

## Computer Aided Graphics in Architecture and Planning

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Computer-aided graphics is illustrated by the use of ARK 2 system in two and three dimensional graphics manipulation. The ease of using this system is emphasized. ARK 2 is a user-oriented computer-aided design system for architects and planners who have little knowledge of computers.

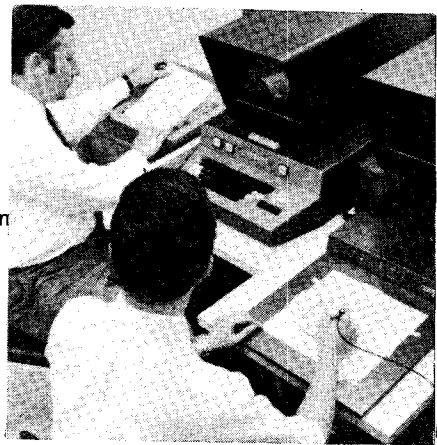
### "KEY WORDS AND PHRASES":

Architecture,  
Planning  
Interactive Graphics  
Computer aided design  
User oriented  
Building  
Plan  
Drawing  
Design Process

"CR CATEGORIES": 3.10, 3.30, 3.34, 3.41, 3.49

As architects and planners we all know how short we are on time. We lack the capacity to absorb the complexities of the vast amount of information being developed, and we are short on resources, especially the money required to do things in a time-honored, traditional manner. At the same time we are heavily weighted with responsibility to the society which we seek to serve, overwhelmed by the demand for our product, and extremely aware of the overriding criteria of social purpose which must invade each of our projects. Stated in the briefest terms, we are asked to produce more work, of a higher quality, with more sophistication and to do so in a shorter period of time than every before.

We know that available information, or accumulated knowledge, doubled between 1840 and 1940. It doubled again between 1940 and 1965, and will do the same between 1965 and 1975. Because of this information explosion there is very little chance that the practitioner in the design/build field will be able to keep complete control of all the actual information he needs to know without some technological aids. We are dealing with the conflict between information and the individual capacity for knowledge of the architect and planner. The problems with population are similar. We can understand the projections which have been made concerning the 40 billion people who are likely to inhabit this earth by 1980, but who among us can respond to these numbers when they are translated into the concept of society, rather than population



ARK 2 Station

With regard to the matter of time, many sociologists and psychologists have spoken about the apparent acceleration of time, when related to society and knowledge. While it is possible for us to envy their remoteness and agree with their interpretation, this in itself provides no answers. After awhile acceleration merely becomes a sensation of speed, and when we are going as fast as we can there appears to be no increase in speed, merely an increase in pressure.

Thus, information, population, and time become for us knowledge, society and speed. There is far too much knowledge to be absorbed by traditional means. Society is growing and demanding at too fast a rate for us to provide for it by traditional means, and the compression of time makes it impossible for us to adequately respond either to the problems of society, or to the problems of knowledge. We believe that the extension of our human ability to comprehend, react, and respond, can be found in the development of new techniques in design and in the application of computer graphics. A better understanding of the way in which we work, the way in which we solve problems, aided by the application of technological means and especially by computers, will better allow the architect and builder to accumulate and apply the information which is available to him. It will allow him to understand and react to the needs of society, and to do so with a speed and accuracy which is unavailable through any other approach.

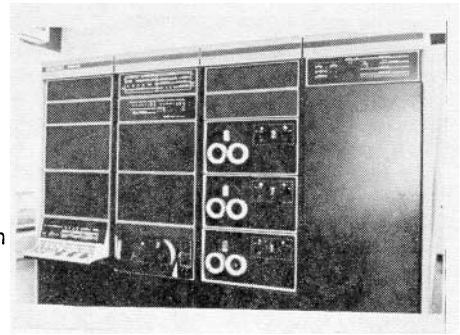
The following discussion concerns a modestly sized and financed interactive graphic system whose goal is simplicity, pragmatism, and economy, without the sacrifice of flexibility, expandability and power. By virtue of its non-experimental daily-use character, we feel it will point the way for greater acceptance and application of computer technology to the field of architecture and planning.

The decision to investigate the application of computer technology to the architectural field was relatively easy compared to the assessment of the manner in which we wanted to conduct the application. We reviewed the efforts of others in this field, and attempted to learn by the problems which others were facing. In an unrestricted way, we tried to look at the total problem and only then set priorities for the specific programs to be written. We attempted to analyze all of the available information which the architect might use, not just what he is currently using. We very carefully specified the method of interaction between the practicing architect and the computer. Finally, we specified the format of the final product.

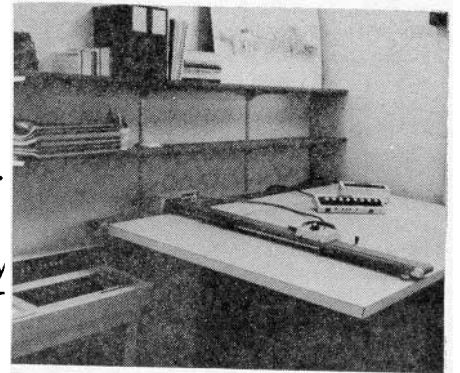
Having established these as general goals of the system, we were able to select equipment which met these goals. The PDP-15 is an extremely fast and easy to use computer. The Computek Storage CRT terminals and their Electronic Tablet and Keyboard allow the designer to work in a very natural and uncomplicated manner; the left terminal is for instructions and selections, the right for graphics. The Gould hard copy device presents very quick and useful hardcopy of both the alpha-numerics of specifications and other data ready for reproduction as well as the graphic record of what has been produced on the cathode ray tubes. The Autotrol digitizer is used only for recording graphical information of big drawings. The programs are linked so that a single data base is available throughout the system. This Data Base is constantly enriched and enlarged by the normal use of the system and does not require elaborate preliminary investments in terms of time or money. The programs themselves are open-ended, and we are almost daily increasing the scope of the system to include new responses to emerging problems.

We can look at the programs as a system of three series. The first series carries the project from the development of the Data Base through the manipulation of adjacency diagrams into the development of block diagrams. The second series, which uses the same Data Base as the first, makes use of visual and dynamic modeling through the use of perspective techniques, and dynamic drafting systems using Standard Graphic Elements (SGE), stored drawings, and the unique drawings prepared by the designer with the tablet. The third series includes all of the librarian functions of specification preparation, office management, critical path analysis, manpower leveling and so on.

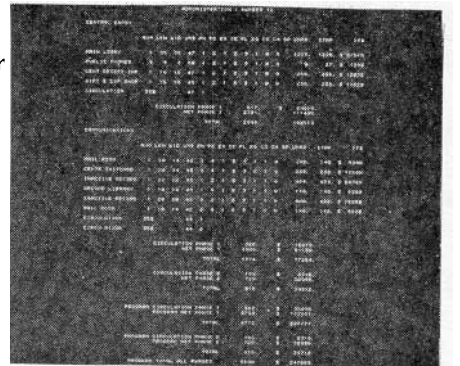
All the programs are based on a menu system which provides a series of options to the designer. Once having picked an option by using the tablet, the designer can either continue to select options from the sub-menus which are brought up for his review or can immedi-



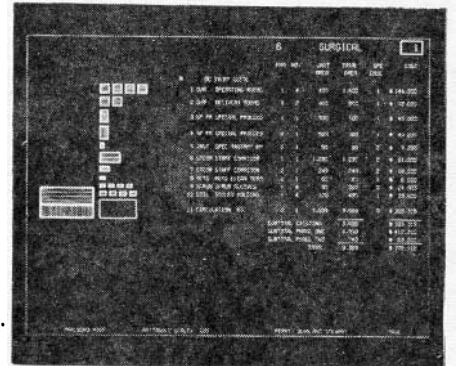
PDP 15 mainframe



Autotrol digitizer



COMPROGRAPH text mode output



COMPROGRAPH, graphic mode output

COMPROSPACE, the basic graphic program, illustrates the interactive aspects of the graphic system. The first selection list which appears on screen one is the Master Operational Menu. Affectionately called MOM, it is the listing through which we select all the subsets of drawings, calculating, zooming and so forth. Each subset is represented by a new list, and some have further subsets each with a more detailed menu. Every subset has an escape back to MOM if we det

block diagram 2

into trouble. The first task is either to call for a drawing which we want to work over from our previous tape, or to select the box labeled "Create a new drawing."

Once the drawing is on the screen, the designer can do a number of things with it. He can overlay it with a variety of grids, move any part of the drawing, add new lines, add a standard graphic element, add notes and dimensions.

The drawings can be on tape under the original title or, if we wish to keep both an original and an edited drawing, we can change the name of the new drawing. If not, the new drawing will automatically replace the drawing of similar name in the tape to keep it up to date. At the same time, we can request hard copy of the drawing to be produced by the Gould printer.

The "Zoom" subprogram allows us to enlarge or reduce the drawing, left, right, up or down at the same or any scale. While the face of the cathode ray screen that we are actually looking at measures 8" x 10", "Zoom" encourages us to think of our projects at immense, overall scale, even full size. By zooming out like a rising helicopter, we can see and draw the entire project in simplified terms. By zooming back into the drawing we can work on it at middle scale, section by section, and by zooming into the drawing further we can design even the smallest pieces at reasonable size. All the data entered on one scale is available at any other scale, calculated and displayed with speed and accuracy at any other scale.

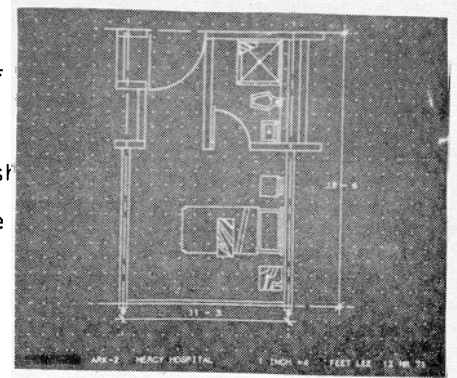
COMPROSPACE then is a single versatile interactive graphic program which, among other things, allows us to draw any subject at any variety of scales; use standard graphic elements singly or in groups; manipulate and repeat parts of the drawing independently; calculate areas and dimensions; make progress prints; create final drawings. And then there are tasks to which it is also being put, each one of which could have been conceived of as a separate program: lay out sign graphics with automatic spacing and proportion; lay out stairs that meet code and convenience and draw them in full detail; lay out auditoria seating with good sight lines and every seat drawn; compare actual areas with program areas to pinpoint discrepancies; compare travel distance with desirable norms; mapping with "zipatone" patterns for demographic studies. This list is by no means complete nor do we have any idea yet of how many different applications exist for the program.

The other program which we can classify as graphic is COMPROVIEW for perspective drawing. Three-dimensional data about a building, a space or a site are digitized and entered into the computer storage. Once this data is accurately entered, it can be used over and over to create new views from any vantage point. By entering the name of the object and answering specifically requested data about distance and angle of view, we create a new and accurate one, two or three point perspective. These are outline perspectives only and do not have tone or texture, which can be added later by the designer. We can enter into the perspective such standard graphic elements as cars, trees or people. We can create specific repetitive elements such as window details and wall panels which can be repeated as often as required.

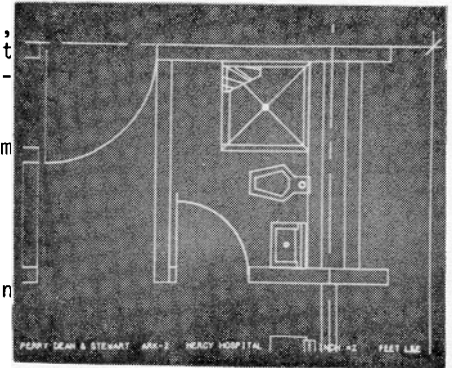
In addition, we can pre-specify multiple station points which traverse a given route and display the building from specific angles. This series of instructions creates an automatic sequence of views, as close as one inch in distance and one degree of angulation, which allows us to drive by, walk up to and through, or fly over an object. While the basic intention of this program is to let us examine the building from any view and select the most telling one for further elaboration in hard copy, we have found that by photographic the screen with motion picture equipment we can simulate excellent motion effects of buildings and sites of great complexity.

The uses to which the ARK 2 system is put to date span the entire gamut of the design process-demographic analysis and modeling; space programming, master planning and block diagramming; schematic design; three dimensional simulation; networking and control, decision making, drafting, specifications and management.

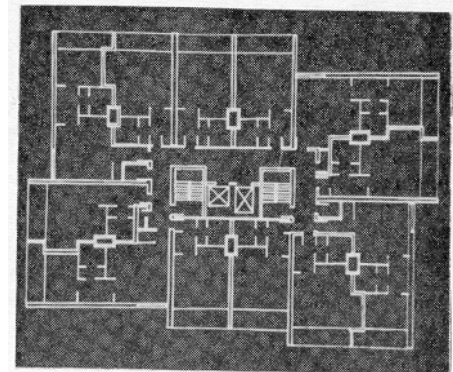
There are some architects and planners who will remain forever skeptical of mechanical & technological innovation. But as professionals, we must be alert to those who will resist change merely to retain the accepted ways of life and who will narrowly refuse even to



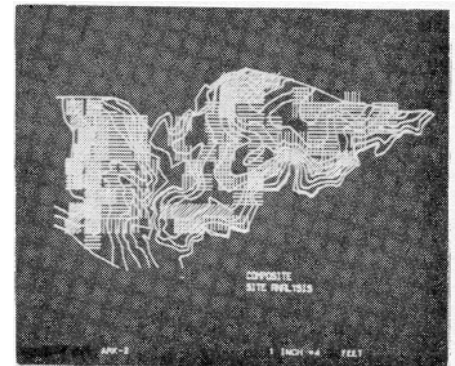
COMPROSPACE, room plan



zoomed



building plan

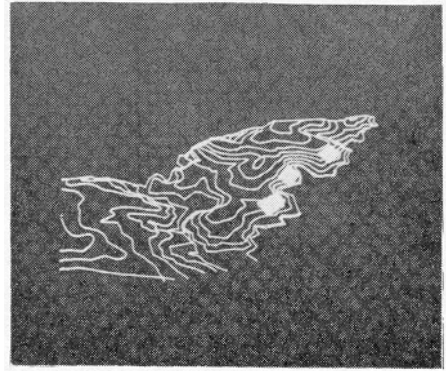


demographic study

become acquainted with this new potential. Computers are no longer a blue-sky visionary dream or a new drafting machine toy, because the hardware and programs are here, and we have used them. They will not create stereotyped design and kill intuitive thought unless we abdicate our position as designers of the environment to untrained and uninterested tradesmen.

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COMPROVIEW

