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Combating poster fatigue: how to use visual grammar and analysis to effect better visual communications

John D. Woolsey

Posters are increasingly being used as a medium for the communication of results and ideas. The organization and presentation of a poster plays an important role in the facilitation of effective communication. In this article John D. Woolsey describes how best to maximize the visual impact of a poster.

Poster sessions have become the major form of communication at many meetings

Lack of enough meeting rooms and time slots for slide presentations has made poster sessions a necessity. Although the poster is the presentation format everyone loves to hate, both because of the labor and techniques involved in producing it and the tedium of reading poorly conceived examples, this format has increasingly been employed even at smaller meetings and in-house symposia because it affords certain strong advantages in communicating with one's colleagues.

Poster sessions enhance collegial dialogue and include several other notable advantages

Unlike most oral communications, posters are presented for several hours, allowing time for lengthy discussion. Data and graphics on the poster are available as long as individual viewers wish to see them. The viewer may focus on aspects which are of the most personal interest. For instance, description of technique may be of prime interest to one viewer and data analysis to another. A poster also allows the viewer to go back and review a figure or some text earlier in the sequence at will. The poster may be studied in detail for taking notes. Some viewers photograph sections or whole posters that interest them. Photographic methods of producing posters enable the printing of inexpensive facsimiles as handouts.

For younger researchers in particular, dialogue at a poster may provide important contacts and valuable responses from scientists outside the immediate field who may have specific ideas regarding technique, analytical methods or the like, but who would not attend a lecture on the topic being presented.

Posters enable great graphic flexibility. The ease of creating color graphics, combining photographic and graphic techniques, computer graphics and outputs from recording devices in many size formats increases the range of graphic options available to the author. Even three-dimensional elements may be used. A poster may be used after the meeting is over. While most posters are displayed at a single meeting only, many authors mount them at their own institutions afterward to communicate recent research to departmental colleagues and students. They also serve as valuable visual aids for visiting scientists and site visits.

The difficulty and expense of producing a successful poster can be minimized with planning

The production of posters is labor intensive mainly because of their size and the requirements for large text. This article contains suggestions for keeping this labor to a minimum.

Poster production requires materials which are generally more expensive than slides, such as large prints, title banners, matt boards and the like. These expenses can be minimized with careful planning. Methods are available for attaching graphic materials to the poster that enable them to be re-used if desired. A poster is bulkier than slides but can easily be assembled in prepasted modules for transport and quick mounting.

The poster audience can be divided into three main groups

Group 1 comprises those colleagues, collaborators and students who follow your work very closely. These are the people who read your publications in detail and who correspond with you. They may number a handful or a few dozen. A crudely constructed wordy poster would not daunt them because of their high level of interest in your area of specialization and motivation to follow it. They should not be considered your primary audience. *Group 2*, much larger, is made up of those scientists who work in the same general area as you, but on different sub-specialities. This audience may wish to review large numbers of communications in their

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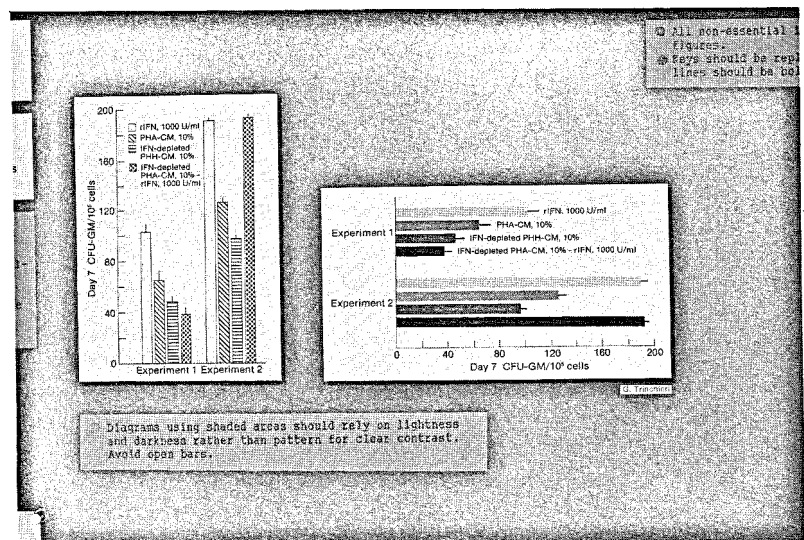

Fig. 1. *Groups of related information function best if tightly composed with a clear surround.*

area, but with less attention to detail. Nevertheless, because of their general knowledge of the field, they may provide valuable suggestions and insight about your research. Group 2 comprises the main target audience for a poster. *Group 3*, the largest group, is made up of those researchers whose work bears little or no relationship to yours. Successful communication on a more general level can take place with this group if they can be enticed to view your poster briefly. Analysing your material visually and presenting it in a hierarchically layered fashion makes it possible to design a poster that effectively communicates with all three audiences without slighting one or the other.

Posters are visual displays and should be organized using visual grammar and analysis

The following is a detailed consideration of the graphic elements that make up a poster: how to organize text, illustrations and other graphic elements into a cohesive whole for easy comprehension, and how to communicate your research findings with immediacy and clarity.

Text must be hierarchically organized and the hierarchy differentiated visually

The text can usually be drawn almost wholly from the abstract and will need to be enlarged for viewing at several distinct distances or scales (Table I).

Main heads carry essential content, and should provide a complete 'take home' message. The main methods, results and conclusions should be clear to casual viewers and provide a complete synopsis. To be read from 2–2.5 m away, type must be about 10 mm high.

Sequence numbers for each section of the poster provide a clear order for reading; these should be approximately 25 mm high.

Supporting text follows main heads. It should be legible at 1–1.25 m, with type about 5 mm high,

and heads should describe each figure in sufficient detail to support its significance and relationship to the main heads.

Details, also to be read at 1–1.25 m, should be subordinated to supporting text by placement, type weight or background color. Reliance on verbal descriptions, with references to figure numbers, while appropriate for publications, defeats the purpose of a poster, which is to display ideas graphically. Your poster is not a publication of record. It is not necessary to describe methods exhaustively or to provide massive tables of data or elaborate statistical analyses. A poster which includes these things is usually more inaccessible. An observer who is concerned enough will generally ask for this information, and detailed material can be discussed or provided in a handout.

Text should be active and purged of redundancy and deadwood

Text should be written to eliminate copy which is meaningless in itself (e.g. 'see Fig. . . .'). Consideration should be given to altering the published title so that it contributes to understanding the research results. Thus, the title *Studies of the Effect of Compound XYZ on Caudal Motor Behavior in the Dog* might be changed to a style which actually communicates some portion of the conclusion: *Compound XYZ Causes Tail-Wagging in Dogs.*

Composition is the visual structure of a poster: it should aid, not interfere with comprehension

The purpose of composition is to make visual ideas flow smoothly and logically from one to another, to subordinate visually those things which are less important and to draw attention to those things which are of greater importance. A poster cannot be 'figured out' at the leisurely pace that a paper can. It is usually read in a few minutes, often amid crowded conditions, and with many other competing presentations. It is essential that it contain no non-essential visual elements. **Edit ruthlessly!**

A good poster composition has a substantial amount of blank space, ideally close to 50%. This space can be used to highlight section breaks. A full poster does not always make its point. It is often too chaotic to follow easily. Figures 1, 2 and 3 demonstrate rules for composing material visually.

Jagged compositions (Fig. 4) make the eye dance around in a restless fashion and draw attention away from content. The eye looks for edges. A poster which is composed of squares of white paper, neatly mounted individually on colored boards which are then mounted on a corkboard surface has many useless and distracting edges with which the eye must contend. If these boards, in turn, are of varying sizes or are not mounted *perfectly* straight, the added jags in the composition take even more attention away from the content. Compositions which are aligned on imaginary center lines rather than the long visual lines created by aligning left or right edges often have this jaggy appearance.

Fig. 2.
Long visual lines help organize the flow of information. Primary long visual lines (thick solid lines) aid in establishing reading sequence and organize information in visual groupings. Secondary long visual lines (dashed lines) remove jagged edges, allowing the eye to scan the composition with less effort.
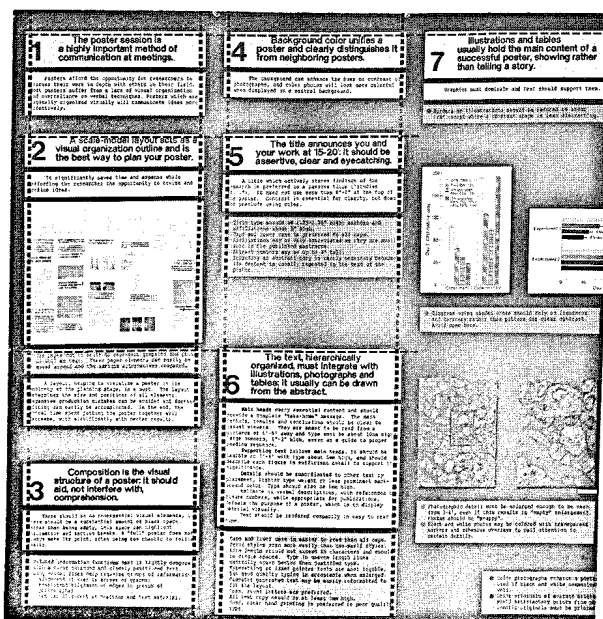
A scale-model layout acts as an outline and is the best way to plan your poster

A layout should determine the size of art and photography, length of text, headings, and flow of information before the final production of any single element. It saves significant time and expense while affording the opportunity to revise and refine ideas. Visualizing a poster in its entirety at the planning stage is a must. Expensive production mistakes can be avoided. Too much or too little information will become apparent and editing can take place accordingly. In the end, the actual time spent putting the poster together will decrease significantly and produce better results.

There are two distinct stages in preparing a layout: the *thumbnail* and the *tight layout*. A thumbnail layout (Fig. 5) is a rough, quick sketch which is meant to work out the basic flow of information in the poster and map out its visual logic. Thumbnails may be done without much regard to the exact amounts of text, but one should have a relatively clear idea of the number and relative sizes of the illustrations, photographs and diagrams to be included. (The posters used at the Society for Neuroscience meetings are 2 units high by 3 wide, so thumbnails could be 12×18 cm.) Several thumbnail alternatives can be worked out in a few minutes each. They are your loose visual outlines.

The tight layout. (Fig. 6) is the working blueprint for your poster. A convenient method of preparing the tight layout is as follows.

(1) A reduction to a quarter of final size is a convenient working size for a layout. On a sheet of graph paper measure the outside dimensions of your poster. Outline it heavily. (2) Divide the rectangle vertically in thirds or fourths. These divisions suggest possible columns to follow in the layout and, later, logical divisions for cutting and folding the finished poster. They will probably be suggested by your thumbnail sketch. (3) Draw a horizontal line about one-eighth of the poster's height from the top for the title area. (4) Use paper cut to scale to represent graphics and photos as well as text. For instance a number of pieces of paper representing 5×7 prints or 8×10 graphs can be cut out. These paper elements can easily be moved around and various alternatives can be compared by taping down the results temporarily and photocopying them. Use scraps of photographic prints or pictures and text from magazines to help give a more realistic visual sensation of the finished product. From now on, there should be few significant changes and the poster can be produced easily by simply transferring the measurements multiplied by four.

It is necessary to determine how much text copy there is so it can be prepared to fit the layout

We'll assume that the text will be printed from a word processing file as 12 pt or 10 pitch type and enlarged on an office copier. Since, to be legible at the optimum of 1–1.25 m the text must be enlarged
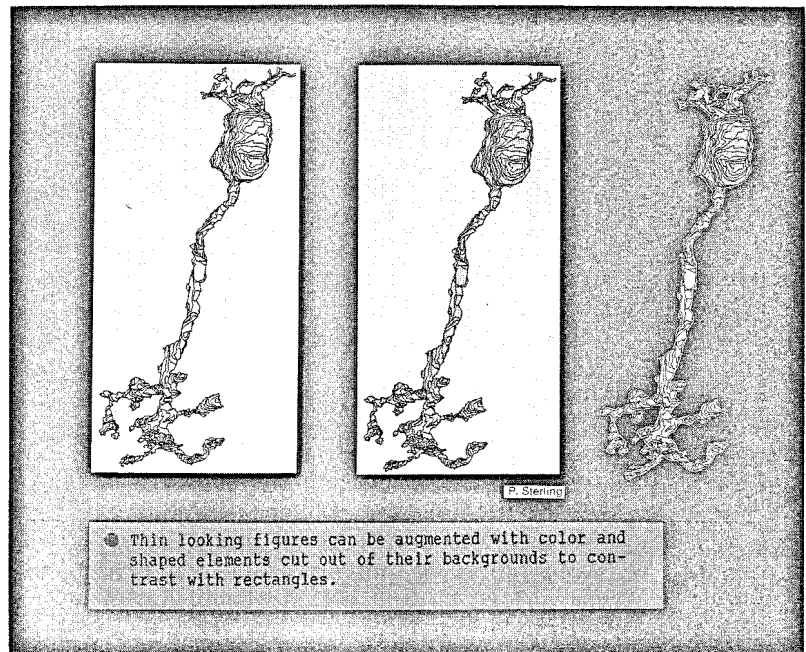

Fig. 3. *Close positioning of an illustration and its text makes a visual unit.*

two diameters, one needs to bear in mind the largest paper that the copier can handle. A line to be enlarged to 20 cm on the poster should be 10 cm on the draft copy (40 characters of 10 pitch type or 48 characters of 12 pitch type). By reformatting your files to these widths you will have an accurate picture of the amount of space to be allotted for type. If you are typing the copy manually, multiply the average draft line length in characters by the number of lines and divide by the proposed new line length in characters to calculate the number of new lines. Since there are normally six lines of copy per inch in typed text, there will be three lines per inch when enlarged to 200%. Therefore, the number of
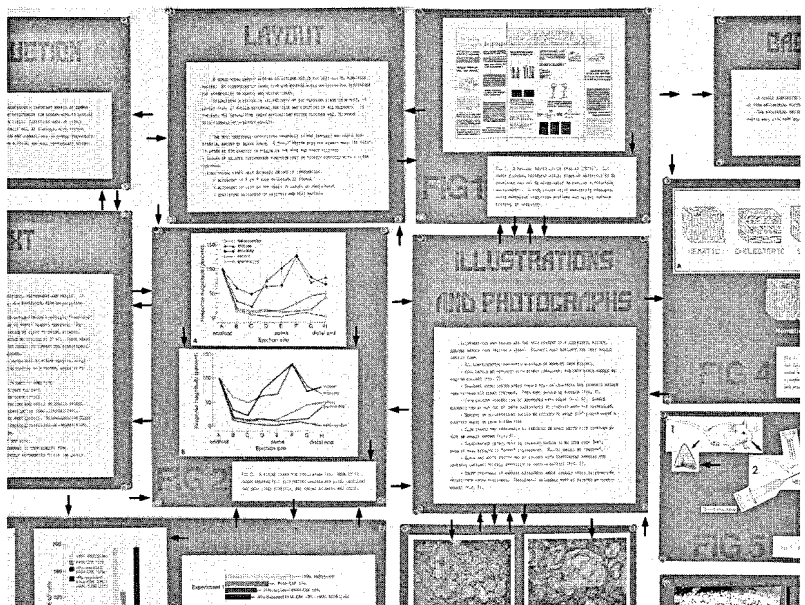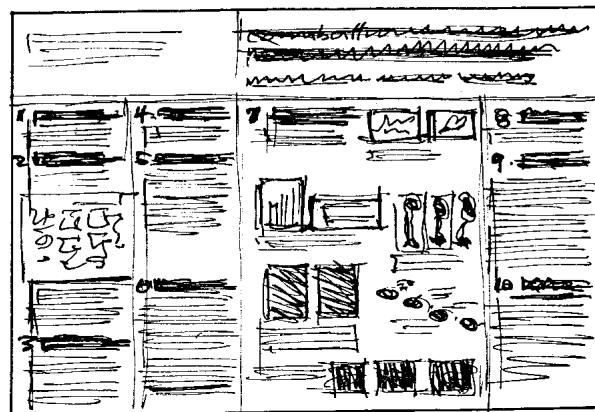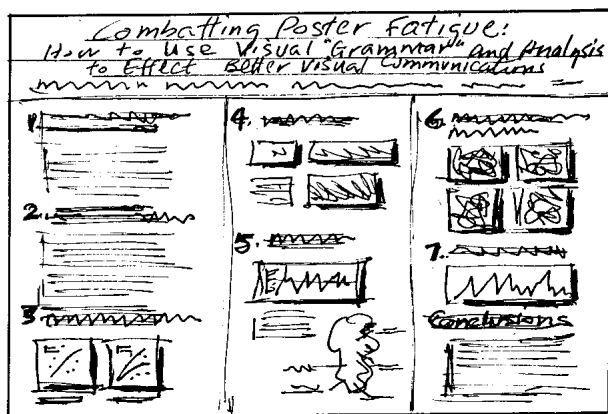

Fig. 4. *Jagged compositions include many extra edges (arrows) with which the eye must contend. These edges contribute to reading fatigue. Lack of long visual lines exacerbates this problem.*

Fig. 5.
Examples of thumbnail layouts. These are quick sketches to explore basic organizational ideas for the poster.

lines divided by three will give the vertical measure of the copy. Handling text with Macintosh-type word processing programs and laser printing the copy allows for even better copyfitting by adjusting type style, size and line spacing.

You may be surprised to find that your text occupies much more space than you expected. Remember that the poster is essentially a visual presentation, that there is a lot of competition for the reader's attention, and that generally where text is concerned, less is more, so edit text critically at this stage. Review its hierarchical organization for maximizing communication to all three audience groups.

A single background color (or closely related set of colors) serves to unify a poster and clearly distinguish it from neighboring posters

This may be the single most important element in creating a visually unified presentation. Colors which are somewhat muted or grayed provide a more restful background than do bright colors. In a brightly lit hall crowded with other posters and people, muted color is more likely to bring attention to your work than is highly saturated color.

Color can be used to unify groups of data. Three colors of similar value (i.e. lightness and darkness) and saturation (e.g. a green-gray, blue-gray and violet-gray) might serve as backgrounds to help tie together the methods, data and interpretations of three related experiments. Such use of color enhances graphic meaning.

Color can enhance the hues or contrast of photographs: dark photos will look darker on a light background, lighter on a dark background (law of simultaneous contrasts); color photos will look more colorful when displayed on a neutral background (like medium gray), less colorful on white.

Art supply and frame shops carry a variety of matt boards. Matt board is superior to thin posterboard (railroad board) not only because the color selection is better but because it does not fade and the surface is less fragile, allowing erasures and repositioning of mounted items.

The title announces you and your work from a distance of 15–20 feet: it should be assertive, clear and eyecatching

It need not use more than 12–20 cm at the top of the poster since, if it is lower, it may be obscured by the heads of viewers. Strong contrast is essential for clarity. This does not preclude using color, however. Title type need be no larger than 3–4.5 cm; authors and affiliations should be about 2.5 cm high. The use of capitals and lower case is preferred to all capitals because it scans better, is more compact and allows proper use of capitalization in abbreviations, acronyms and terminology. Affiliations may be abbreviated as they are available in the published abstracts. Including an abstract in the title area or elsewhere on the poster is rarely necessary because its content is usually repeated in the text of the poster and is redundant. A clear border around the title copy provides 'breathing room' for the copy and helps readability. Similarly, names and affiliations may be shortened when they are too wordy or where details are self-evident. Middle initials may be dropped from names; cities may be dropped from well-known affiliations (for instance, New Haven could be dropped from Yale University); state names may be eliminated (Philadelphia is sufficient, but Miami should include OH if it is not
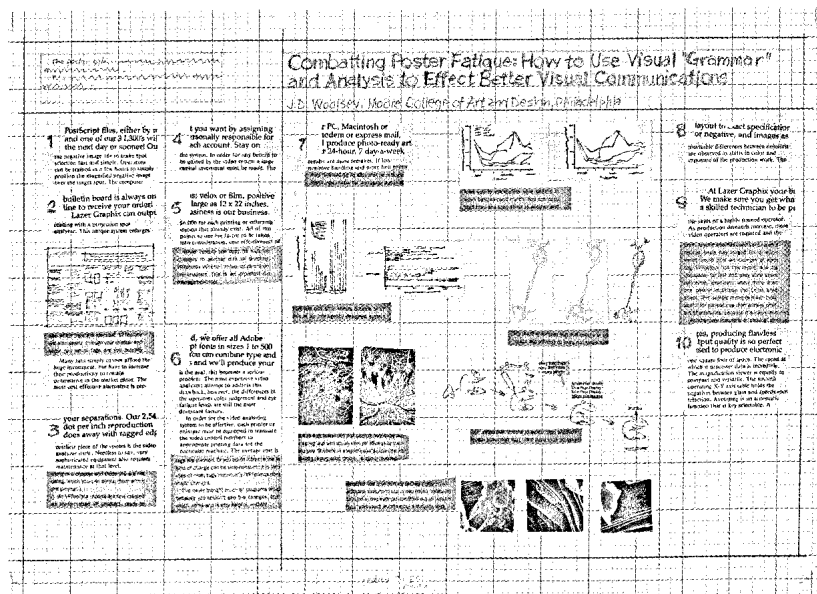
Fig. 6. *Example of a tight layout to scale using graph paper as a base. Magazine copy and illustrations cut to scale simulate actual poster elements and help convey a sense of visual flow and logic.*

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the one in FL!); departments may often be eliminated. Multiple affiliations should be handled in the most direct fashion, each affiliation following the appropriate author rather than employing elaborate footnote schemes which are more appropriate to publication. Where space is available, an author's first name rather than initials often proves useful, helping facilitate direct dialogue with the presenter.

Deciding whether to center the lines of title text or to align them left or right is best done in the layout. There is no 'correct' presentation here. Lettering techniques may determine the best method: professional typesetting can produce centered text with ease as can most computer generated systems. Vinyl letters and hand lettering are more difficult to center. If the job is not done perfectly with these techniques, errors are glaring.

Color for a title banner is limited by contrast between the type and the background. High contrast is necessary for reading from a distance and the ability to use color on the title banner may be determined by the technique used to produce it. However, because of the bright, flat light in convention halls and the prevalence of other black and white presentations, using some color in the title is recommended, for instance as drop shadows, outlines or borders. The use of logos on posters by authors with corporate affiliations may be required by their companies, but should be kept to a scale consistent with the text size. School letters and mascots have little meaning to anyone outside that institution and their use is questionable.

Text must be enlarged sufficiently to be easily legible at the three reading scales

Appropriate type sizes and weights are shown in Table I. Other rules for good typography are listed below.
(1) Capitals and lower case are easier to read than all capitals becuse they aid in creating unique word shapes which speed reading and comprehension. Avoid using *Orator* type or similar all-capital fonts. (2) Serif styles (those type faces characterized by cross-strokes at the ends of most letters) scan more easily than sanserif styles, especially in long passages. Sanserif fonts (such as Helvetica) are appropriate for shorter labels and copy blocks such as main heads. (3) Line length should not exceed 65 characters and should be single spaced. Excess line spacing contributes to difficulty in reading. Line spacing should be roughly 20% of the type height. Type in uneven length lines (flush-left, ragged right) scans better than justified (even line length) type when read from a distance. (4) Professional typesetting or laser printer fonts based on classic type designs are most legible, and, depending on the font chosen, are generally more compact than typing. Centuries of design evolution has gone into production of high-legibility type styles. It is silly to throw away these developments if they are available for producing text. When type is to be read at a distance, maximum legibility is all the more import-
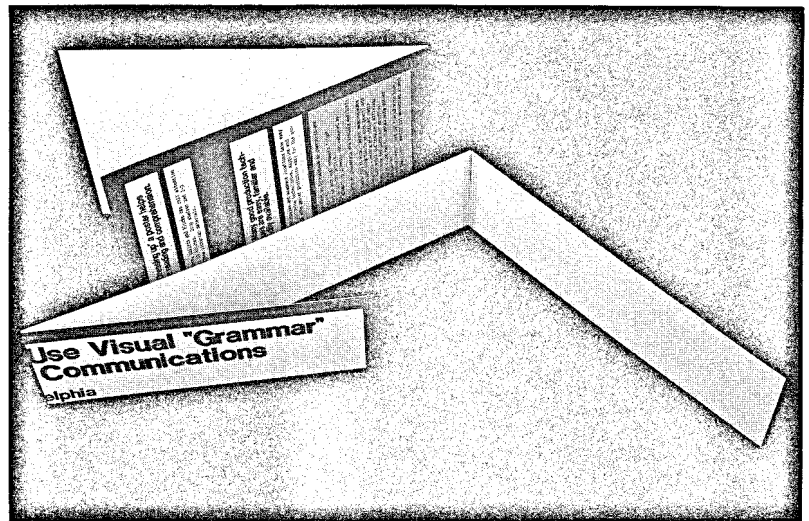

Fig. 7. *Hinged poster modules. Larger sections of a poster may be pre-assembled on boards, then cut and hinged with tape on the back. An average poster may have four or five such units which may fold for easy carry-on transport or to fit a briefcase.*

ant. Recommended are *Times Roman, Garamond, Palatino* and *Century Schoolbook* type, and *Courier* or *Prestige* typewriter and printer fonts. (5) Open, round letters are preferred to condensed, small-bodied ones. All text copy should be at least 5 mm high (about two times typewriter size). (6) Good, clear hand-printing is preferred to type which is too small, too light (as basic dot-matrix renditions), or in inappropriate novelty fonts such as *Old English*. (7) Computer-generated text may be easily reformatted to accommodate the layout, and many typographers can set inexpensively directly from disks or via modem and provide laser printer output.

Illustrations and tables usually contain the main content of a successful poster, showing rather than verbally telling a story

Graphics must dominate. Text should be used to augment, not overwhelm, illustrations. Illustrations and text should be integrated in reading order rather than referenced with figure numbers as in a published paper.

For clarity, all non-essential information should be removed from figures, such as data lines not considered in the text and elaborations of statistical analysis. Keys should be replaced with direct

TABLE I. Appropriate text characteristics for poster sessions

Text content	Reading distance (feet)	Type size	Type weight
Title	15–20 (far)	30–45 mm	Bold
Authors, affiliations	15–20 (far)	25–30 mm	Bold
Main heads	6–8 (medium)	10 mm (36 pt)	Bold
Sequence numbers	6–8 (medium)	25–50 mm	Regular or bold
Supporting text	3–4 (close)	5 mm (24 pt)	Regular or bold
Detail text	3–4 (close)	5 mm (24 pt)	Regular

A comparison of two posters whose
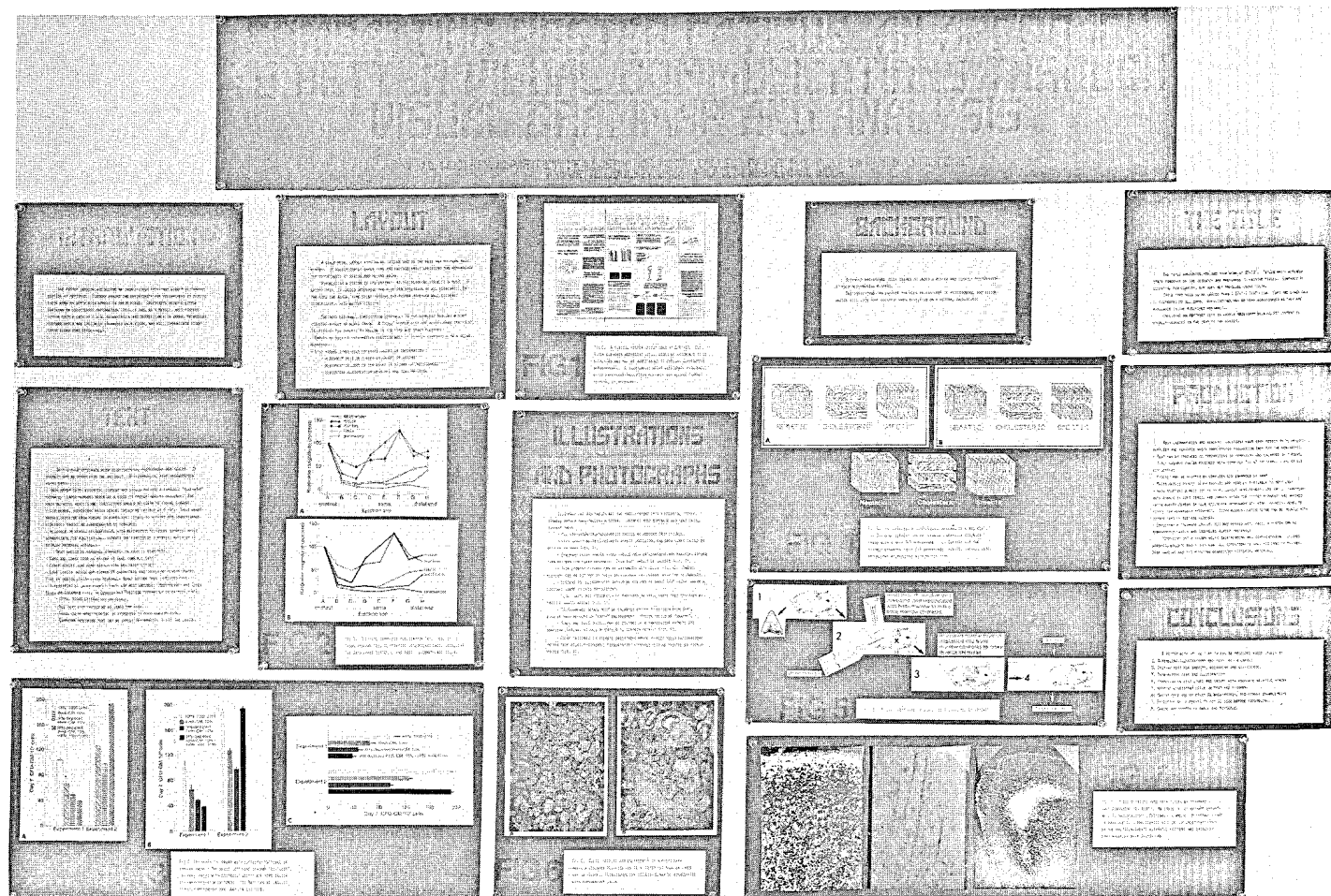
Left-hand poster

This poster uses many of the techniques which are commonly seen at large meetings and are fairly typical of 'home-made' posters. Many of these techniques significantly reduce legibility and/or comprehension, or simply render the poster's message less accessible.

(1) The title is larger than necessary and authors and affiliations too small for far-reading scale.

(2) The text and figures are arranged in a publication style, are overly wordy and reference figures whose legends are then repetitive.

(3) Section headings are merely labels which do not convey the substance of the poster. They are not sufficiently contrasty, and are too large relative to the text type.

(4) The layout creates a reading sequence which criss-crosses the poster. There are few clues to aid in reading this sequence, making it difficult to follow.

(5) Mounting individual items with borders has created many superfluous edges, which are distracting to the eye. Moreover, mounting items individually is time consuming.

(6) Text type is too small for the 1–1.25 m close-reading scale and too diluted by white space, both between lines and surrounding the copy block. Lines of over 80 characters exceed the 65 character maximum recommended for easy scanning.

(7) Type set in large and small capitals in a font such as Orator (though highly reduced here) is difficult to scan because the words do not form shape pictures created by their ascenders and descenders. These elements in lower case letters are a significant factor in legibility.

(8) Nearly every element is centered on itself rather than arranged within the whole to allow visual flow from one item to the next. The composition is jaggy with few long lines to carry the eye. There is no consistency of spacing and placement of analogous elements.

(9) There is inadequate blank or negative space in the composition to allow the eye to rest.

(10) The figure numbers are too large and prominent, and do not completely indicate reading sequence.

(11) There is inadequate attention paid to scale; hence, it is necessary to move very close to read the poster, yet a number of items are unnecessarily large at that distance.

labeling of lines or bars, etc. The same version of an illustration does not always serve all purposes equally well. A graph prepared for publication may have symbols and a key for significance values, standard error bars or data lines included for reasons apparent in the publication but not so obvious in a poster. These elements should be appraised critically and eliminated if at all possible. A graphic also does not achieve scientific lucidity simply because it has been drawn professionally or by a computer. A well-edited graphic produced in a hand-drawn style is usually preferable to an overloaded or poorly

:ontent is essentially the same

Right-hand poster

   This poster represents the application of visual grammar concepts to material presented in the left-hand poster. Its chief strength is its organization. The techniques used to produce it are all readily available in most laboratories. These include typewriters or word processors, photocopiers, peel-off stationery store numbers and simple photography. More shortening of the text and reduction of the material presented would further increase its effectiveness.

(1) The title (produced with a dot-matrix printer and a simple sign printing program) is sufficiently contrasty to be read from 3–4 m and its sub-elements are in scale to one another.

(2) Text and figures have been integrated and the publication style of organization replaced with a visual one. Text has been organized into major heads, supporting information and details. These have been grapically differentiated (larger heads for mid-distance reading, smaller text on white and colored grounds).

(3) Section headings are active and carry the essential information of the display for the casual reader.

(4) Text layout is columnar, and a single section can be read before proceeding on to the next. Large numbers establish a reading sequence.

(5) A single background color has unified the poster and rid it of many distracting edges.

(6) Type, enlarged on a copier from a conventional typewriter font, is large enough to be read from 1.25 m away and is relatively compact (single spaced). Use of capitals and lower case letters aids in scanning copy, as do shorter 50-character lines and ragged right (non-justified) formatting.

(7) Individual elements are composed relative to others rather than centering on themselves. Spacing and placement of analogous items is consistent and the resulting long visual lines reduce distracting jaggies.

(8) There is significant blank resting space for the eye.

(9) Modest decoration with simple drop shadows and bullets helps to dramatize illustrations and specific technical points.

(10) Scale of text and figures has been adjusted to be legible from the same reading distance.

conceived figure, even if professionally drawn.

   Color may easily be added to illustrations with overlay films, colored tapes and markers (use water-base markers on photocopied materials), and black and white figures may be copied on to colored papers on most office copiers.

   Key points for the preparation of illustrations:

(1) Data lines should be bold or colored with markers or tapes.

(2) Diagrams using shaded areas should rely on differences of value (lightness and darkness) rather than pattern to be clearly contrasted. Avoid open bars.

(3) Thin-looking figures can be augmented with

color, using adhesive color overlays or markers.

(4) Borders on illustrations should be reduced to about 5 mm except where a constant shape is less distracting in a group of similar figures (e.g. several graphs, the largest of which fills an 8×10 format).

(5) Flow charts may frequently be executed in small units tied together by tape or marker arrows. Shaped elements can be cut out of their backgrounds to contrast with the rectangles that usually dominate a poster.

(6) Photographic detail, especially in electron photomicrographs, must be enlarged enough to be seen from 1–1.25 m, even if this results in 'empty' enlargement. Photos should not be overly contrasty, but should have a 'snappy' appearance.

(7) Color photographs enhance a poster, but need not be used if black and white communicates a point equally well. Black and white photos may be colored with transparent markers and adhesive overlays to call attention to certain details.

(8) Color photos of average brightness range usually yield satisfactory prints from photofinishers. However, problematic originals must be printed by custom houses. When in doubt, plan your poster pictures early enough to order color prints first from a photofinisher and then from a custom house if necessary. In smaller cities, prints from color slides often must be sent to Kodak or some larger facility for processing, taking 7–10 days. These prints are relatively inexpensive because they are produced on automatic equipment which is calibrated to produce the best results for standard snapshot subject matter. A very light original will frequently be rendered dark and brownish. Conversely, a dark original will often have a greenish cast and decreased color saturation. In both, detail may be lost. These problematic originals must be sent to custom laboratories which print by hand. Good communication with the laboratory detailing what is important in the photo will help yield the best results. Most custom laboratories work quickly, in 24–72 h, and are expensive.

Dressing up a poster helps ease reading and comprehension

Colored borders, bullets and blocks can call attention to specific text or figures. Drop shadows of cut paper, chart tapes or marker can make artwork appear to pop out from the surface. Three-dimensional mounting on pieces of cardboard or foam-core board dramatizes photographs and other important pictorial materials.

Many good production techniques are easy, familiar and readily available

Though professional artists use a number of techniques which seem mysterious to the scientist, most laboratories and academic locations have easy access to the following technologies, supplies and services which make poster production easy for the non-artist. Remember that the most graphic impact of a poster comes not from the neatness or professionalism of its execution, but from its *graphic planning*.

(1) Text can be produced on typewriters or computers and enlarged on copies.

(2) Title banners can be printed with computer sign-printing programs, vinyl or die-cut letters or laser-printed text enlarged on a copier or printed from tiled files. Black and white output may be enhanced with colored markers, overlay sheets or pencils.

(3) Figures may be plotted by computer and enhanced by hand using the color techniques above.

(4) Black and white photographic prints are readily available to most laboratories. Color prints are available from most photofinishers and at custom photo laboratories catering to the commercial trade. Most moderate- and large-sized cities usually have such services, and they are often available via mail and express delivery services elsewhere.

(5) Using the layout as a guide, mounting boards may be cut to size, and layout measurements easily transferred in soft pencil and erased after the poster elements are affixed.

(6) Rubber cement or glue stick may be used for temporary affixing, and elements of the poster may be 'tipped in' by simply gluing the top edge and allowing the bottom to fall free, if desired. Mounting adhesive tissue such as *3M Positionable Mounting Adhesive* should be used where permanence is desired. Items needing later reuse can be slipped into acetate sheet protectors glued to the mounting boards or with rings of tape on the print back.

(7) By using a columnar layout of 45–60 cm units wide in sections 30–45 cm deep and hinged with tape on the back (Fig. 7), a poster can be transported easily, assembled quickly, and avoid damage in transport. All elements will be in precise position when mounted and the author may quickly attend to questions from viewers.

(8) Cardboard packing approximately 5 cm larger in each dimension than the poster will minimize damage and bent corners.

Concluding remarks

A poster that communicates with ease and visual clarity can be produced successfully by:

● Assembling illustrations and text with a scale model layout plan

● Editing text for brevity, hierarchical structure and efficiency

● Integrating text with illustrations

● Composing in long visual lines and tight groups with adequate negative (blank) spaces

● Keeping a consistent reading scale in the text and figures

● Making good use of color in backgrounds and figure enhancements

● Producing all elements to actual size before assembling

● Making the poster foldable and portable