins)
Option 2 (Columns)
Option 3 (Set position)

Select: *Option 3 (Set position)*

Result: *Offset from left of page: 0"*

Type: *3*
Type: *(Return)(Return)*

The logo is now 3 inches from the left hand border of the page. The ability to align boxes with borders of page or column makes it easy to control the appearance of the document.

Resizing Figure Boxes

It's just as easy to size a box as it was to move it.

Type: *ALT-F9 (Graphics)*
Select: *Option 1 (Figure)*
Select: *Option 2 (Edit)*

Result: *Figure 2*

Type: *1*
Type: *(Return)*

Select: *Option 7 (size)*

Result: *You're presented with four options:*

Option 1 Set Width/Auto Height
Option 2 Set Height/Auto Width
Option 3 Set Both
Option 4 Auto Both

If you choose Option 1 (width, auto height) the height of the box will automatically be made proportionate to the width of the graphics file being placed.

Option 2 makes the width of box proportionate to the height of graphics file.

Option 3 offers maximum flexibility but must be used with care. Since you will specify the dimensions, proportionality is often lost. Do not use this option unless there is a need to distort the image.

• Increasing Box Width

Try the following to make the box wider, but maintain correct proportions:

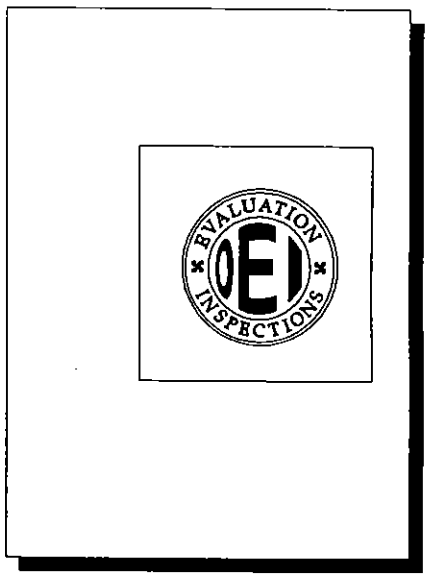
Select: *Option 1 (Width/Auto Height)*

Result: *Width = 3.25"*

Type: *5*
Type: *(Return)*

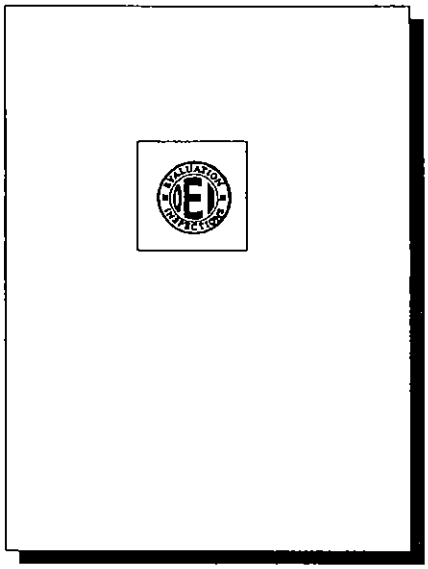
Result: *Since the logo file is a square, the height also is made 5 inches. (See Figure A-4.) If the original logo had been rectangular, the height would increase by an amount proportionate to the width.*

Figure A-4



• Decreasing Box Height

Figure A-5



Select: *Option 7 (Size)*
Select: *Option 2 (Height/Auto Width)*

Result: *Height = 5"*

Type: *2*

Type: *(Return)*

Result: *Notice how the width is reduced to 2 inches, again maintaining the correct proportions of the square graphic. (See Figure A-5.)*

Now create a rectangular box for the square graphic.

Select: *Option 7 (Size)*
Select: *Option 3 (Both)*

Result: *Width = 2"*

Type: *5*
Type: *(Return)*

Result: *Height = 2"*

Type: *4*
Type: *(Return)*

If you view the document, the logo will be centered in the box and stretched horizontally.

Moving Graphics Inside Boxes

It's a simple matter to move the image (crop) inside the box.

Type: *ALT-F9 (Graphics)*
Select: *Option 1 (Figure)*
Select: *Option 2 (Edit)*

Result: *Figure 2*

Type: *1*
Type: *(Return)*
Select: *Option 9 (Edit)*

Result: *Figure 1, with logo image appears on the screen.*

Type: *Left cursor control key.*

Result: *Each time you hit the left cursor control key, the logo will move slightly to the left. This shifts the percentage in the lower right hand corner of the screen. (10 percent is the default.)*

Type: *(Insert) Options are 1, 5, 10 or 25 percent displacement.*

To move the image a set distance.

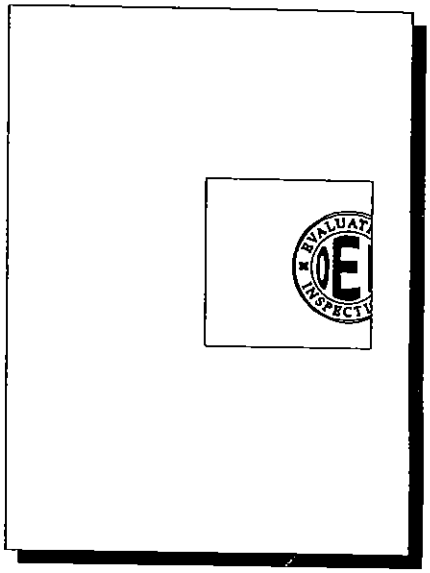
Select: *1 (Move)*

Result: *Horizontal = 1"*

Type: *2*
Type: *(Return)(Return)*

This moves the logo 2 inches to the right. (See Figure A-6.) Enter a negative number (e.g. -2) to move to the left.

Figure A-6



Select: *1 (Move)*

Result: *Horizontal = 2"*

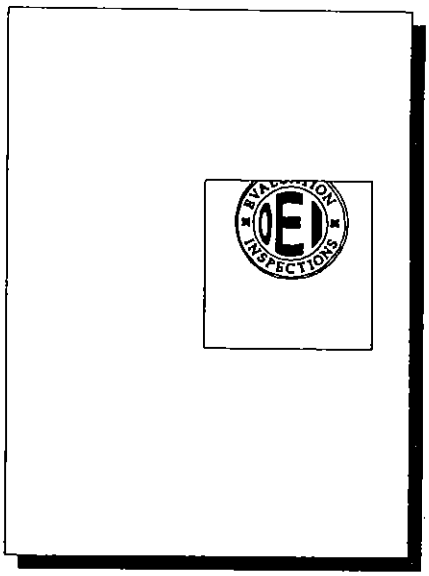
Type: *-2*
Type: *(Return)*

Result: *Vertical = 1"*

Type: *1.5*
Type: *(Return)*

This moves the logo one & one-half inches higher in the box. (See Figure A-7.) If you want to lower it, enter a negative number (e.g. -1.5).

Figure A-7



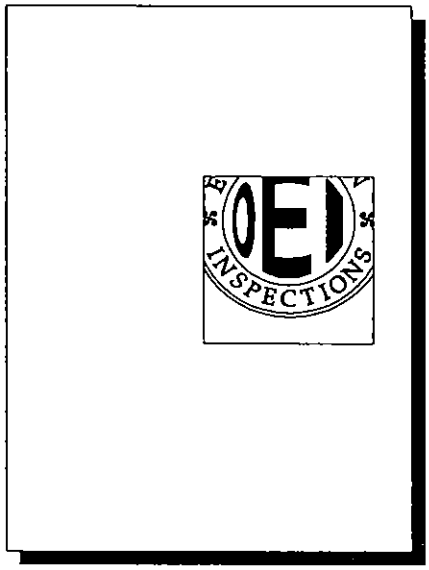
Resizing Graphics Images Within Boxes

Simply by pressing (Page Up) or (Page Down) you can change the size of the image in the box.

Type: *(Insert)*

Again this increases or decreases the image by 1, 5, 10 or 25 percent. Increasing the image by 25 percent changes the image as shown in Figure A-8.

Figure A-8



Rotating Graphics Images

To rotate the logo to the left, hit the (-) key. To rotate to the right, hit the (+) key. Once again, you can hit the (Insert) key and toggle 1, 5, 10, and 25 percent rotation.

Select: *Option 3 (Rotate)*

Result: *Enter number of degrees (0-360)*

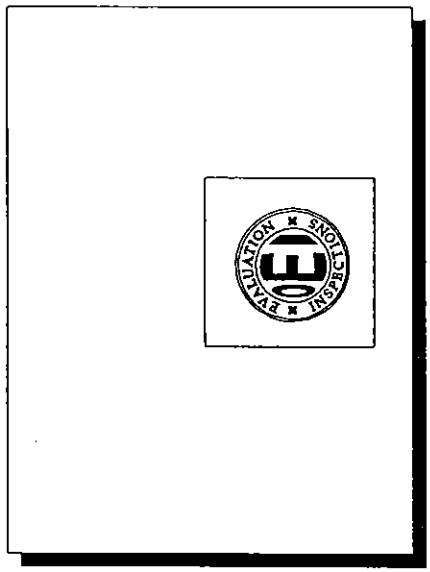
Type: *90*
Type: *(Return)*

Result: *Mirror Image? (Y/N) No*

Type: *(Return)*

Result: *The logo is rotated 90 degrees to the left. (See Figure A-9.)*

Figure A-9



Changing Borders

Type: *ALT-F9 (Graphics)*
Select: *Option 1 (Figure)*
Select: *Option 4 (Options)*

Result: *You're presented the Figure box options menu*

Select: *Option 1 (Border Style)*
Select: *Option 7 (Extra Thick) four times*

Result: *This replaces the single line border with an extra thick border. (See Figure A-10.)*

Select: *Option 1 (No) four times.*

Result: *The border disappears.* (See Figure A-11.)

Figure A-10

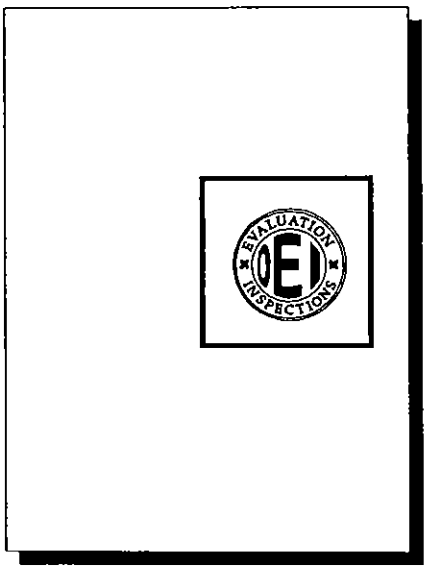
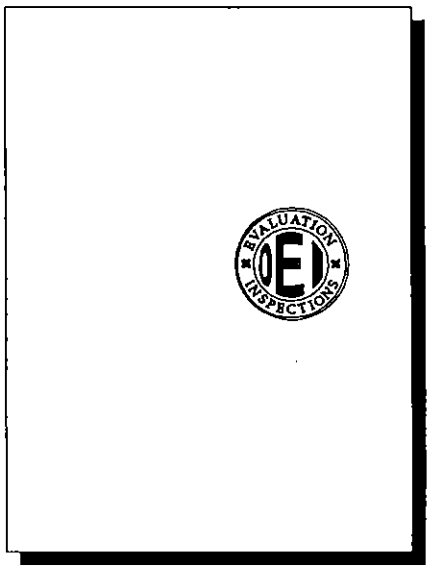


Figure A-11

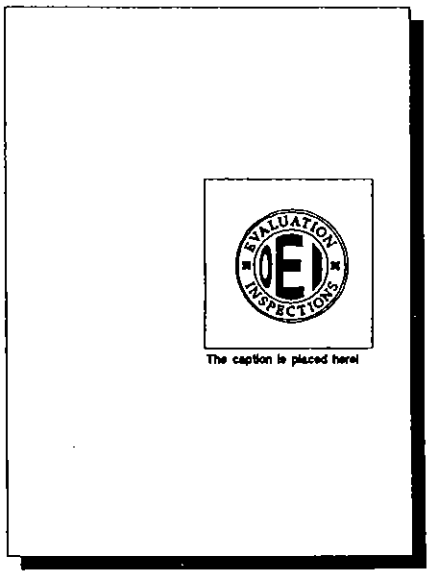


Placing Captions

Type: *ALT-F9*
Select: *Option 1 (Figure)*
Select: *Option 4 (Options)*
Select: *Option 7 (Position of Caption)*
Select: *Option 1 (Below Box)*
Select: *Option 1 (Outside of Border)*

Result: *The caption is placed below the box. (See Figure A-12.) If you had selected (Above Box) the caption would have been placed above the box. Usting the caption to place the title of the graphic along with the figure box reference works very well. Placing the title in the caption box, rather than including the title in the graphics program prior to exporting the file, provides consistency (e.g., title font and size) and provides more flexibility if you need to size the graphic. Specifically, if the title is a part of the imported graphic, it will increase or decrease in size as the graphic is sized. As a consequence, title sizes can quickly begin to vary in size from graphic to graphic within a report. Varying title sizes are not desirable.*

Figure A-12



Appendix B: Graphics Files and Formats

Graphics File Compatibility With WordPerfect

File incompatibility is a problem faced by anyone who wants to merge/incorporate graphics produced in one graphics package with another graphics package or a word processor (in our case, WordPerfect 5.1). Prior to WordPerfect 5.0, we were unable to incorporate graphics into our text documents created with WordPerfect 4.2. Our only alternative was to cut and paste a copy of the graphic onto the hardcopy document after printing or to purchase a utility program such as INSET by INSET Systems which could merge graphs and word processor files at the time of printing.

With WordPerfect we have a program which will incorporate graphs via the ALT-F9 keys. Is it true we no longer have to cut and paste or buy other programs to achieve graphics and text merging? The answer is largely yes. However, it depends upon what graphics package produced the graphic, what file formats the graphics package can export, what changes occur in the file image as it is exported from the graphics package and then imported into WordPerfect 5.1, and finally what quality of graphics image you are willing to accept.

Graphs produced directly by a graphics package to a printer such as a Laserjet or Postscript printer are usually of high quality. Even graphs produced by dot matrix printers are good although they do not usually reproduce on a copy machine as well as output from a laserjet. However, the same graphic imported into WordPerfect 5.1 may be totally unacceptable. Rarely does anything come without a cost. The cost for us in importing a graphic is the output may not be of the same quality as we can get from cutting and pasting the original into the document. This is not to say that programs cannot export files that produce good, if not the same quality, of result as the graphics program itself produced. DrawPerfect works very well with WordPerfect.

The question that you must be asking is why shouldn't any exported file look just as good produced in WordPerfect as it looks directly from any graphics package. The answer is technical. There are so many makers of graphics programs, word processors and desktop publishing programs. While there are several American National Standards Institute (ANSI) standards, like many laws, these have been more honored in the breach than in the observance. Quite simply, every software vendor believes that he or she knows best about how graphics should be done in a particular application. There is no market leader in graphics that everyone else will fall in line with. Certain formats, like PC PaintBrush's PCX and 1-2-3's PIC, have become popular, but they're not standards in the same way that Lotus's WK1 is for spreadsheets or Ashton-Tate's DBF for databases.

WordPerfect can import the following formats directly with no changes. A partial list of file extensions (see WordPerfect documentation for full list): cgm, eps, pic, pcx, tif, wpg (WordPerfect's own graphics extension). Some programs, such as paint

programs, and only one presentation graphics program (e.g., DrawPerfect), produce files in a format that WordPerfect can import directly without the graphics program having first gone through the process of exporting the file (exporting is not the same as just saving a file). Virtually all presentation graphics programs have the ability to export a graphics file in a format(s) acceptable to WordPerfect. However, you may notice that the imported version of the graphic looks a little different. The shading patterns have changed and the typeface of the labels and title are different. Using different printer drivers can have differing results (example, using the driver for a plotter as the output device before exporting the file and importing into WordPerfect). You must experiment to find the best results.

Only DrawPerfect produces files with WordPerfect's graphics file extension (wpg). Since WordPerfect developed DrawPerfect, it is no wonder it suffers few or none of the distortions of graphics imported into WordPerfect from other graphics programs. For this reason alone, DrawPerfect is worth your consideration when creating graphics.

Some other programs (e.g., Harvard Graphics) may even require that a special driver be installed in the computer's config.sys file prior to the generation of the exported file. The driver is required to allow the metafile created to retain all of the characteristics (e.g., font type) of the graphic as viewed in Harvard Graphics.

Raster and Vector Graphics

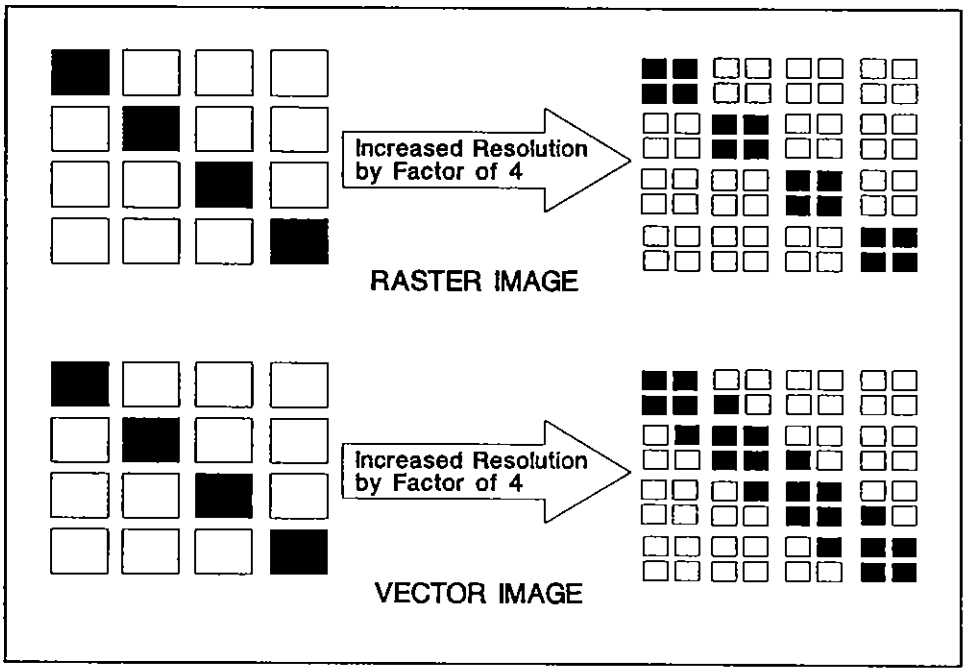
The two basic types of graphics file formats are known as raster (more commonly called bit mapped) and vector (or object based). Each is used for different types of graphics. A bit map uses one bit of computer memory (or more if shading or color) to store a black or white dot. Such a method limits the resolution of the drawing to the limitations of the computer's memory. To illustrate this limitation: a full page of bit map drawing at 300 dots per square inch (dpi) would require over one megabyte of memory. Consequently, most commercial paint programs use the resolution of the computer screen which results in poor quality when printed on a LaserJet at 300 dpi.

Draw programs, on the other hand, print at the highest resolution of the output device (LaserJet) regardless of the screen resolution. That's why you can produce beautiful graphs using a low resolution CGA monitor even though it looks terrible on the screen when viewing the graph.

Paint programs, screen capture programs and scanners produce files in a raster format. Examples are PC Paintbrush and Windows Paint. Raster images can be described as a series of pixels or dots. On the other hand, vector images are stored as a list of drawing instructions describing individual objects. Postscript (.EPS extension) are unique. The images are stored in the postscript language and thus can only be printed on a postscript printer. The language is more complex than a simple vector list of instructions.

The great advantage of vector graphics over raster is that vector graphics can be sized without loss of resolution, lines are smaller and objects are treated individually. An explanation of resolution follows. Imagine if you increase the resolution of your LaserJet (dots per inch), or computer screen (pixels per inch) by a factor of 4. Wouldn't the drawing you did in PC Paintbrush look or print with more resolution (smoothness of lines)? The answer is "no." The following illustrates why. Notice how the resolution of the image (blackened squares) does not get better for raster images while vector images do get better.

Figure B-1



Raster (paint type) images offer less latitude for image enlargement or reduction. When the images are reduced in size, the dots become too close to each other and detail is lost. Likewise, enlargement can cause an image to break apart, because the dots defining the image are moved further apart.

The fact that vector programs store objects like lines as individual objects, allows you to manipulate (rotate, flip, move, size) the object easily. All that is involved is altering the information (e.g., specifying the line: start point, stop point, width, etc.). This is not the case with an image created with a paint program. Since the image is made up of individual pixels (dots), every dot must be altered individually. You must settle for painting portions of the image back to white (or whatever color) and starting over.