COMPUTER GRAPHICS: THE DESIGNER DRAFTSMAN

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1971

Submitted to the Faculty of the Graduate College
of the Oklahoma State University
in partial fulfillment of the requirements
for the Degree of
MASTER OF SCIENCE
July, 1978

COMPUTER GRAPHICS: THE DESIGNER DRAFTSMAN

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ACKNOWLEDGMENTS

I would like to express my appreciation to the advisory committee chairman, Dr. Harold J. Polk, and committee members, Dr. Clyde Knight, and Dr. Richard Tinnell for their assistance and guidance during this study.

To business and industry in the state of Oklahoma, a special thanks for making this study possible.

Appreciation is also expressed to the author's wife, Susan, without whose understanding, encouragement, and tireless hours of typing this study would not have been possible. The author's son, David, must be given special thanks also for his encouragement and understanding during this study.

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CHAPTER I

PROBLEM DEFINITION

Introduction

Computer graphics is a relatively new area. It is the unique blend of two elements, one being the computer and the other being the area of graphics. The computer, as Webster describes it, is an electronic machine that performs rapid, often complex calculations or compiles, correlates, and selects data. This machine has revolutionized the business world and has now spread into various fields. The computer was primarily used for data storage and retrieval and, almost at the same time it began to be used in research and calculations. The computer is based upon the memory system and this enables it to do a variety of work. Graphics, on the other hand, is that which is described in realistic detail; vivid. It also involves any form of visual representation. But graphics is based upon a mathematical process. By combining the computer and graphics we have an electronic machine that describes things in realistic detail through visual representation. The power and potential of computer graphics related to the design process is far reaching. In less than two decades the computer has sprang from a dream to unbelievable reality.

The designer draftsman has an unusual blend of two types of knowledge; one of drafting and other of design. The draftsman is trained in a very old profession, that of doing detail drawings with a variety of

of instruments. In fact, many of those instruments are still used today; the t-square and the drafting table. The use of these is still very basic in the training of a beginning draftsman. The use of the conventional method is very time consuming thus creating a loss to large firms. Drawings must be constantly updated and new ones started. A draftsman cannot be rushed while he is using such outdated equipment. Other devices are being accepted by large companies but by the time this acceptance has been made the equipment has again become outdated. The drafting machine came along to update the t-square. It has a movable arm with a turning radius which is connected to a ninty degree set of measurements, usually made of rigid plastic. The horizontal bar is another type of a replacement of the t-square and it is connected on both ends by a cord which extends from the top of the drafting table to the bottom edge. The bar can only be used in the up or down position. The latest and most impressive of these types of instruments is called the Trac II which is a vertical bar similiar to the horizontal bar. The Trac II is supposidly the best of drafting equipment in use today. One problem is that companies are reluctent to install some new equipment at all. The reason being economics, the immediate cost. The drafting process is still very time consuming and one way out of this outdated process is by combining computer graphics with the designer draftsman. Computer graphics is new but has proven itself very useful in the drafting field. This is where the designer draftsman comes into his own field.

A designer draftsman is one who designs and then produces a detail drawing of the design. He collects information, data and ideas for formulating his design and proceeds to use these in a combination

representative of a detail drawing, working drawing, and/or pictoral drawing. The interaction between the designer draftsman and computer graphics is the basis for this study.

Statement of the Problem

A computer programmer is one who operates the computer by supplying it with data pertinent to a problem. He is specifically trained in the area of programming. A programmer must know how and why a computer works, but mostly how to make it work for him. Computer programming is a profession in its own right. The designer draftsman is trained in his own area and it is also a profession. The main question that envolves from this is, "Would it be beneficial for the designer draftsman to be trained in the basics of computer operation?" This problem is widely recognized in industry and business and questions concerning it are being asked.

Purpose of the Study

The purpose of the study is to determine if the computer and the draftsman are working together; how many firms are now using computer graphics and if there is an increase in the use of computer graphics within the state of Oklahoma.

Research Questions

Based on the purpose of this study, the following research questions were developed as guides in the collection and analysis of data:

1. Who does the equipment effect?
2. Who does it aid?

3. Who determines the use of the equipment?
4. What factors determine the use of computer graphics in reference to designer draftsmen?
5. What would be the effective output of such equipment in a variety of firms?
6. Where would the use of the equipment be required?
7. Where would this equipment be used?
8. What factors determine the need for computer graphics?
9. How is the equipment being used?

Scope of the Problem

This study includes those ninety-five selected firms listed in the Dun and Bradstreet Million Dollar Directory, having firms based in Oklahoma, with assets of one million dollars or more.

Assumptions

This study was based upon two major assumptions:

1. It was assumed the ninety-five firms were representative of Oklahoma based firms.
2. It was assumed that responses were deliberate and sincere.

CHAPTER II

REVIEW OF THE LITERATURE

The purpose of this study was to determine if the computer and the draftsman are working together. The main project of the study was confined to the state of Oklahoma.

Computer Graphics had its beginning in the 1950's by a study from the General Motors DAC Project (design augumented by computer); which was finalized in 1963. Credit is generally given to Ivan Sutherland for the pioneering effort demonstrating the feasibility of useful graphical communication using a CRT, light pen, and function keyboard console. This was done during the years 1960-62 on the MIT TX-2 computer which is recognized as somewhat of a classic under the name SKETCHPAD (1, p. 70).

Computer graphics is relatively new as stated before but one type of computer is a stand out in the field of computer graphics. This computer is called the digital computer. It has been used in industry for less than two decades. The time span is short compared to the complexity of the machine. Webster describes the digital computer as one using coded digits to solve problems by means of arithmetic. It can be recognized as a valuable asset to the graphic industry. Remembering that the basics of graphics is mathematics, it can be seen how such a machine could be utilized. The full impact of this machine has not been felt and will not for some time to come.

One of the major breakthroughs was with the cathode ray tube display. The actual devices associated with computer graphics include a variety of cathode ray tubes, plotters, recorder, and scanners. The main focus of the CRT is a graphical communication device, because of the significance of being able to draw directly on the face of the scope thus enabling designers to communicate with the computer in a form not restricted to a set of alphabetical, numerical, or special characters without the necessity of an intermediate medium (1, p. 20). The CRT is used in all phases of industrial design today and will continue to be in the years to come.

Major Problems

The first major problem with the computer was that of communication concerning the design area. Prior to 1957, the engineer had to learn machine language in order to express his computations in a form that could be input to the computer. Not only the core of the learning process was felt by the engineer but a restriction on the means of communication meant that he had to recast his problem in a form that was meaningful to the machines limited vocabulary. Each step had to be reduced to the level of addition, subtraction, and equility comparisons. The time consuming chore of recasting desired procedures into a suitable form could be given to a computer programmer; but if the engineer did not know programming and the programmer was not familiar with engineering, the result was suseptible to gross error. A significant advancement occured in 1957 with the introduction of FORTRAN (FORmula TRANslater) developed by J. W. Bachus and associates at IBM. This type of high-level language meant that the engineer could express his

problems in algebraic terms, which he more readily understood. FORTRAN was a major step toward making the computer a useful tool for the engineer. With this the use of computers soared as engineers became familiar with the language of FORTRAN (1, p. 3).

The second major obstacle that was faced by the engineer was that of availability. The high cost of rental meant that the machine had to be fully utilized and no mistakes on the part of the engineer could be afforded. The reason for this being that is usually took several runs before the desired results were obtained (1, p. 36). A recent development took place at Massachusetts Institute of Technology called Project MAC and it was the advent of the time-shared system. The system is one in which the computer services a number of remote terminals. It scans the active stations according to some scheduling algorithm, and allots sufficient equipment and processing time to each in turn, so that to each used it appears that he has full, continuous use of the computer's capabilities (1, p. 37). Similiar systems have since been developed at different locations. This also allows a reduction in the cost of operating the equipment. In 1968 the University of Utah under-took a development of high-level programming systems for remote terminals. Their conclusion was that the system had been designed to allow the exclusive use of high-level programming languages, and to provide a very fast graphical response. The result has been that high-level languages have been used with success to produce working programs in a very short time, and a response time of 60 milliseconds or less could be guaranteed if the user's program was in sequence (2, pp. 200-222). As stated by R. C. Woolacott in his paper on "Computers for Engineering Design Purposes by Remote Access", with the time-sharing system, the

user need not be a trained programmer, since the "conversation" with the computer enables the user to learn rapidly. It is evident that constant changes are being made in the field of computers with respect to the design process.

The problem of communicating with the computer has been solved to a great extent. The time-sharing system has helped in the area of computer usage and also of cost. The next question is what type of machinery are we dealing with in the role of active computer graphics. It is characterized by real-time operation. In this type of system man-machine communication is highly interactive as well as graphical. The relationship between the designer and the computer is intimate, and progress is paced by the designer. The computer responds to a problem posed in graphical and non-graphical terms with a reply in the same terms. The major role to be played by active computer graphics is in assisting the designer to conceptualize and analyze his design (2, pp. 40-51).

Console Equipment

The console equipment is that instrument which brings the men and computer together usually including a cathode ray tube, a light pen or voltage pencil, a function keyboard, and an alphanumeric keyboard. The graphic input is accomplished by drawing on the scope. Nongraphic communication is accomplished by use of the alphanumeric keyboard. The operator could press the function button "Straight line begin" the pen will be moved across the screen to the desired termination point and the "line end" button will be pressed. Another fact being if desired, the computer would ensure that the line would be straight. The light

pen is actually a fiber otics bundle, open at the end which is pointed at the scope. The opposite end terminates at a photomultiplier tube, which is actuated whenever the light pen receives a flash of light from an illuminated spot on the scope. The point where the light pen is directed is determinable because of the correlation between the time the flash is received and the position elation between the time the flash is received and the position of the electron beam which is generating the scope display.

Drawing on the scope is accomplished by calling onto the screen a tracking cross. Each leg of this cross consists of a series of dots. To begin drawing, the light pen is pointed at the center of the cross. When the pen is moved, the movement is sensed in relation to the legs of the cross. This image is directed by the computer to move in such a way as to position itself exactly under the center of the pen's field of view. The cross generates a line as it moves. The advantage of this to the designer can readily be seen.

A card reading device may be present at the console for the input of limited data. General Motors has such a system for the identification of operators. This system can be used in a variety of ways. In this manner, control of access, as well as reduced danger of destruction, can be achieved.

Consoles, such as have been described, can be connected on-line with the computer in any one of three operating modes. One is on a full time basis; that is, while in operation the console is the only device being serviced by the computer. The second operation mode is on a multi-programming basis. This scheme includes the provision for the central processor to operate in the traditional batch mode and serve the

console in real-time on an interrupt basis. The third operation mode which was discussed earlier in the time-sharing mode. The amount of time required of the central processor to service a console has been appreciably reduced by the development of special console support hardware (1, pp. 56-60). The types of console configurations are varied from the simple and inexpensive to the most sophisticated and very expensive. As of mid-1966 there were only three computer equipment manufactures that had announced equipment that was appropriate for use in active graphics. These were Control Data Corporation, Digital Equipment Corporation, and International Business Machines Corporation. Many others were in the process of building such equipment at the time. At the present time there are many manufactures in all phases of computer graphics. An essential element to the area of computer graphics is called drafting aids.

Aid Machines

Drafting aid machines come in primarily two types; one being the flat bed type while the other is the drum type. The flat bed plotting machine is where the drawing is made on a fixed flat piece of paper. The drum type draws on a roll of paper capable of being rotated while the drawing is in progress. Quite a lot of the manual part of programming can be mechanized by a number of devices, such as the D-MAC Pencil Follower. There is a high frequency output from a coil in the pointer and this is followed by an inductively coupled trolly under the table top operated by a null seeking servo system. The digital output is taken from shaft encoders on the servo system. A read out of coordinates is obtained by a switch on the probe or by a foot operated

switch, or at fixed time intervals when following a free curve. There are many varieties and types of these machines. The largest of which measures 10 feet by 6 feet. One of the most sophisticated is one in which a panel contains a number of function buttons to specify what type of line is being probed, such as vertical up or down, horizontal left or right, and other straight line clockwise or counterclockwise circles, or tangency conditions (3, pp. 100-102). Another one is the Orthomat, an American machine which has almost everything. The CRT machine screen is for optical reading heads with either manual or computer predicted line following, allowing the machine to be used as a digitizer. These machines have precision rack and pinion drive and anologue or digital feedback control, usually from shaft encoders. They are presesion machine tools and operate to similiar accuracies, generally of the order of 0.002 inches anywhere on the table. The earlier machines were programmed exactly as machine tools, now they have linear, circular, and parabolic interpolators, character generators and requires a large size computer to drive them.

These drafting machines are not usually on-line, because the time taken to produce the drawing is so much greater than the time the computer needs to prepare and output the necessary information. They are usually used off-line, and run from paper or magnetic tape. They can give round-the-clock service when the workload is enough to require it (3, p. 110).

Related Research

The use of computer graphics has been described in the previous chapters. The question remaining, who is using these machines and to

what extent? Some papers written in the electronics field: Computer Aided Design, On-Line Interaction Computing for Electrical Power Systems Planning and Design, (5, pp. 51-55), Design of Wound Components Using Digital Computers (5, pp. 57-62), Computer Aided Transformer Design (5, p. 63), Three Computer Aided Design Programs for use by Draftsmen and Engineers (6, p. 368), A System for Producing General Engineering Drawings by Computer and its On-Line Development (6, pp. 352-369), Computer Aided Design and Drafting of Large D C Machines (6, pp. 360-367), and many more too numerous to mention.

The field of architecture is another one utilizing the computer graphics machines. At the 10th Design Automation Workshop in June of 1973 a program was discussed, "Towards a User Based Automated Architectural Design System: Theory, Systems Operation and Future Development" (7, p. 97). A manual entitled C A P 3 which was put together by three men, Clifford Douglas Stewart, Eric Teicholz, and Kaiman Lee. The manual was composed of Computer Architecture Programs in various fields of architecture (8). In Drafting Technology by J. W. Giachino and Henry Beukema it was suggested that some industries are experimenting with a number of devices that can actually make drawings. One such device utilizes an electronic beam to produce lines, dimensions, and graphical symbols from information supplied by a computer. Another machine can prepare standard type drawings on vellum, glass, or cloth with drawing instruments (9).

An article in Engineering and Technical Drawing by Earl D. Black says that, "Computer drafting does not take the place of man-made decisions. There are many instances where drawings are used to simplify mutual comprehension of computer output" (10, p. 8). The magazine

Industrial Education, January 1974, surveyed four drafting instructors on a series of subjects, one being computer graphics in the schools. Three of the instructors agreed that this was a coming thing and needed to be introduced into their programs, but said that the cost of such equipment prohibitied the use of it. The other one, Michael B. Atkins, who is with the Department of Industrial Education at the Western Michigan University says that; we must include computer graphics experiences in our drafting rooms. Numerically controlled machining and graphics is no futuristic dream but a current reality in industry. To communicate with a plotter so that it will draw an object the student must first learn how to organize the description of the object or put into a sequential and exact series of statements. The best way for a student to check his program is to put it on the plotter for verification. He also said because of such high costs involved in the usage of computers that several schools could purchase one and all use the same one. At best if a university is close by inquire and obtain permission of the use of theirs.

Summary

Computer graphics in our present society is indeed on the upswing and curriculum developers should pay close attention to the ever changing aspect of this field. The power and potential of computer graphics is no longer in question or doubt. The question is left up to the educators to train draftsmen in the basics of computer programming. The designer draftsman does not want to learn computer programming more than is necessary to help him in his work. "The future of computer graphics holds a promise of relieving man from all of the tedium of

precise graphic construction while giving him complete flexibility in the use of graphics for design, analysis, synthesis, and communication" (4, p. 479).

CHAPTER III

METHODOLOGY

The purpose of this study was to determine if the computer and the draftsman are working together. The main project of the study was confined to the state of Oklahoma. A chosen number of firms were sent a questionnaire concerning the objective above. The results of the study were determined by the questions and the analysis of the results were tabulated into meaningful data for the purpose of constituting further action in this area.

Based on the purpose of this study, the following research questions were developed as guides in the collections and analysis of data:

1. Who does the equipment effect?
2. Who does it aid?
3. Who determines the use of the equipment?
4. What factors determine the use of computer graphics in reference to designer draftsmen?
5. What would be the effective output of such equipment in a variety of firms?
6. Where would the use of the equipment be required?
7. Where would this equipment be used?
8. What factors determine the need for computer graphics?
9. How is the equipment being used?

Answers to the previous questions were used to determine if there was

an interaction between the computer and the designer draftsman. Interaction being: "Can the two work together effectively in a given situation?" Is the designer draftsman involved in computer graphics, or is there a need for him to become involved? If he is involved, how is this so? If the technicalogical society continues to change at the rapid pace that it has in the past two years then should it not be determined how people can best keep up with this pace effectively?

Instrument

The instrument used for this study was a questionnaire. The questions used in the questionnaire were brought about through personal inquires with instructors in architecture, computer programming and arts (design). Personal inquires were also made with the department head in industrial arts.

As a result a questionnaire was drawn up incorporating many of the suggestions received from those inquires. The questionnaire was then mailed to ninety-five selected firms. The firms were chosen from the "Dun and Bradstreet Million Dollar Directory".

The selected firms were restricted to the state of Oklahoma and had to have assets totaling at least one million dollars.

Collection of Data

Data for this study were obtained by mailing the study instrument. A cover letter (Appendix A) was attached explaining the purpose of the study and a method for responding. The instrument was mailed to business and industry firms within the state of Oklahoma having assets of one million dollars or more. The asset amount of one million dollars

was a bottom-line figure for firms which might be using computers in drafting and design areas.

The first mailing was made on June 5, 1974. Plans were made for a follow-up letter to non-respondents in five weeks if the total of returns was not at least 60 percent.

Treatment of Data

Descriptive statistics were used to analyze participants responses. The firms that responded to the questionnaire were listed in columns according to their responses to the different types of questions asked; yes and no, importance, length of time, and percent of time used. The information was then added for the purpose of analysis, in order to obtain meaningful comparison. The percentages were found by dividing the total that responded, to a given question, into the total number of firms with the same response. It was necessary to aggregate the data into smaller groups. The information was then placed in ten tables for the purpose of ease of understanding.

CHAPTER IV

ANALYSIS OF DATA AND FINDINGS

The purpose of this study was to determine if the computer and the draftsman are working together. The main project of the study was confined to the state of Oklahoma. A chosen number of firms were sent a questionnaire concerning the objective above. The results of the study were determined by the questions and the analysis of the results were tabulated into meaningful data for the ease of understanding.

Computer graphics is new and the designer draftsman came about later. With its birth in the mid 50's computer graphics has been on the increase ever since. Because of this increase the need for a designer draftsman was recognized and is now very much a part of computerized drafting. The designer draftsman not only assists in programming but performs actual programming of the computer.

This study was concerned with computer graphics and the designer draftsman as applied to business and industry within the state of Oklahoma. A questionnaire was mailed to ninety-five firms in the state and these results were obtained from returns. The firms selected were taken from the Dun and Bradstreet Million Dollar Directory. The firm chosen had to have assets in excess of one million dollars.

Ninety-five questionnaires were mailed on June 5, and at the end of five weeks a 55 percent return was realized.

TABLE I

RATE OF RETURNS OF QUESTIONNAIRE
BY MAILINGS

Mailings	Number of Questionnaires Mailed	Number Returned	Percent Returned
First mailing	95	53	55
Second mailing	43	19	44
Total no. of mailings	138	72	76

At this time a second mailing was sent out and after two weeks 44 percent were returned, thus making a total of 76 percent. Fifty-seven percent of the firms said that computers were used. Twenty-two percent of the firms stated that graphic devices were connected to their computers and another firm planned for one in the future.

TABLE II

LENGTH OF TIME COMPUTERS WERE USED
AS REPORTED BY SELECTED FIRMS

Number of Years	Number of Firms	Percentage
0-4	11	27.5
4-6	10	25
6-9	5	12.5
9-12	9	22.5
12-20	5	12.5

The length of time that computers have been used in these firms ranged from four months to 20 years with an average of seven and one-half years.

TABLE III

PERCENT OF TIME COMPUTERS WERE USED IN DRAFTING SECTIONS AS REPORTED BY SELECTED FIRMS

Time Percentage	Number of Selected Firms
25%	4
50%	1

TABLE IV

PERCENT OF TIME COMPUTERS WERE USED IN DESIGN SECTIONS AS REPORTED BY SELECTED FIRMS

Time Percentage	Number of Selected Firms
50%	2
75%	3

In comparison, Tables III and IV have shown the popularity of design over drafting. A greater number of firms were spending more computer time in the design sections.

TABLE V

IMPORTANCE OF COMPUTER AS REPORTED
BY SELECTED FIRMS

Importance	Number of Reported Firms	Percentage
Very Important	27	68%
Important	13	33%
Not Very Important	0	-

The importance of the computer to the selected firms was identified by a 68 percent very important, 32 percent important and zero percent not very important. This illustrates the use of the computer, in any capacity, is becoming a means of normal operation.

TABLE VI

IMPORTANCE OF COMPUTER IN DRAFTING
AND DESIGN AS REPORTED
BY SELECTED FIRMS

Importance	Number of Reported Firms	Percentage
Very Important	21	66%
Important	11	34%
Not Very Important	0	-

Fourteen percent of the firms stated that computers were used in their drafting and design sections. The percentage of time used by the computer in each section was almost two to one in favor of design, but there was a promise of increase in the drafting area. It seems that design has more of an application to the computer than that of drafting. Fifty-one percent consider drafting very important and twenty-one percent consider it important.

Forty-three percent own their computer, twenty-three percent use on-line, and thirty-five percent use it various other ways. On-line means that it is hooked into a computer at another location. The length of time computers have been in the drafting section of these firms ranged from four months to eight and one-half years with an average of two and one-half years. The design section shows a range from four to ten years with an average of six years. Design was applied much earlier to the computer than was drafting. The two are now coming closer together in use.

TABLE VII

COMPUTER USAGE AS REPORTED
BY SELECTED FIRMS

How Computer was Used	Number of Reported Firms	Percentage
Owned	17	43%
On-Line	9	23%
Other	14	35%

Twenty-two percent stated that they had considered the use of computers in their drafting and design areas, but chose not to because of various reasons, some of which are: process expansion, would not arrive at results desired, does not appear economical, priorities in other areas of business, cost and applications, and heavy overhead factors. The effectiveness of the computer to the drafting and design in terms of time, cost, employer and employee satisfaction were overwhelming in all areas. Several stated that they could not do without the use of the computer. Their success depended upon it and its application in the various areas.

How the computer is used in these areas is of great importance, these results were obtained: computer solving math problems related to drafting of various components. Drafting of design via plotters is now under consideration. Design calculators, graphs, patent drawings and process flow sheets; usage anticipated to increase, heat exchanger sizing, circuit determination, fan performance, heat load calculator, structural steel calculator, and other; designing air-cooled heat exchangers, aide for design layout of printed circuit cards, maintaining wire lists and generating wiring information for automatic wire wrapping equipment, and one firm stated that they used it for almost everything applicable.

TABLE VIII

PROJECTED EXPANSION OF COMPUTER USAGE
AS REPORTED BY SELECTED FIRMS

Yes		No	
Number of Firms	Percent	Number of Firms	Percent
18	45%	9	23%

The size and type of the computer used is varied as these results will show: ten firms use IBM System 3, four use NCR's, five use Honeywell, and many use service bureaus and time sharing systems. These are only a few of the number of computers available today. With respect to the future the projected use of the computer was very positive, sixty-eight percent responded to the question. Approximately fifty percent stated they would expand into new areas including drafting and design. Twenty-three percent said they projected no future use in the drafting and design area. Fifty-five percent responded to the question of what drew their attention to the use of the computer in their firm, increasing business, labor saving, accuracy, and computerization of new areas. Most expressed a definite need was recognized before the use of the computer was considered. Seventy percent said they were pleased with the results of their computers. These are the same seventy percent that responded to the question.

TABLE IX

NUMBER OF DRAFTSMEN EMPLOYED AS REPORTED BY SELECTED FIRMS

Number of Draftsmen per Firm	Number of Firms
1-3	13
4-6	12
7-10	4
12-15	4
15-21	2
25-30	2
35-50	2
55	1

The number of draftsmen employed by the firms ranged from one to 55 with an average of eight draftsmen per firm.

TABLE X

DRAFTING EQUIPMENT USED OTHER THAN COMPUTER AS REPORTED BY SELECTED FIRMS

Methods Used	Number of Firms	Percent
Conventional Methods	20	71%
NCR Accounting Machine	1	3%
Computer Vision Drafting	1	3%
Multiple Function Calculator	1	3%
No Special Equipment	5	17%

The last question asked was that of the type of drafting equipment used other than the computer, seventy-one percent responded with conventional equipment, one used a multiple function calculator, one used a Hamilton Autoshaft table with a Guideline drafting machine, one used a K & E drafting machine, an NCR accounting machine, and a computer vision drafting with "call-up" for special commonly used functions.

The results of this survey indicate a very low use of the designer draftsman and computer graphics, but those that are using them have found them very effective and an effective team.

CHAPTER V

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

The use of the computer is widespread and has been for a number of years. The primary use of the computer was, and still is, storage and retrieval of materials. Later, it evolved into mathematical calculations which has really opened the door in the computer field. This machine has entered into almost every field conceivable, but the one area that stands out is computer graphics. The field is new with exploration dating back some twenty years. The speed and accuracy of the computer has made its widespread acceptance, especially in the area of computer graphics.

Speed and accuracy have always been a part of the computer system, but not until the advent of the digital computer could progress be made into the graphic field. The CRT along with the digital computer were the major breakthroughs responsible for computer graphics. To be able to call up a design on the tube and change it by the use of a light pen and then send the design back was, understandably, a remarkable step forward. A problem was created, computer engineers were problem solvers, not graphically trained like designers in the true sense of the word. Computer programmers were needed to program the machines, to give it instructions, and to feed it known information, but they were also not basic designers. Someone was needed who had a background of graphics and design like that of a draftsman. A draftsman, no matter what field

he represented, had the graphic design background; hence, the term designer draftsman.

The designer draftsman has to have a set of two types of knowledge; one being graphic design and representation along with the abilities of drafting and the other being that of the use of the computer in the graphic field. The designer draftsman is now a profession and it is becoming more widely recognized throughout the world. This study was only concerned with how widespread is it in the state of Oklahoma?

Conclusions

The conclusions reveal that only twenty-two percent of those questioned used computers with graphic devices attached. Of those twenty-two percent most agreed that there would be future expansion into the computer graphics area. Computer graphics is not widespread in the state of Oklahoma, but there is a move in that direction. The following conclusions are based on the results of this study and are organized around these questions.

Question 1. Who does the equipment effect?

It was the findings of this study that the equipment effects the total operation of the company (draftsman, computer programmers other than designers, operation schedules) which is reflective of total input and output.

Question 2. Who does the equipment aid?

It was the findings of this study that the computers aid the companies in time and cost wise production in the largest firms.

Question 3. Who determines the use of the equipment?

It is the findings of this study that certain priorities take presedence over others, thus determining the use of the equipment.

The priorities are dependent on the type of the company, data storage and retrieval over designing, mathematical problems over drafting, etc.

Question 4. What factors determine the use of computer graphics in reference to designer draftsmen?

It is the findings of this study that the factors were (1) type of firm, (2) production schedule, (3) size of firm, (4) future expansion plans, all determine the use of computer graphics.

Question 5. What would be the effective output of such equipment in a variety of firms?

It was the findings of this study that computer graphics introduced in a variety of firms would result in increased production, design capabilities, and also may increase the need for expansion and growth.

Question 6. Where would the use of the equipment be required?

It was the findings of this study that the use of this equipment would be required at the time of drafting and design changes.

Question 7. Where would the equipment be used?

It was the findings of this study that (1) type of firm that deals in drafting and design, (2) location, location on the interior of the firm close to drafting and design area, (3) other variables in the size of firm, production capabilities and projected expansion needs; allowance for initial cost for use of computers.

Question 8. What factors determine the need for computer graphics?

It was the findings of this study that the size of firm (large, medium, and small), type of operation (bookkeeping or

designing) and increase of drafting and design capabilities depend on the need.

Question 9. How is the equipment being used?

It was the findings of this study that the equipment is being used depending on the size and type of firms. The larger ones could own their own computers. Middle firms could use them on-line and smaller firms could lease or rent computers when its needed.

Recommendations

Knowing that the use of the computer in the drafting and design area is not widespread, but those firms know using it in this area are satisfied with the results, thus creating a positive trend forward.

Designer draftsmen should, in the near future, also be trained in basic computer operations enabling them to increase their potential as well as the firms. The age of computers is well into its own and lack of computer knowledge would, or soon will be, a definite draw back.

The results indicate those selected firms have considered many variables in the use of computer graphics. The ones who have already chosen to use the computer in the drafting and design area are well pleased with the results.

It is known that the small firm cannot possibly be expected to purchase a computer, but many avenues are open for using one, renting, short term, lease, and on-line, thus enabling the smaller firms the financial ability to use and/or have access to a computer on need basis only.

Recommendations for Further Study

Results from the data show that a comparison study with a state having larger and more numerous firms should in effect show the widespread use of computer graphics and the designer draftsman.

The possibility of curriculum development in the area of computer graphics and programming for designer draftsmen should be studied for possible changes.

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APPENDIXES

APPENDIX A

COVER LETTER

Oklahoma State University

INDUSTRIAL ARTS EDUCATION

STILLWATER, OKLAHOMA
104 INDUSTRIAL BUILDING
(405) 372-6211 EXT. 7261

Drafting and design are, to some extent, an important part of your business. The design draftsman along with his particular area of interest is being challenged by a new advent of technology called 'Computer Graphics'. Computer graphics has provided its usefulness in the area of drafting and design. I am developing a study to determine how effective is the interaction between the design draftsman and computer graphics in the state of Oklahoma.

The purpose of the study is three fold: (1) is there a need in business and industry for the design draftsman and computer graphics to work together, (2) are the two working together at the present time, (3) and if so, how are they working together? (3b) if the answers to these questions are negative why?

The enclosed questionnaire is designed to obtain this information in a most direct manner. I have attempted to keep the questionnaire brief and objective to conserve your time in answering the questions. Your cooperation will be greatly appreciated in completing the questionnaire and returning it in the enclosed, self-addressed and stamped envelope. If you wish, an abstract of this study will be mailed to you upon request.

Sincerely,

Burton Brandt Jr

Burton Fred Brandt, Jr.

BFB: sm

APPENDIX B

INSTRUMENT

THE INTERACTION BETWEEN THE DESIGN DRAFTSMAN AND COMPUTER GRAPHICS

Burton Fred Brandt Jr., Graduate Student
Department of Industrial Arts Education
Oklahoma State University
Summer 1974

Name of firm or business_____

Your title_____

1. Are computers used in your firm? yes_____ no_____

2. If so, are graphic devices such as CRT units (cathode ray tubes) and plotters connected to your computers? yes_____ no_____

3. How long have computers been used in your firm? yrs._____ mos._____

4. How important is the computer to your business? very important_____ important_____ not very important_____

5. Are computers used in the drafting and design section of your firm? yes_____ no_____

6. What percentage of time are computers used in the drafting area? 25%_____ 50%_____ 75%_____ 100%_____ Design? 25%_____ 50%_____ 75%_____ 100%_____

7. How important is drafting to your business? very important_____ important_____ not very important_____

8. Do you own your computer or are they used on-line? _____

9. How long have computers been used in the drafting section of your business? yrs._____ mos._____ Design? yrs._____ mos._____

10. If the computer is not used in the drafting and design section of your firm, have you considered it? yes_____ no_____ If answer is yes and you decided against it, why? _____
_____

11. If the computer is used in the drafting and design section, how effective is it in terms of time, costs, employer, and employee satisfaction? _____
_____
_____

12. How is the computer used in the drafting and design section of your firm? Designing, duplicating, updating drawings, and others.
_____
_____

13. What is the size and type of computer that you are now using?

_____

_____

14. With respect to your firm, can you project the use of the computer in the future? _____

_____

15. What drew your attention to the use of the computer in your firm?

_____

16. Are you pleased with the results of your computer? yes_____ no_____

17. How many draftsmen do you employ? _____

18. Other than the computer, what type of drafting equipment is used in your firm? _____

_____

VITA 2

Burton Fred Brandt, Jr.

Candidate for the Degree of

Master of Science

Thesis: COMPUTER GRAHPICS: THE DESIGNER DRAFTSMAN

Major Field: Industrial Arts Education

Biographical:

Personal Data: Burton Fred Brandt, Jr., was born in Watonga, Oklahoma, October 8, 1943, the son of Mr. and Mrs. Burton Frederick Brandt, Sr., of Watonga, Oklahoma.

Education: Graduated from Watonga High School, Watonga, Oklahoma, in 1962; received Bachelor of Science degree from Southwestern Oklahoma State University, Weatherford, Oklahoma, in 1971, with a major in Industrial Arts; completed requirements for a teaching certificate in Industrial Arts from Oklahoma State University, Stillwater, Oklahoma, in 1973; completed requirements for the Master of Science degree at Oklahoma State University, in July, 1978.

Professional Experience: Basic Occupations Teacher, Pioneer Area Vocational-Technical School, Ponca City, Oklahoma, 1973-1978.

Professional Organizations: American Vocational Association, National Association of Trade and Industrial Teachers, Oklahoma Vocational Association.