

A Prototype Computerized Page-design System

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The graphic designer has need for an interactive computerized design system to enable him to match the capabilities of available computerized type-editing and typesetting systems. This article describes a prototype system devised to investigate both the problems and capabilities of using computers for page design. The two aspects of the investigation are the appropriate representation of graphic material on a low resolution television-like display and the development of interactive features. The ability to add, delete, and move blocks of symbolized type and illustration on the display has the advantage that the computerized form of the final design is immediately compatible with computerized typesetting systems.

Computer-assisted type-editing and typesetting systems for the graphic arts industry have made considerable progress in recent years, but the graphic designer, who organizes typographic and illustrative material and who makes decisions which ultimately control these devices, has had much less computerized assistance made available to him.

In general, the typographic systems which have been developed are ones using special purpose devices designed for typographic situations. They are concerned (1) with the input of text for a given page of a book or magazine, or (2) with the final output display of the typography for use in making printing plates. To date, text-editing systems (such as MACE at Bell Telephone Laboratories) or typesetting systems (such as the Harris-Intertype Fototronic or the Mergenthaler Linotron system) have only begun to deal with a wide variety of non-typographic material (Miller, 1969; Anderson, 1970). Such systems concentrate on the two "ends" of the complete chain of activities: from the input of an author's text to the output of finished typography and illustration necessary for the production process. This paper describes a prototype computerized system which was developed by the author at Bell Telephone Laboratories, Murray Hill, N.J., and which addresses itself to the requirements of the

graphic designer who occupies a middle position in this sequence of activities.

The graphic designer's role entails more than mere administration of pieces of type; he seeks to provide a stimulating and appealing composition at all levels of design. It is the complexity of the factors governing aesthetically successful design which prevents an algorithm (i.e., a set of instructions) for the entire process from being developed. The nature of the design process therefore requires human intervention and judgment within a computerized system. An interactive system requires the designer to remain at the center of the design activity while predetermined algorithms take over as much of the mechanical subtasks as possible. Even in relatively simple problems of page design, the creation of a program capable of dealing with all logical possibilities, of ranking their desirability, and of optimizing the page composition would be an extremely difficult programming task. For the present, both the computer and the human being possess capabilities which ought not to be underused or misused.

In composing a page, the graphic designer requires a model or diagram of his work with an appropriate level of precision and accuracy. In some cases, often in the beginning, a few pencil strokes will suffice; in other circumstances, he must see a comprehensive diagram.

In addition to a model which he can easily interpret, the designer requires quick, reciprocal interaction between himself and his diagrams. The designer makes changes on the basis of the visual displays available to him whether they are pencil-line sketches, photographic reproductions, or electronic displays. He works back and forth between alternatives trying to account for certain prescribed rules and responding directly to visual forms, adjusting them to incorporate the semantic and the pragmatic parameters of explicit communication as well as the syntactic aspects of form-making which incorporate long professional experience and aspects of implicit communication at a deep, broad cultural level. The more feedback a system provides the designer as he alters visual form, the better he can judge the validity and coherence of his decisions.

Among other capabilities, a computerized page-design system must simulate the traditional tools of pencil, paper, scissors, and paste. The designer must be able to add, subtract, or move elements freely within a normal display area. This area might be the two-page

spread of a book or magazine on which the designer usually composes across the entire surface available to the reader, comparing elements visually on either of the two opposing pages.

Since the designer usually manipulates visual elements by pointing to them and moving them to tentative positions, some analogue device must serve to translate his spatial gestures into appropriate information for a digital computer. Certain of the designer's reactions to the display may be based on clearly formulated rules. In so far as an algorithm for such a response may be described, that subtask of the graphic designer's total activities which is repetitive in nature can advantageously be taken over by computer control.

Having briefly indicated how a computer might assist the designer, a more detailed examination of the problems of developing such a system follows. The first question that arises concerns the appropriate kind of visual display and the nature of a meaningful abstraction of graphic elements symbolized on it. The second question concerns the kind of interactive features appropriate to the graphic designer's activities.

Graphic Abstraction

The graphic designer distinguishes between a great variety of visual elements. He must be able to recognize headlines of varying importance, main text, footnotes, captions, continuously appearing material, page numbers, tables, and line and halftone images. At a finer scale, he may have to discern differences in the style (e.g., roman or italic), size, weight, or setting (e.g., ragged-right or justified) of the type.

In a realistic system, an analogue for each of these elements must be available on the display in order that the designer may properly discriminate these particular features. In addition, the system must be capable of displaying individual graphic elements with enough precision that they validly serve as a basis for aesthetic judgments relating to the rhythms of size, location, orientation, shape, and color. A suitable abstraction of the printed page has been devised which can signify basic information to the designer.

There exist presently no high resolution displays which can present a large amount of detailed information on a page and which can change displays fast enough for use in an interactive mode. Therefore, a low resolution display has been considered.

The experiments discussed here utilize a scanned television-like display controlled by a Honeywell DDP-224 computer. The primary advantage of this scanned display is its ability to output large amounts of data without flicker. This would be necessary to display a full page of typographic or illustrative material. The TV display presently operates with four levels of brightness, and a scanned image of 240 points in width by 254 points in height is put out every 30th of a second (Noll, 1971).

Dummy text incorporated into the program as "input" can be displayed on two facing pages each of whose dimensions may vary up to $8\frac{1}{2} \times 11$ inches. For type unit sizes (type size plus leading) between 8 points and 12 points—a range wide enough to cover the normal limits of variation for body text sizes—the display requires from 176 to 237 raster lines to display 11 inches of page height, with each line of standard type represented by one to three raster lines on the screen. No attempt is presently made to provide exact word-for-word display of a given text. This would require a powerful text-editing and hyphenation program such as is already provided by programs like MACE (Miller, 1969). An editing program would be necessary in order to change sizes, column widths, and settings of any text typography, since this necessitates altering end-of-line word breaks. Using dummy text, the current program allows such alterations of typography and ignores some details of exact word break changes.

However, the system does provide precise (to the typographic point unit as a first stage), accurate locations of all graphic material. For this reason calculations are more time consuming to program and to execute. Essentially, the data concerning locations of text and illustrations must be kept on a micro-grid of typographic point unit measures while the information for the display is computed according to coarse units related to the particular display device. Not only does this allow the program to be relatively easily altered for different display devices, but the exact location data is available for any precise typesetting device which might be interfaced at some later time.

One aspect of the prototype system is that the vertical screen raster is adjusted to correspond exactly to the main type in the display; i.e., the type unit is represented by an integral number of raster lines on the display screen for ease of vertical alignment visually. On the other-hand, the horizontal raster is arbitrarily fixed. This assumes that the

designer is less concerned about exact horizontal positioning, often being interested only in the basic column positions, and he can be less demanding about the precision of the display horizontally.

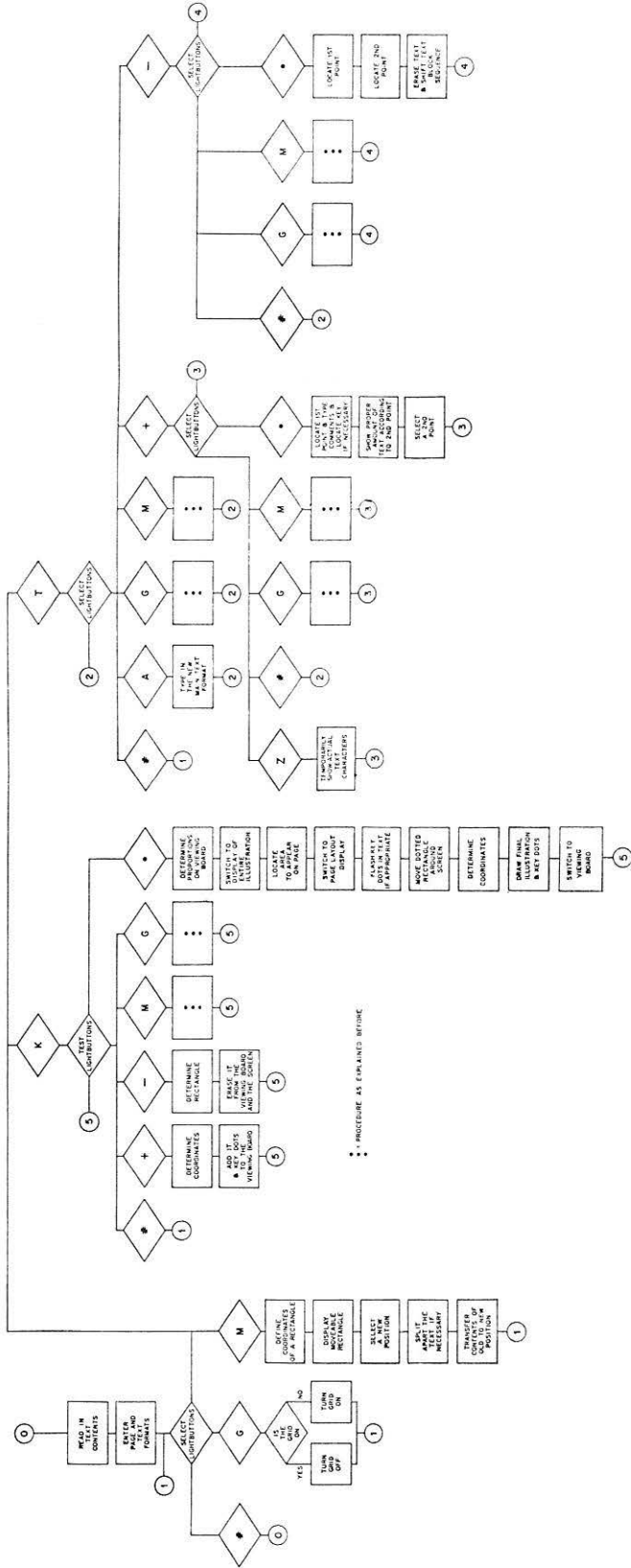
Another feature of the system is that references between text material and illustrative material can be simply distinguished even on the coarse raster display through the use of flashing dots which locate certain desired text sections and particular illustrations; e.g., to signal where an illustration is mentioned in the text. The flashing dot calls the user's attention to this special relationship between graphic elements.

Finally, the decision has been made to show typographic material as white dots against a black background. This form reverses the "normal" color situation of black type on a white paper surface. The display hardware on the DDP-224 computer can produce with equal convenience either black type on a white field or white type on a black field. Perceptual effects make it more difficult to represent lines by vacancies in a white dot background array than vice-versa, because the area of the missing dot associates itself with the small blank area around every white array dot. White type against black background did not seem to cause "perceptual" discomfort and was quickly accepted as natural. However, the effects of reversed display viewing on design situations should be further studied.

The low raster resolution of the presently available hardware is undesirable for the precise graphic needs of some design situations, but even this coarse depiction of typography might satisfy the requirements of design situations for some catalogues and journals whose typographic requirements do not vary as greatly as, for example, those of popular magazines. The illustrations indicate that the prototype system does enable basic parameters to be shown and easily interpreted. Among variants displayable on this low resolution screen are roman vs. italic; light, medium, or bold type; ragged right vs. justified settings; and variations in column width and type size.

Interactive Features

Among other interactive features, a page-design system should display, when necessary, a grid used for the proper location of all graphic materials. It should also enable the designer to preview in some way graphic material before it is placed in the final position on the pages



or before it is even brought onto the page display. It should enable text material, as needed, to appear on the page. It should enable all graphic elements to be moved about the page or to be erased from the page and prevent overlapping of the graphic elements unless desired. Finally, it should allow digitalized photographs to be viewed.

The program devised to meet these requirements was written in FORTRAN, a widely used programming language, with some subroutines in assembly language. The Honeywell DDP-224 computer used in this project has one tape drive and two disk drives (Table I). The tape drive is used as secondary storage for text to be displayed; the disks are used primarily for rapid storage and interchange of complete page displays.

Interactive input to the program is primarily through a typewriter and a two-dimensional input device similar to a "joystick." The typewriter allows entry of page size and typographic specifications and also allows warning or advisory messages to be given by the program. The input device allows the user to easily specify a position and to leave the device at that position while both hands are involved with typing or with using an auxiliary sense-switch box which controls various modes that the program may enter. The system uses the input device to control a tracking dot around the screen and an "under-lining" flag which activates light buttons that appear to the right of the two-page spread shown on the screen.

Table I. A flowchart summary of the interactive features of the computerized page-design system. Below are light button symbols used to represent these options which appear in the flowchart.

- G GRID. Enter option to display a page grid.
- K RECTANGLES. Enter option to add, erase, move, or select rectangles representing illustrative material.
- M MOVE. Enter option to move any part of the display to a new location.
- T TEXT. Enter option to add, erase, or move blocks of text type.
- Z ZOOM. Enter option to "zoom in" and view magnified version of type or illustration.
- + ADD. Enter option to add a new element.
- DELETE. Enter option to subtract (i.e., erase) an element.
- ≠ FINISHED (RETURN). Enter option to declare the present state finished and to return to a previous state.
- . DOT. Enter option to select a particular element.

Text may be added, subtracted, or moved about the display. Rectangles symbolizing digitalized photographs may be added to or subtracted from an auxiliary display (referred to as a viewing board) and may be brought onto the page display for final positioning. A grid display based on the main text specifications can be mixed with the page display at almost every stage in the page design activity in order to help locate typographic and illustrative material according to pre-established positions.

All text masses and illustrations displayed on the screen have their co-ordinates constantly re-specified exactly on a microgrid with a basic unit equal to one typographic point. In addition, their co-ordinates are re-specified for the TV display.

The language of the program speaks of text entries, text blocks, and picture (illustration) blocks. Text entries may be considered to be paragraph-lengths of text characters, although they may possess only enough characters to fill one text line (e.g., subheads within the text) or no characters at all, implying one skipped line. Text blocks refer to columnar areas on the screen which are to be filled with type and which may require more than one text entry of characters to fill them. The top left and the bottom right base-line end points are kept track of as well as the particular character of each text entry associated with both of those locations. Thus, any particular character and its location within the text entry may be found. Picture blocks refer to rectangular areas drawn on the screen to symbolize illustrations, and their locations are recorded in a manner similar to text blocks.

Viewed for its abilities for user-oriented page design, the system is equally as primitive as its graphic representation aspects, but it demonstrates several important features. For instance, the system's ability to reference certain characters within the sequence of text characters—namely, those which begin and end sections of text—suggests clearly how actual text character data may be used in a more sophisticated system to display and vary symbolization which would permit crucial word and line breaks and the length of the text to be observed. If the computer knows the characters to be set and the information about the widths of characters, it can compute the lengths of lines, paragraph lengths, number of columns of text, etc. This capability goes beyond that available in many design situations where not until the text has been actually

set does one have such detailed knowledge. By then, resetting mistakes or trying different text settings may be too time consuming.

The system also indicates how auxiliary displays of the page grid and a previewing display for illustrations may be incorporated into a workable system. In addition, the necessary careful bookkeeping of text and illustration positions on a microgrid suggests that relatively easy interfacing can be made with a system to display on a high resolution device the final, exact contents of the two-page spread.

The relative ease of selecting light buttons and of positioning graphic material on the page demonstrates that the user may work quickly and naturally in building up a page composition (see accompanying illustrations). This aspect could certainly be improved given time to perfect the algorithms of the system's response to user-oriented options and to perfect, through human engineering analysis, the physical organization of the hardware.

Discussion

In the next stages of development some approach must be developed for the simultaneous display of a broad range of type sizes. This is an important and immediate feature for all but the most strict design situations. The ability to see a magnified view of a given area of the page display would be another desirable feature. This could use the character generation mode of the TV display to actually "set" with fixed character-width type the given content of the text to be examined, added, subtracted, or moved. Since the program secretariat maintains information about the characters of particular sections of text on the pages, this would be accomplished with relative ease.

The present system has, of necessity, restricted itself to a single display of black and white pages. In the near future interactive color TV displays will be available at Bell Telephone Laboratories and will allow the addition of variable color controls to investigate, as for black-and-white typography and illustration, how adding color to low resolution scanned displays could increase the information to the designer in the abstractions chosen for graphic elements. For example, in the design of directories, two different colors could represent adjacent alphabetical sections of listings. The designer would thus be able to sense where certain changes in the text occur even if the typographic symbols were extremely simple.

It may also be possible that low resolution color displays could provide enough information to permit the designer to evaluate single photographs or entire pages in terms of simple aspects of color balance.

The use of multiple screens would allow the designer to see the material being worked on, completed pages, and the next available material. This is simply a matter of how many display devices are available, since the computer has the ability to store and to display simultaneously many different combinations of text and illustration.

Among the options envisaged for a more sophisticated system, the possibility of putting any display or part of a display onto disk storage together with identifying comments and recalling this at an appropriate time for further manipulation should be made available. This implies that the display could return to its previous state if the most recent change were not finalized.

An option for exact alignment on the page grid of recently added graphic material should be added. When necessary, the graphic elements could be positioned to particular locations. For example, certain horizontal lines might signify the top-most and bottom-most base-lines for main text. Other grid lines might signify special locations for photographs, footnotes, headlines, captions, subheads, etc. If graphic elements were placed near enough to these particular positions, they would be automatically moved to the desired locations.

Lastly, a complete option for examining, cropping, and positioning digitalized illustrations should be added. This would allow the proportions of an illustration quantized into discrete levels to be determined; subsequently a "sampling" of the digitalized illustration would appear on the page display. An appropriate number of gray levels for an abstracted symbol for photographs and other illustrations would have to be determined through experimentation. In the future, it may be possible to place the image from a simple television camera into a previously bounded area on the page display, position the illustration by hand, zoom in or out on it optically, alter its proportions, then fix it permanently on the scanned display screen.

These last three options represent straightforward elaborations of the program structure which time did not permit carrying to a more sophisticated stage in the author's program (with the exception of television camera techniques).

The use of a high speed digital computer would enable the development of a system which could be altered relatively easily to meet the conditions of the required design problem. The multipurpose computer implies a flexibility achieved by changing programs, not special purpose devices, i.e., software not hardware. More specifically, the computer-based system could provide the designer with an accurate description of all typographic and illustrative elements even in the preliminary design stages. Thus, in those design situations in which the designer has to consider and manipulate “dummy” type, he would be in a position to call up a given text in almost any desired format of type style, size, leading, and setting and to see the effects on length of columns, paragraphs, word breaks, etc.—all factors which influence large scale decisions of page design.

Some of the lesser, more mechanical tasks could be done automatically in such a system. For example, if the designer decides to insert some new material into a column of primary text material, the system’s logic could account for splitting the column and automatically moving down the text within the primary text material positions which follow. A computer-based system is capable of keeping track of all the pages being worked on and of making changes which a given design causes in preceding or subsequent material. A system provided initially with a set of design rules (either fixed or dynamic) could alert the designer if he violated them so that he would be aware of invalid choices or inconsistencies in his work.

Additionally, a computer-based system could allow, as an automatic feature, the exact alignment horizontally and vertically of all material according to a previously established grid which determined locations for primary text material, footnotes, photographs, etc. This particular capability of a computer-based page-design system is of great importance. In normal page design operations, either the designer himself or an assistant uses the preliminary design decisions to position securely and precisely all pieces of type and all illustrative material horizontally and vertically.

Even if the page design does not follow the specifications of a grid, the ability of the computer to account for the exact location of all graphic material means that this information could be made immediately available to a computer-based high resolution typesetting device which could either present a given page to the designer to

contemplate or directly create the negative or plate for printing. This represents a considerable advantage over photo-mechanical graphic design tools such as that developed by Hycon, Inc., for *Life* magazine.¹ In that system the final form of the designer's decisions is a photostat of illustrations and dummy text which another person interprets in order to place the exact text and illustrations for making printing plates.

Finally, several versions of a given design could be easily constructed and stored in the computer's memory for later evaluation. There would never be a problem of insufficient materials to use in new organizations of the visual elements. In some cases, simultaneous alterations could be made to all other alternatives while the designer worked on a single version—an improbable capability with traditional methods of page design. The designer could thus operate in a human, inexact manner sketching broad patterns with the computer following after him putting every piece into its necessary position. The ability of the designer to create exact compositions of text and illustration and to change them in an exact manner is one of the primary advantages of a computer-based system. With computerized assistance, the designer would have more opportunity to judge alternatives, his essential human task.

Earlier the implications of this prototype system in terms of its low resolution display and the interactive options available were discussed. Several other aspects of an interactive page-design system should also be mentioned.

In the immediate future, the experience with the program described here suggests that page design, particularly for stricter design situations, will better match the electronic speed now available for reading, editing, and setting text and illustrations. It also seems possible that interactive color displays may assist the designer in more quickly evaluating color relationships, even of ink and paper combinations, and the effects of these combinations under different printing and viewing environments.

1. For varying descriptions of this device, see *Life* LXIX (August 14, 1970), 3; *Saturday Review*, LIII (September 12, 1970), 93-94; *Print Magazine*, XXIV (July/August 1970), 66-68.

Furthermore, a computerized intermediary between the human designer and the designed object provides a relatively easy means to record the designer's operations. Algorithms replacing many of the present subtasks of the graphic designer's activities might well result. The projected system would still require the active participation of a skilled, professional designer to provide the decisions in the most creative phases of the visual design process: the inspection of visual displays of appropriate detail and complexity and the alteration of these displays to satisfy the designer's conceptions of clear communication and aesthetic form.

As computerized data communication and display become more sophisticated and ubiquitous, the physical delivery of many forms of visual communications—such as telephone directories, mail, and newspapers—will gradually disappear. Many homes and businesses in highly industrialized societies today possess a means of typesetting, namely a typewriter; tomorrow they will compose not only typography but illustrative material as well and communicate it directly to an audience through electronic means. For the graphic designer, this provides yet another impetus towards his changing role as a designer of processes instead of final products. It suggests that it will be necessary to “pre-design” graphic formats for many kinds of visual displays which will allow a user to create his own finished communication. Interactive design systems, perhaps using Picturephone networks and terminals which are a form of low resolution scanned display, may be integrally involved in daily communication requirements.

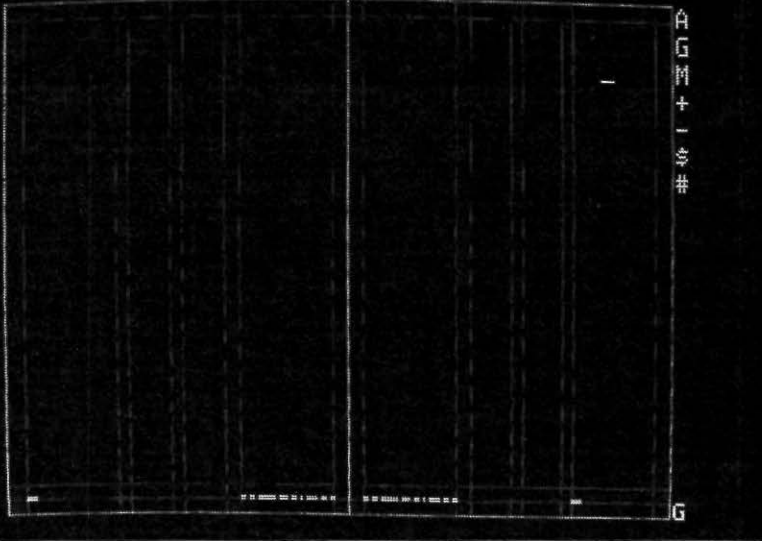
It is therefore important for visual designers of all kinds to recognize the possibilities and limitations of the computer-assisted systems which will certainly be developed in the next decade. It is even more important for them to assist where possible, preferably by direct participation, in the establishment of goals for such systems which will enhance their effectiveness as helpful, human-oriented tools.

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The illustrations which follow demonstrate a sequence of typical interactive page-design activities which are possible with the computerized system. (All photographs are courtesy of Bell Telephone Laboratories and are taken directly from a modified, but conventional, television monitor.)

Figure 1. The designer can check the page grid for basic compositional requirements. The page size has been entered by typing in that information as well as type specifications for the main text. Margins and column placements can be easily changed by altering a few program statements, and are here assumed fixed. It would be relatively simple to make this, too, an interactive option. Normally the grid could be present during most of the page design activity, but for clarity it is not shown in the illustrations which follow.

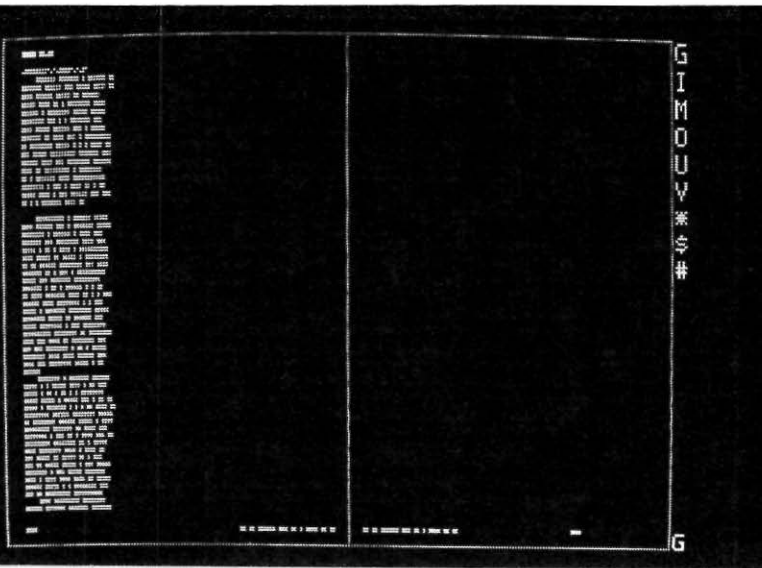
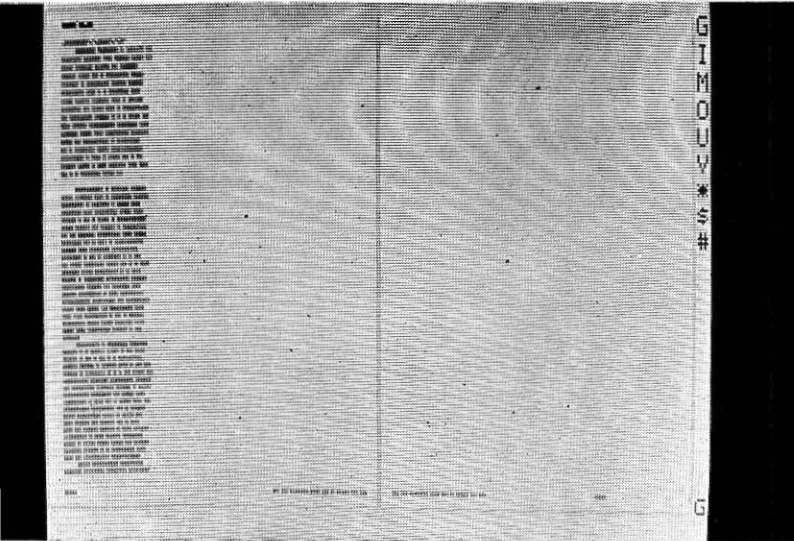


Figure 2. The designer begins placing the next available type, including subheads, adjusting the length of the column as desired. The symbolization shows one line for every line of type that would appear on the final page. The system uses only a dummy text generating sub-routine, because it is not presently connected to an available text-editing program which would determine hyphenation. The dummy text sub-routine allows type specifications to be altered during the design activity, thereby showing that different column widths, paragraph lengths, etc., may be tried for the same text which can appear justified or ragged right. The type symbol shows the x-height in a very simple manner (one, two, or three raster lines), but refinement of the typographic image and thus the "look" of the type is more dependent on the display device than on the program. Roman vs. italic and medium vs. bold weights can be distinguished. As sections of type which are to be keyed to illustrations appear, flashing dots signal their location within the columns. The exact contents of



headlines are typed out on the typewriter for identification and are assumed given, but this arrangement could be easily changed to an interactive option.

Figure 3. The designer can view the display in reverse (black symbols on a white background) at various stages in the design process.

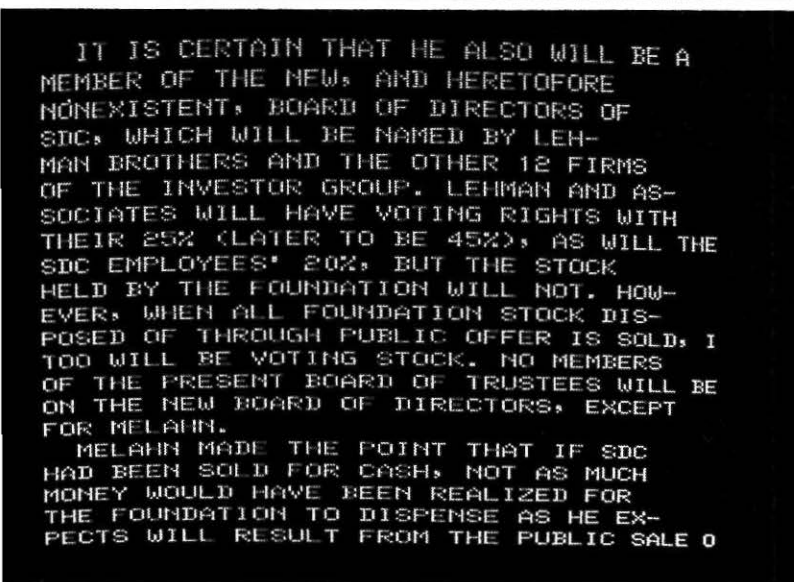


Figure 4. If necessary, the designer may examine the contents of the text on a large character-by-character display, much like a galley proof. In a more sophisticated system using editing programs now available, changes could be made in the text by entering new characters through the typewriter. Eventually such an enlarged display could simulate the spatial placement of the text. For example, by turning a knob the present column would move to the left and the column to the right would come into view, thus giving a magnified version of the low resolution page display.

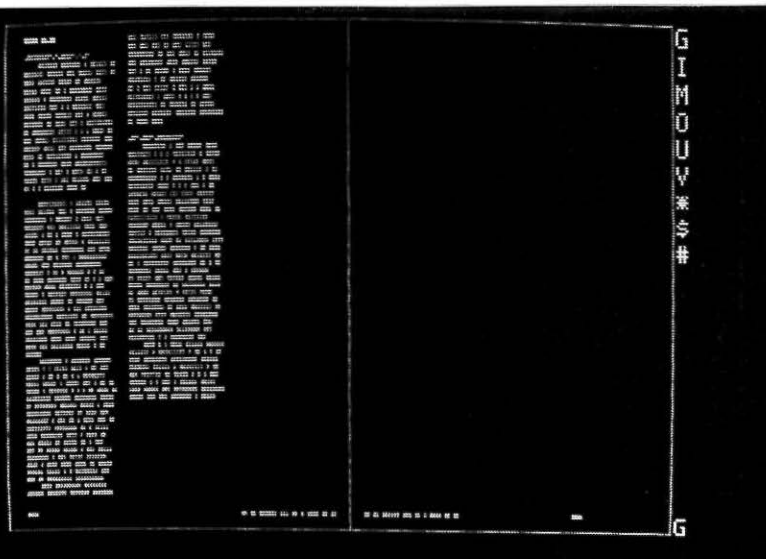


Figure 5. Another type mass is placed. Automatic checks prevent its extending beyond the top and bottom margins or its overlapping material already on the page.

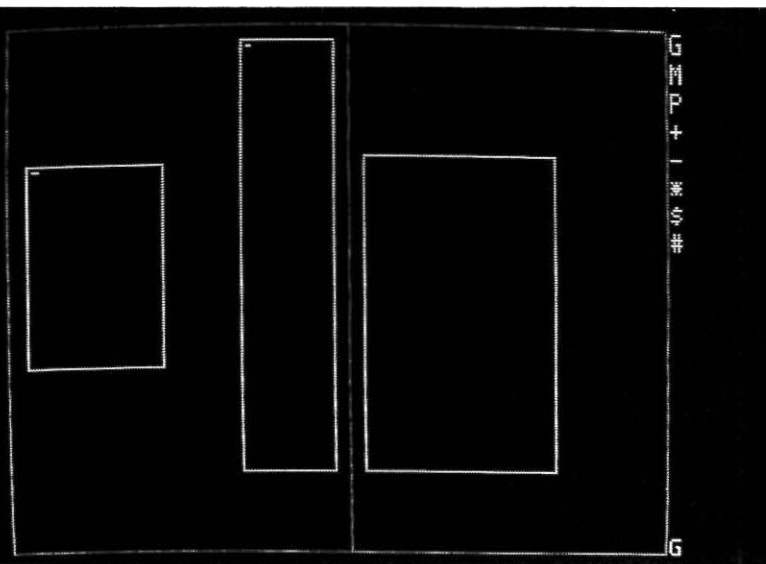


Figure 6. The designer now decides to switch to the viewing board to select an illustration. Here he may add the grid again when determining the sizes and proportions of illustrations symbolized by outlines. Moving a tracking dot to within an illustration's borders, he signals with a push button that this illustration is required. This is only one of many ways in which illustrations might be sized and proportioned; it is meant only as an example. Variations in procedure could be easily programmed.



Figure 7. The viewing board disappears and one of the actual illustrations which has been coded and stored in the memory of the computer is instantly brought to the screen as a “half-tone” image. The present coarse version has only four levels of brightness but indicates that even this low resolution image conveys much information about the “look” of the illustration. It is also possible that the illustration might appear on a higher resolution screen, since it might not have to change in the rapid, interactive way in which the page design changes. In the present system the designer can determine which portions of the illustration are to appear on the page by moving about the image four dots representing the corners of the final illustration.

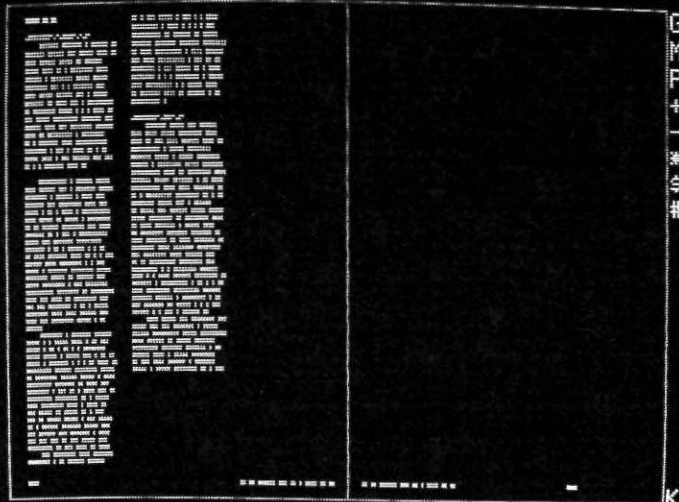


Figure 8. When the desired portion of the illustration has been selected, the four movable dots then appear on the two-page spread and can be positioned. If the illustration is keyed to a particular section of text, flashing dots in the text columns make this apparent to designer.

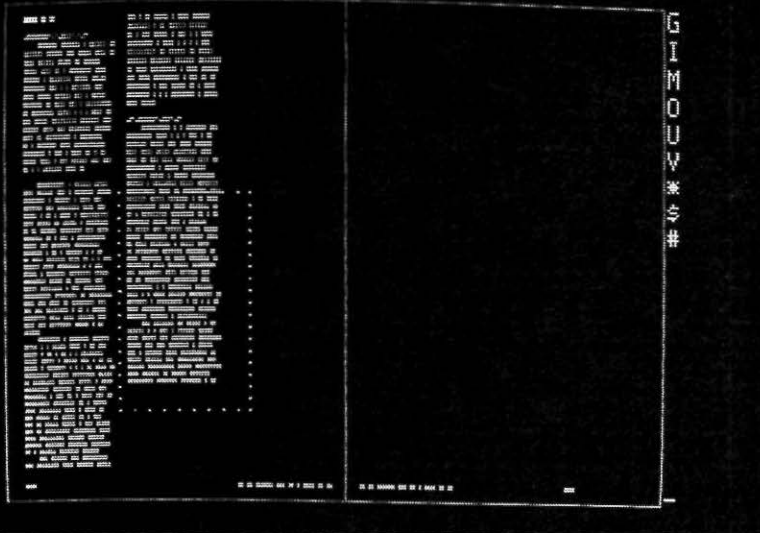


Figure 9. In this example, the designer decides that the last portion of the most recently added text will be in the way of the desired location of the illustration. Therefore, he interrupts his present activity, signals the computer to enter an erasing mode, and indicates the type to be erased by describing a variable outline.

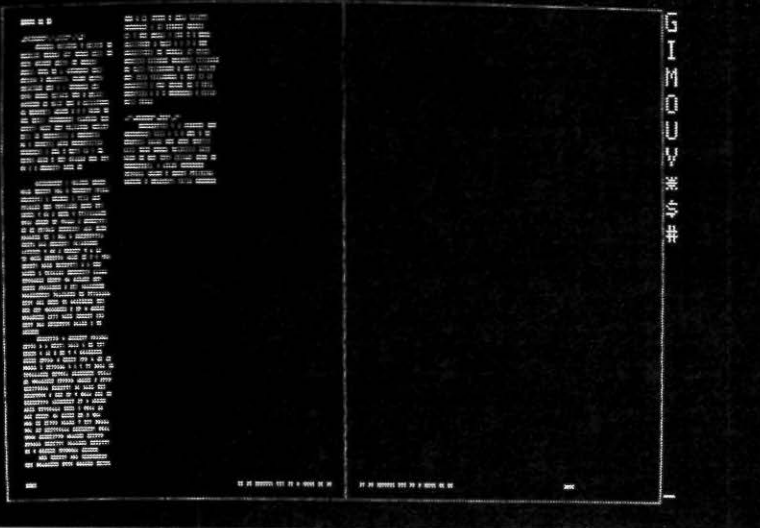


Figure 10. At the push of a button the desired number of lines disappear from the screen and the computer backs up its location in the file of text information. The next time text is added, the same paragraph lengths and headlines will appear (the dummy text sub-routine which simulates the presence of a text-editing program coupled to this system generates new word lengths).

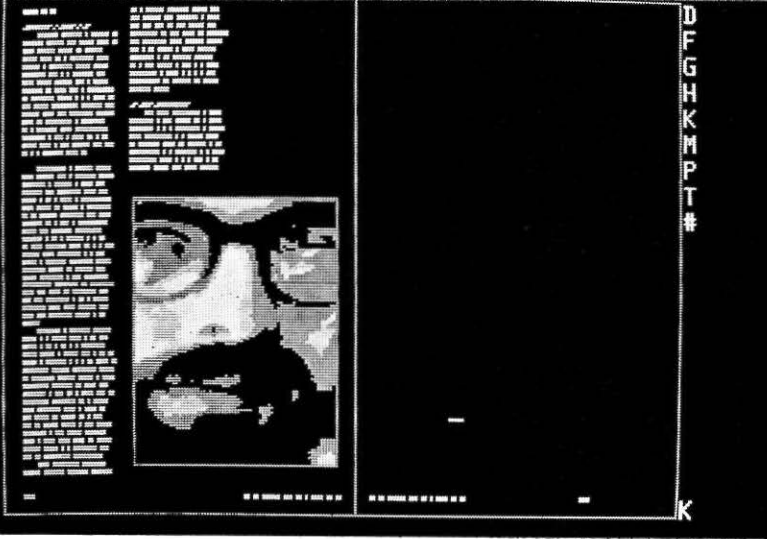


Figure 11. After re-selecting an illustration (the same one or another in the computer's store of illustrations), the four corner positions are fixed, and the illustration appears on the screen. In this particular program it is assumed that the display might be intended for eventual reversed display viewing on a screen; thus it appears as a positive image. A simple programming alteration could prescribe that a negative version of the illustration would appear at this point in the procedure.

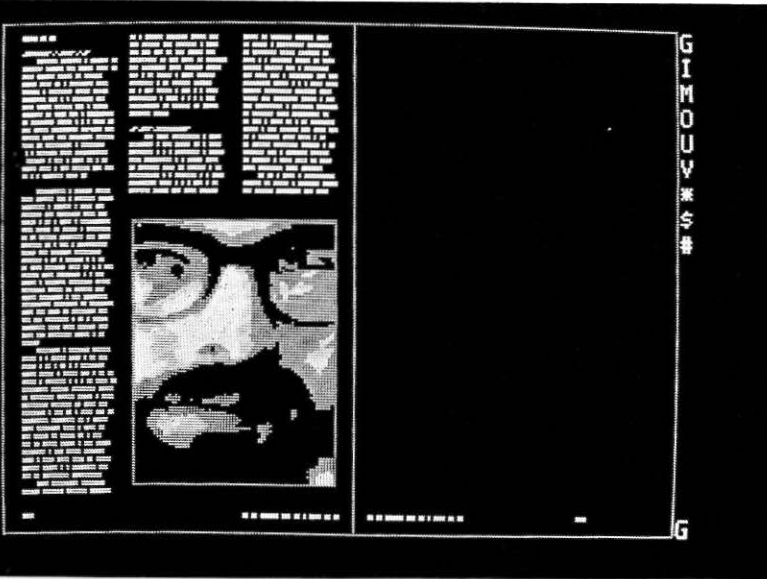


Figure 12. Additional text, beginning with the most recently erased material, is added, and the left page is completed. In the present situation it is assumed that the illustrations are explained directly in the main text. A programming alteration would allow the designer to draw upon two or more sources of text material (e.g., captions and footnotes) and to add these independently to the screen.

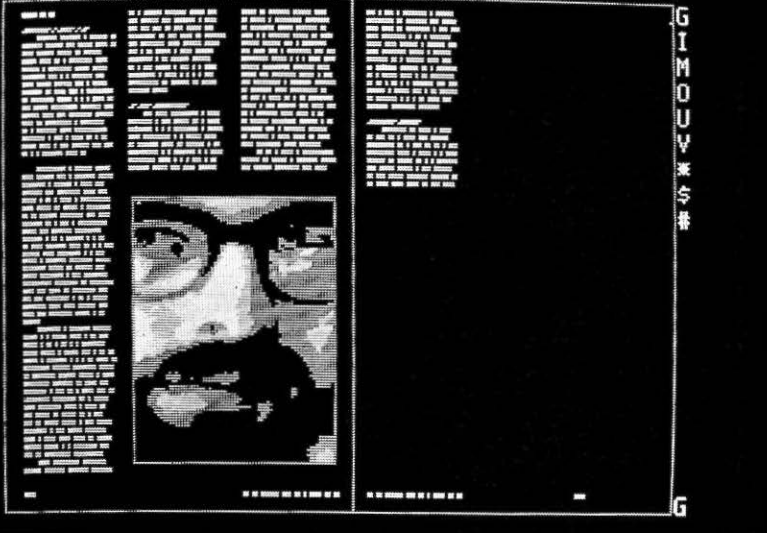


Figure 13. A text mass is begun on the right page, and the designer decides to move this to another location. Any text material, from a single line to a column, and any complete illustration may be moved.

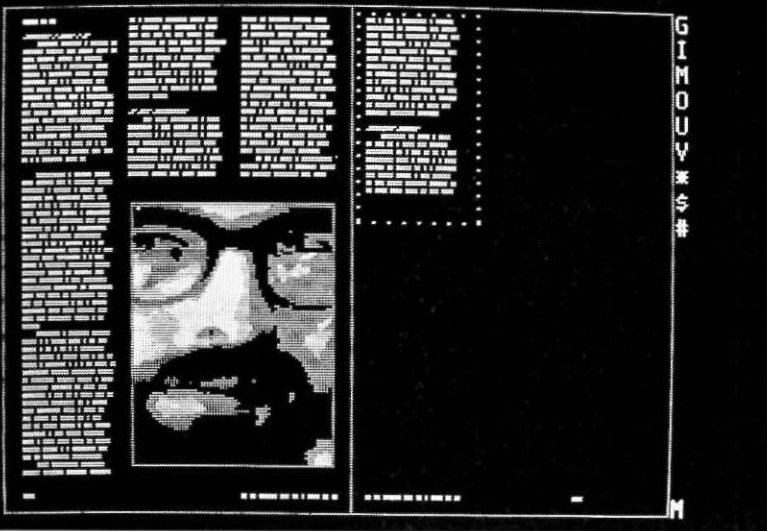


Figure 14. The area to be moved is designated by a variable outline.

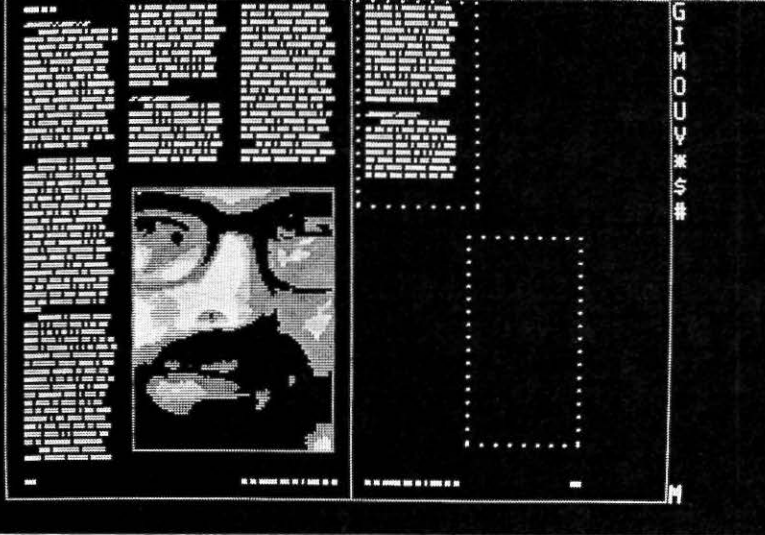


Figure 15. An identical, moveable outline may now be shifted anywhere on the page. Automatic checks prevent graphic elements from being placed on top of other elements. In this program no "bleeding" of illustrations is allowed, but simple program alterations would include this possibility.

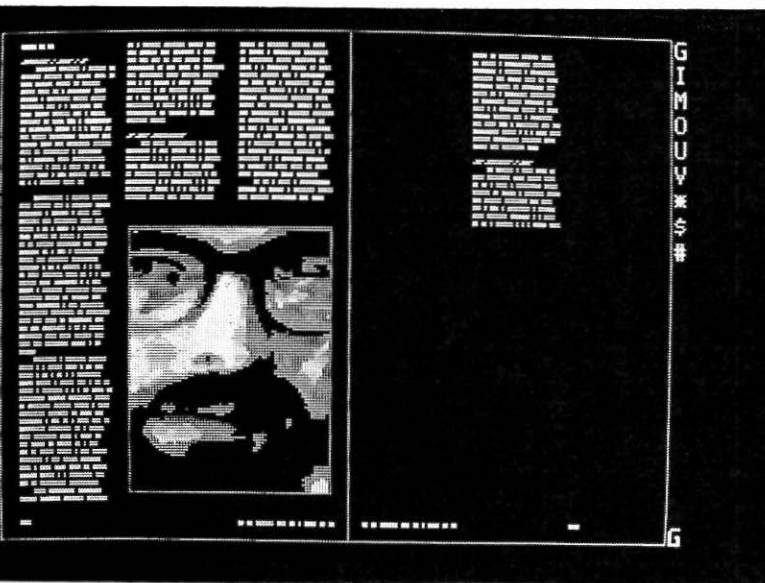


Figure 16. When the new position is decided, the movement option is executed, and the new locations for the characters are recorded.

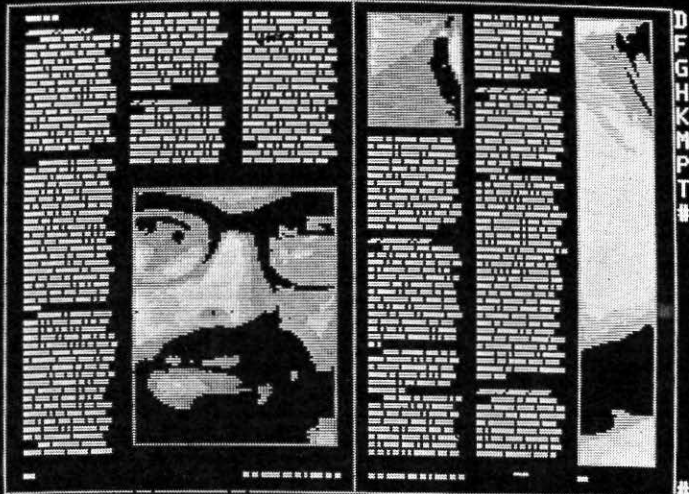


Figure 17. Other illustrations and text are added, subtracted, or moved about the display until a tentative version is completed.

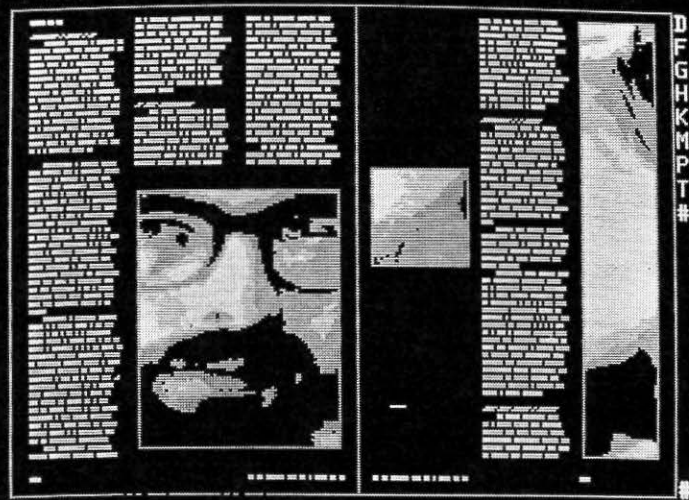


Figure 18. The page composition may be changed continuously until a satisfactory version is achieved.

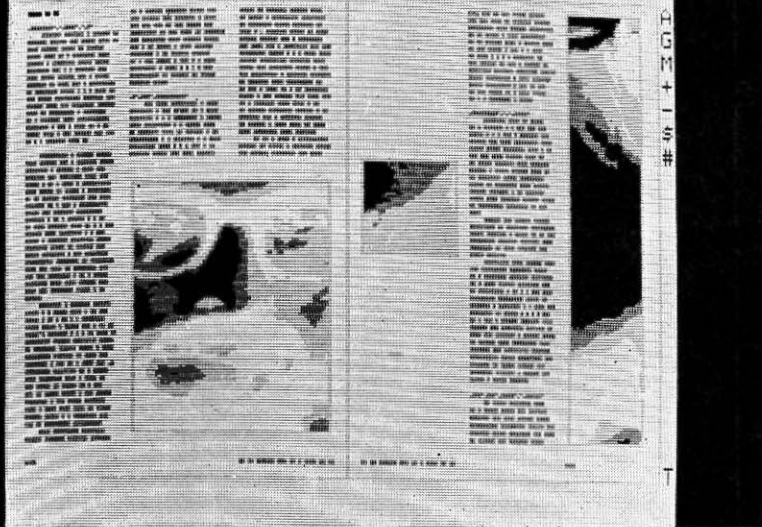


Figure 19. The designer may again check a black on white version of the display. (In other circumstances the illustrations could appear as positive images.)

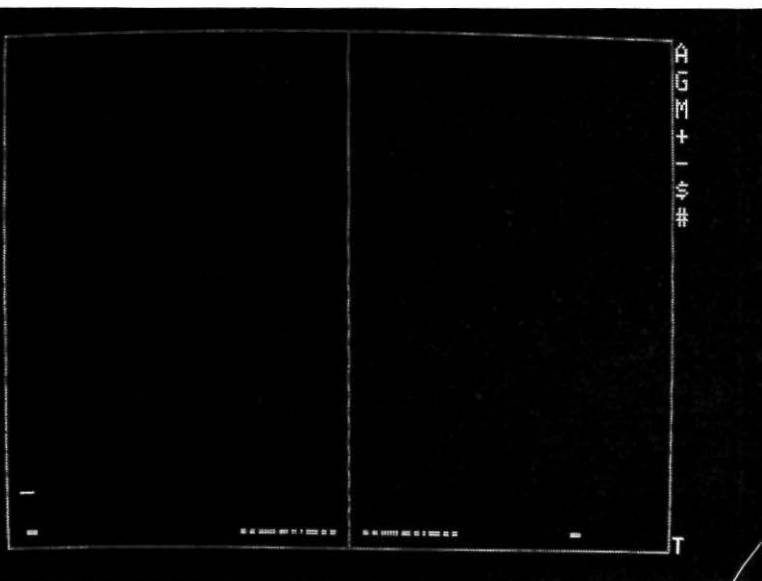


Figure 20. Finally, the designer sends the completed spread to the computer's memory, then calls up a new two-page spread or recalls an old one. The present system does not have the ability to move material directly from one spread to another, but it suggests how in a more sophisticated system, the designer could quickly move from spread to spread, working out a tentative sequence of pages, then returning to make final decisions about text placement, the number and size of illustrations, etc. The present program devised by the author, who is a practicing graphic designer, is intended primarily to indicate possibilities rather than to provide immediately a commercially useful system.