

301 / DEVELOPING A MICROCOMPUTER GRAPHICS

LESSON USING COMMERCIAL SOFTWARE,

by

DONALD DELWYN LOFTIS

B.A., UNIVERSITY OF TEXAS AT EL PASO, 1968

A MASTER'S REPORT

submitted in partial fulfillment of the

requirements for the degree

MASTER OF SCIENCE

Department of Computer Science

KANSAS STATE UNIVERSITY

Manhattan, Kansas

1983

Approved by:


Major Professor

LD
2668
R4
1983
L63
C.2

A11202 244855

TABLE OF CONTENTS

	Page
LIST OF FIGURES	iii

Chapter

1. INTRODUCTION	1
PURPOSE OF REPORT	1
LESSON OVERVIEW	2
Content of the Report	3
2. COMPUTER ASSISTED INSTRUCTION	5
GENERAL	5
COMPARISON OF DEVELOPED LESSON AND COMPUTER ASSISTED INSTRUCTION	5
BACKGROUND OF COMPUTER ASSISTED INSTRUCTION	7
Future of Computer Assisted Instruction	8
Need for Computer Assisted Instruction Hardware	9
Computer Assisted Instruction Software Solution	10
Computer Assisted Instruction in Higher Education	11
Computer Assisted Instruction at Kansas State University	11
3. SOFTWARE AND HARDWARE TOOLS USED FOR THE LESSON IMPLEMENTATION	14
GENERAL	14
VISICALC	15
Background	15
VISICALC's Uses	16
VISICALC's Functional Capabilities	16
VISICALC's Limitations	18
Data Interchange Format	19
VISIPILOT	20
Background	20
VISIPILOT Functions	20
VISIPILOT Advantages	24
VISIPILOT Limitations	25

VISILOT'S Interaction Techniques	25
4. LESSON DEVELOPMENT METHODOLOGY	29
GENERAL	29
CONCEPT OF LESSON	29
Complete Lesson	29
Lesson Options	31
LEARNING ENVIRONMENT	31
Assessment of the Learning Environment	31
Lesson Implementation Environment	32
Hardware Environment	33
Software Environment	33
PURPOSE	34
Determination of Lesson Purpose	34
GOALS	36
General	36
Goals for Lesson Segments	36
OBJECTIVES	36
General	36
Background	37
Objectives for Computer Graphics Techniques	38
Measurement Criteria	38
Evaluation	39
BIBLIOGRAPHY	41
REFERENCES	44
APPENDICES	
A. APPLE II PLUS MICROCOMPUTER	45
B. LETTER FROM VISICORP	52
C. TEACHING OBJECTIVES	54
D. LESSON MANUAL	58
E. LESSON PLAN	126

**THIS BOOK
CONTAINS
NUMEROUS PAGES
WITH DIAGRAMS
THAT ARE CROOKED
COMPARED TO THE
REST OF THE
INFORMATION ON
THE PAGE.**

**THIS IS AS
RECEIVED FROM
CUSTOMER.**

LIST OF FIGURES

	Page
Figure 1. VISIPLLOT Bar Chart	22
Figure 2. VISIPLLOT Line Graph	23
Figure 3. VISIPLLOT Pie Chart	24
Figure 4A VISIPLLOT Control Menu	26
Figure 4B VISIPLLOT Main Menu	26
Figure 5. Lesson Segments	30
Figure 6. The Computer Learning Environment	32

CHAPTER 1

INTRODUCTION

PURPOSE OF THE REPORT

The purpose of this report is to present the design of a lesson which will enable students to gain a working knowledge of the commercial software packages VISICALC and VISIPLLOT. The report will also describe the development of the lesson and explain the background, utility and computer graphics concepts of VISICALC and VISIPLLOT. In addition to the lesson, a VISICALC and VISIPLLOT classroom demonstration was developed. This student-oriented demonstration is designed to present business and business graphics software to a computer graphics class. Finally, the report will discuss the status and future of computer assisted instruction in order to provide a taxonomy for the newly developed lesson.

The lesson was written primarily to allow students to use VISICALC and VISIPLLOT, but not to require the students to

expend 12 to 15 hours in order to learn the software. The lesson will reduce this time to approximately 3 hours. In addition, the lesson will give students the opportunity to create business graphics in an interactive mode. The current facilities at Kansas State University do not have the capability to create business graphics interactively.

A secondary reason, but perhaps the most valid, this project allows the development of a project that has some utility. While other projects may provide an educational benefit to the author and add to the overall mass of academic knowledge, student design projects of this nature provide many more advantages. These advantages include the relative ease in project coordination on the part of the supporting faculty and an increase in the motivation of students since the project is "close to home". Additionally, it is easier to generate a faculty member's interest since his courses will benefit from the project. Finally, projects of this nature result in a valuable product for the educational process of the institution. (NIED82)

LESSON OVERVIEW

The lesson developed for the VISICALC and VISIPLLOT software consists of a tutorial lesson and classroom demonstration. These two documents can be found at Appendix d

and at Appendix e respectively. Besides teaching the students how to use VISICALC and VISIPLLOT, the training package will interleave several interactive computer graphics concepts with the mechanical mastery of the software. These concepts are:

Window

Clipping

Viewport

Viewing Operation

Segmentation

Logical Graphics Input Devices

These concepts are not a primary teaching goal of the lesson, but these concepts are used to describe the functioning of VISICALC and VISIPLLOT.

In addition to the lesson manual and demonstration lesson plan, the training package consists of the commercial software, a data disk and a graphics printing disk. The data disk contains sample VISICALC files and files for transferring data to the VISIPLLOT program for plotting. The graphics printing disk provides a means to print VISIPLLOT graphs and also contains several graphs for the classroom demonstration.

Content of the Report

The next chapter discusses the current status and future

prospects of CAI. The third chapter will provide a technical discussion of the hardware and software used for the lesson. The hardware tool is the Apple II Plus microcomputer and VISICALC and VISIPILOT are the software tools. The fourth chapter presents the instructional design methodology for the development of the lesson.

CHAPTER 2

COMPUTER ASSISTED INSTRUCTION

GENERAL

This chapter will first present a comparison of the lesson developed for this report and CAI. Next an overview of the present status of CAI and the future prospects of CAI will be discussed. Last, this chapter will present the use of CAI by other universities and the implications of this use for Kansas State University. In this discussion, the use of a lesson such as the lesson developed for this report will be explored.

COMPARISON OF DEVELOPED LESSON AND COMPUTER ASSISTED INSTRUCTION

CAI is defined as the use of a computer to augment or supplement conventional instruction. There are two types of CAI that have evolved. The first type is adjunct CAI. Adjunct

CAI is that instruction which augments or reinforces concepts presented in the classroom. The second type of CAI is primary CAI. This type of CAI completely replaces conventional instruction. Of the two types, the lesson developed for this report is of the adjunct type. (CHAM80)

CAI has certain characteristics which make it an effective teaching tool. First, CAI provides immediate feedback for the user as to the correctness of his input. The lesson presented here requires the user to visually inspect the video screen against a written example for feedback. In the same category, CAI provides error detection and most often provides the correct method to arrive at a correct response. Again the lesson presented here requires the user to visually detect his errors. The correct methodology is provided only by retracing the preceding steps in the lesson.

CAI also provides a mechanism for administrative record keeping. This facility records the student's progress, total time spent with the lesson and even certain minor statistics about the class as a whole. The lesson developed for this report only provides an exercise for the instructor to check the student's progress. Even with these shortcomings, there is still a need and a use for a lesson of the type presented in this report.

BACKGROUND OF COMPUTER ASSISTED INSTRUCTION

Current Status of Computer Assisted Instruction

The current state of computer assisted instruction (CAI) has not matched the expectations of the 1960's. The major problems that have plagued CAI purportedly are being overcome by technology. The primary technological advance has been the development of the microcomputer. Closely following this development has been a software explosion, which will permit cost-effective use of CAI in both the traditional classroom and in other environments (CHAM80).

Another major reason for the stuttering growth of CAI can be linked to its non-achievement of effective results. Some studies show that the use of CAI resulted in no learning improvement over conventional methods (BOET81). An overall assessment of CAI reveals that: (1) the use of CAI either improved learning or showed no differences when compared with conventional methods, and (2) the use of CAI reduced learning time when compared with the traditional classroom methods (CHAM80). These mixed results have led researchers to conclude that CAI effectiveness is determined by "how" CAI is used rather than the mere fact CAI was used (BOET81). Furthermore, the more varied the classroom approach, through a combination of classroom instruction and CAI, the more the student will

learn and the more he will retain. CAI becomes even more effective when CAI and other modes of instruction build on one another and when there is a planned transition between the modes (BRUN80) (DWYE73).

The meager increase in effectiveness of CAI has been one of the major factors in its less than anticipated use. This reluctance is easily understood when the degree of CAI effectiveness is compared with the hardware and software costs of the 1960's and the 1970's. In the 1980's, with the cost of hardware dropping dramatically, the cost of courseware appears to be the major source of cost concern. The time required to develop a lesson ranges from 100 hours to 500 hours per 1-hour of CAI contact time at a terminal. With little portability of software and with computerized authoring systems in their infancy, it is not surprising that educators are still reluctant to pursue CAI. However, with conventional instruction costs increasing at the rate of 13 percent per year while CAI costs are decreasing at the rate of 5 percent per year, CAI should be increasingly considered as a means to aid in cost reduction. (CHAM80).

Future of Computer Assisted Instruction

What then is the future of CAI? In the near term researchers predict that the major obstacles to CAI (software and hardware) will be overcome by 1987, resulting in the

general acceptance of CAI in higher education by that time. These barriers will be overcome by cost-effective technology which will include large-scale mini and microcomputers with voice input and output. Video text, video disk systems and satellite communications will also impact heavily on CAI. Others envision nationally and internationally distributed education networks with large, shared databases. The individual user will be able to use a microcomputer to download lessons from the network or to communicate with instructors and tutors via the network (CHAM80).

Need for Computer Assisted Instruction Software

CAI appears to be nearing some of its earlier predictions of success but a decade late. The biggest stumbling block appears to be the lack of software and the difficulty of producing it. Even though authoring systems have been developed for courseware (PLATO, COURSEWRITER, TUTOR, VAULT), there does not appear to be any evidence to suggest that authoring systems have resulted in transportable courseware in any practical sense. With the proliferation of microcomputers, the need to find ways to allow novice users to develop software is becoming a major problem. This situation is especially true in education where there are literally thousands of teachers who want to use CAI, but do not want to program themselves (KEAR82).

Computer Assisted Instruction Software Solution

There is a need for CAI software. The CAI lesson developed for this project provides an example of a method to develop a CAI course without programming. All an instructor needs to develop a lesson of this type is subject matter expertise. Next, he must become proficient with the commercial package. Then he can document a textual lesson which guides the student through the software while teaching the student concepts of the subject matter. Once finished, the student will have learned the theory or techniques of the subject matter, and he should have enough knowledge to be able to work a more independent problem using the same software. The availability of commercial software for this type of educational purpose is good. Using two subject areas as an example, there are 32 graphic and computer-aided design software packages and 26 agriculture-related packages for the Apple II. The time to prepare a lesson of the type developed for this report is between 10 and 20 hours, depending on the formality desired for the lesson materials. This time is in contrast to 100-500 hours for other methods of CAI lesson preparation. Of course, the lesson developed here is not completely computer driven and relies extensively on a written companion lesson to guide the student.

Computer Assisted Instruction in Higher Education

Research for this report has revealed a number of universities with an interactive computer graphics CAI curriculum already in being. The University of Arizona uses the PLATO system to teach architectural drawing. This PLATO site consisted of 12 terminals at the time of the article in 1978 (DVOR78). The University of Texas has a freshman computer graphics laboratory housed in the Mechanical Engineering Department. At the University of Texas there are eight Hewlett-Packard 2647A intelligent graphics terminals connected to a printer/plotter and also to a color pen plotter. This facility is being used to teach engineering graphics to freshmen engineering students (HAM182). Marquette University has had a course for two years that has the stated purpose of: "the development of computer graphics educational aids for use in other electrical engineering courses" (NIED82).

Computer Assisted Instruction at Kansas State University

At Kansas State University there are no CAI computer graphics courses and there are only a handful of graphics terminals. However, if the major obstacles to CAI are soon to be overcome, as was stated in the introduction, the impetus for Kansas State University to enter this field may soon begin to develop.

The Computer Science Department could play a major role in the expansion of CAI and in particular, CAI for computer graphics instruction. An investigation of the current state of authoring systems should be initiated. Then plans for purchasing an authoring system for the university could be made from an informed background. The Computer Science Department could become the focal point for the implementation of a CAI production facility. At a minimum, the department could be the coordinator for this effort in computer graphics. If the Computer Science Department fails to take the lead, then another department will assume the leadership or the effort will become fragmented over several departments.

The Marquette University course mentioned above, supports an exciting facet of this project. Producing a lesson or a portion of a class provides an exceptional method of completing a report or project. The success or failure of a student-design project is not important. What is of primary importance is that "educationally useful" student design projects provide a special motivational appeal. Hopefully, the outcome of these projects has a significant benefit and useful lifetime in the educational institution (NIED82).

This report provides a framework for the development of CAI lessons without extensive programming through the use of commercial software. The survey of current literature on CAI, and in particular, CAI for computer graphics, serves as an

indicator of the status and growing interest in CAI for computer graphics. Properly implemented CAI lessons of this type and pure CAI lessons developed through programming or by improved authoring systems could have a significant impact on the educational process at Kansas State University.

Futhermore, students can obtain significant educational benefits from the design and production of these lessons for the purpose of reports or for a complete course.

CHAPTER 3

SOFTWARE AND HARDWARE TOOLS USED FOR THE LESSON IMPLEMENTATION

GENERAL

The Apple II Plus microcomputer was the hardware selected for the lesson implementation. The Apple II was chosen because of its availability in the Computer Science Department and because of its compatibility with VISICALC and VISIPLLOT. This chapter will not provide the hardware details of the Apple II. The Apple hardware details may be found in Appendix A to this report.

The software chosen for the lesson implementation was VISICALC and VISIPLLOT. This chapter will provide an external discussion of these software packages. A discussion of the computer graphics capabilities of VISIPLLOT and the graphics techniques displayed by this software will also be presented.

VISICALC

Background

VISICALC is a screen-oriented matrix calculator for doing projections, budgeting, and many other numeric/data manipulations. VISICALC is one of the most innovative and popular software packages written for microcomputers. Written in 1979, VISICALC has sold over 200,000 copies by the end of 1981. Its creator, Dan Bricklin, won the Hopper Award in 1981 for significant contributions to the computer industry (YASB2). VISICALC is one of the most exciting and influential pieces of software that has been written for microcomputer applications (RAMS80).

VISICALC is sold for a variety of microcomputers. It is marketed by VISICORP of Personal Software, Inc. The program is sold as a package consisting of the VISICALC program on a diskette and an accompanying manual. Its retail price is \$150.00. Attempts to get technical information from the VISICORP Corporation have been unsuccessful (See Appendix B). Therefore, the following discussion of VISICALC will provide an external view in order to address the software's capabilities and limitations.

VISICALC's Uses

VISICALC has found many applications. It is advertised as a screen-oriented matrix calculator for projections, budgeting and many other numeric/data manipulations. Accounting applications are probably the most appropriate, but other uses have been found in real-property investment analysis, estate and gift planning and for financial modeling (RAMS80). The ability to design templates for the worksheet has created a complete sub-industry of suppliers for various VISICALC users. Complete software to interface with VISICALC has also been developed, and at least two national VISICALC user's groups have been formed. VISICALC may be the first software for microcomputers that has been responsible for sales of entire systems (RAMS80).

VISICALC's Functional Capabilities

VISICALC is an electronic worksheet on which one can write labels (row or column titles), numbers and formulas. The worksheet is sixty-three columns wide (lettered A thru BK) and 254 rows long (numbered 1 to 254). Any coordinate (column/row) can refer to any other coordinate arithmetically or trigonometrically. Once the values of both coordinates have been established, any change of one value which affects other values is automatically updated. A variety of screen formatting

facilities allows for the worksheet to scroll over the screen, titles to be fixed while numbers are scrolled, column widths to be changed, and the screen to be split horizontally or vertically. Values can be formatted as two-placed values (for financial use), as integers or in full-decimal notation (up to eleven significant digits). VISICALC has the capability to replicate an entire series of coordinate functions with a minimum number of key strokes. This replication function is especially valuable for doing long-range financial projections.

VISICALC has the capability to create templates that can be used as blank forms for entering data. The blanks can assume values once a number is entered through a previously entered formula. The resulting template can be saved or printed under another file name, thereby saving the original template for repeated use. The biggest value of a template is that a novice to VISICALC or to mathematics can use the template with instructions provided by the creator. These templates, or any portion of the electronic worksheet can be stored in any stage of completion. There is also the ability to insert, delete, and move entire rows and columns. This capability is valuable when correcting mistakes or creating new templates from ones with similar designs. VISICALC is compatible with most printers. The program allows the user to send the appropriate ASCII codes to control a printer's output characteristics (BEIL82).

VISICALC's Limitations

The primary disadvantage to VISICALC is the limited programmable memory available to the user (RAMS80). With a 48K Apple the user has about 25K available once the VISICALC program is loaded. Because the program was developed for speed and simplicity, a user cannot read or write between other disks once the program is loaded.

A sometimes catastrophic weakness of VISICALC is the inability to "lock" certain enteries. Formulas and data can be inadvertently destroyed.

There is only limited character manipulation in VISICALC. Characters can be entered but not manipulated. A VISICALC sheet cannot be made interactive even though statements can be entered for numeric processing. Along with the character limitations, no sorting for numbers or characters can be done with VISICALC. However, VISICALC numeric values can be transferred to a companion software program (VISITREND) for sorting.

A program or file cannot be executed with VISICALC. A file of data and commands cannot be executed together and then a VISICALC sheet created with the file. This limitation becomes especially cumbersome when printing a full (63x254) VISICALC sheet. A string of print commands cannot be created in order, instead each segment must be entered and be printed

seperately.

The limitations outlined above are largely due to the specific purposes for which VISICALC was designed. The tremendous popularity of this software is because of its capabilities. (BEIL82).

Data Interchange Format

Mentioned above was a companion software package called VISITREND. VISITREND is usually packaged with this report's other major tool, VISIPLLOT. All of these software programs exchange data with one another through a common file format for data transfer. This file formatting utility is called the Data Interchange Format or DIF.

For this transfer of data to occur, Software Arts, Inc., the creators of VISICALC, developed the DIF to be used as a common data format for data transter. The DIF is one of the formats in which VISICALC saves data. DIF is also the same data format that other VISICORP software uses. The type of data addressed by the DIF is data that is stored in tables, columns and rows. Examples of this type of data would be time series, such as the daily price of one or more stocks that are to be input into VISITREND for regression analysis or the expense figures for a company that are to be used as the starting point for a forecast (DIF80).

The DIF will allow processing of BASIC, PL/1 and PASCAL.

Since BASIC is so minimal in its structure, DIF was created with the detail required to run in BASIC. Since PL/1 and PASCAL allow the use of subroutine libraries, DIF provides subroutines to users of these languages freeing them from many of the details of processing data (DIF80). Of course, the immediate concern of this report and for the lesson manual is that the DIF provides us a method to exchange data between VISICALC and VISIPLLOT.

VISIPLLOT

Background

VISIPLLOT is a plotting and graphing program developed to graphically portray the data generated by VISICALC. As with VISICALC, technical information from the VISICORP Corporation is not available (See Appendix B). Therefore, our discussion of VISIPLLOT will also be limited to its characteristics, capabilities and limitations.

VISIPLLOT Functions

VISIPLLOT allows data to be presented in a graphical format on the screen and then to be printed out on a wide variety of printers. Data can be entered directly into the program or the data can be transferred from other VISISERIES software using the DIF format presented above. Any data, once entered, can

also be edited. As many as 645 points in 16 series can be handled in storage simultaneously. The data or the completed graph can be stored on disk and/or printed on a graphics printer.

The plotting portion of the program allows line, bar, half-bar, area, pie, high-low and scatter graphs. The range of the values displayed is automatically determined by the program, but they can be overridden in the editor module.

Once the selected graph is displayed, the user's options have only begun. Several title, format and color options are available. The five-choice title option lets the user label various positions or axis on the graph or a moveable title-option allows any portion of the graph to be labeled. Formats exist to allow a vertical or horizontal extension of the graph or to compare two graphs simultaneously in two different screen viewports. Also, two graph series may be overlayed for additional contrast or comparison. Colors are offered in six choices for the background or for bars, pie segments or areas of the graphs. Three examples of printed graphs are shown in Figures 1, 2 and 3. Obviously, on a color monitor the results are much more impressive.

FIGURE1
VISIPILOT Bar Chart

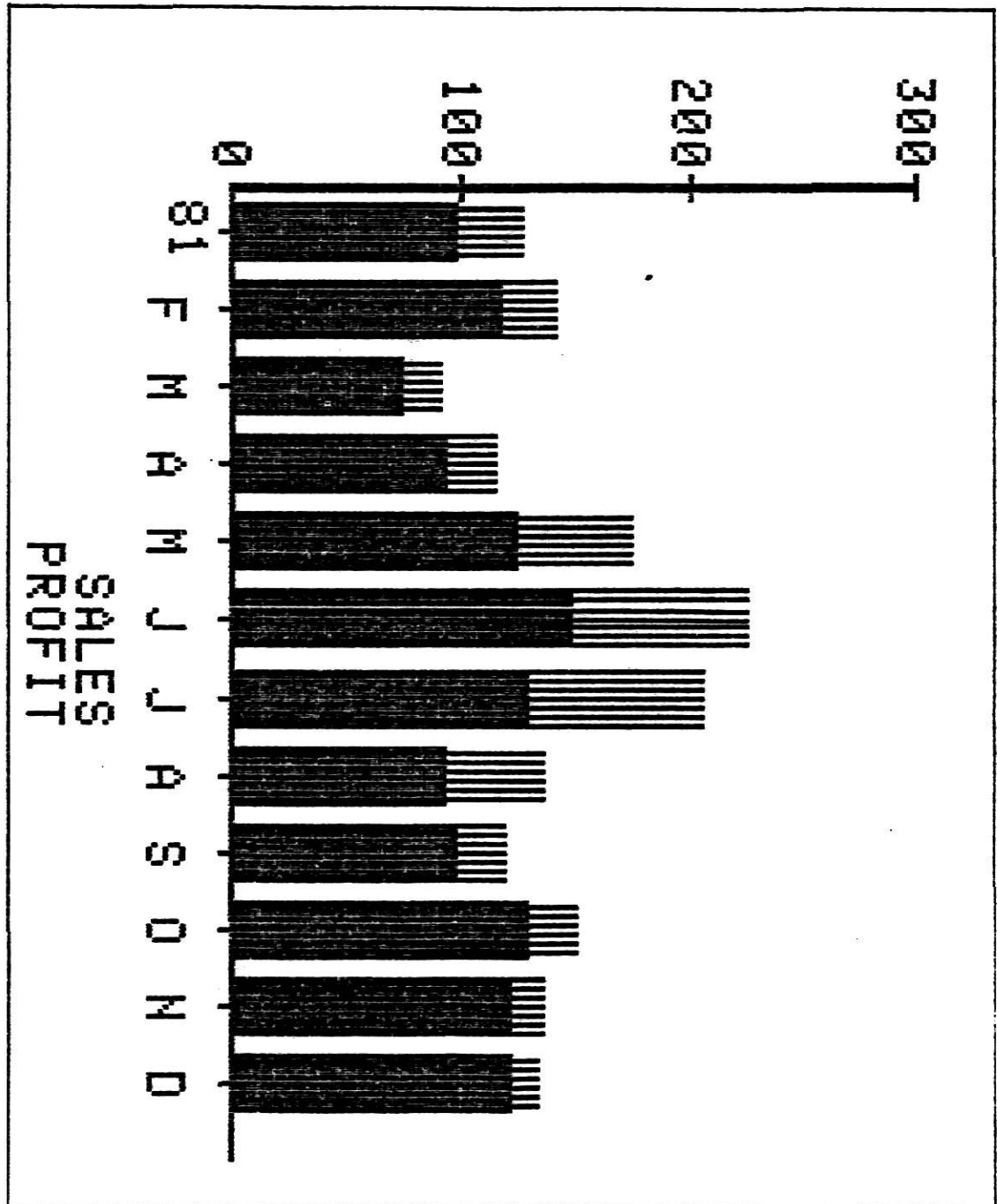


FIGURE 2
VISIPLLOT Line Graph

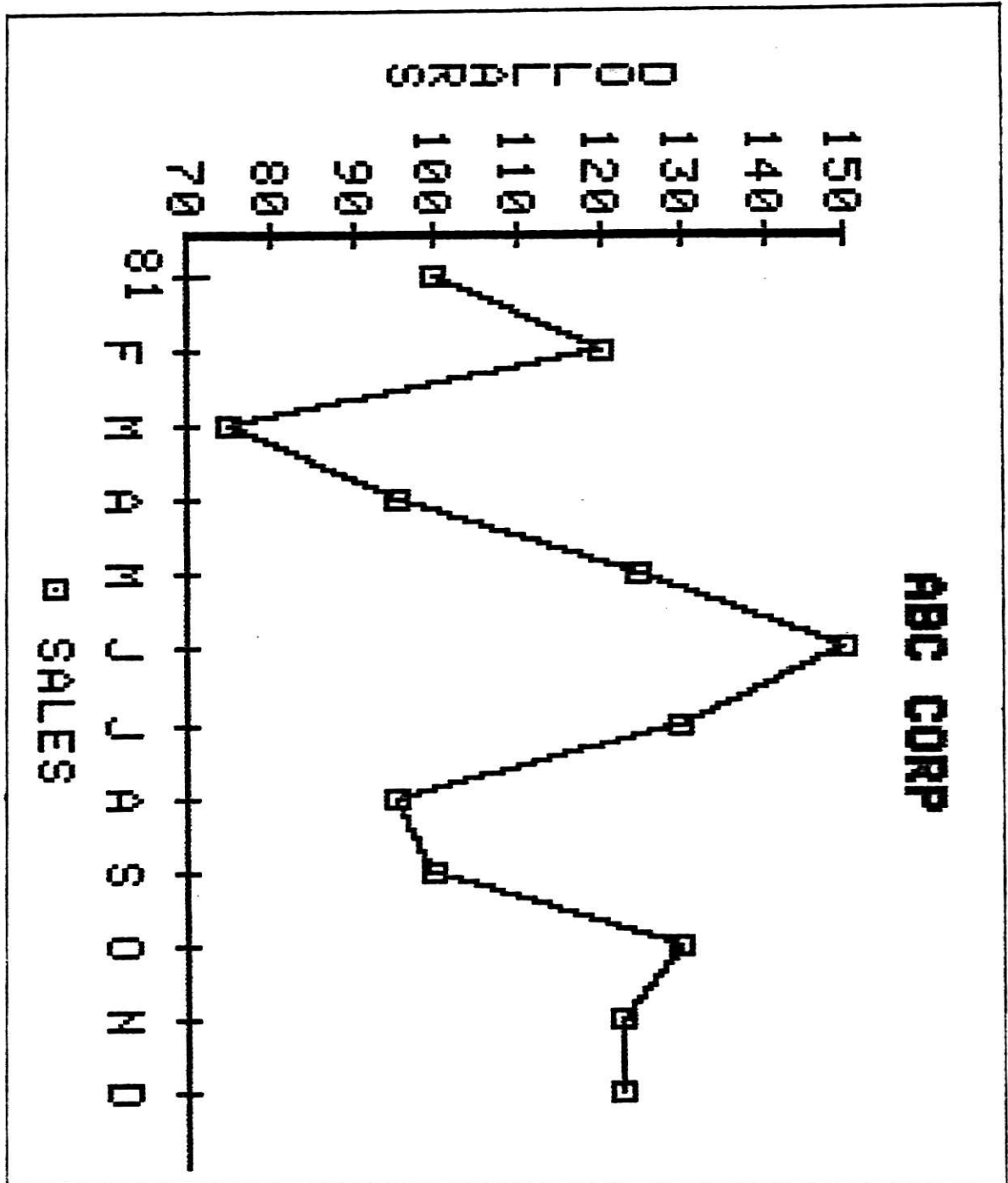
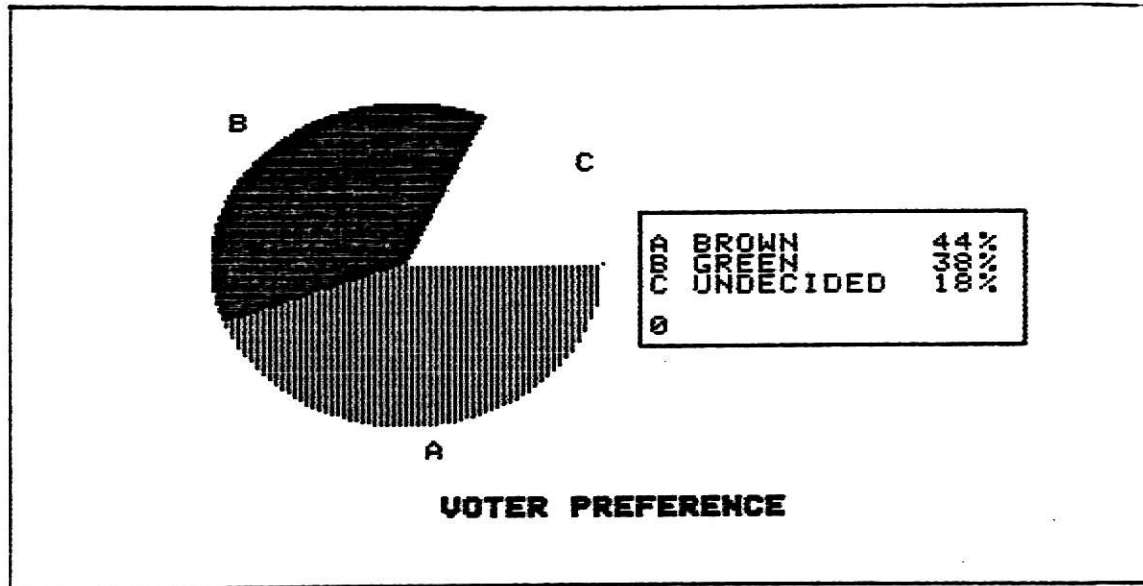


FIGURE 3
VISIPLLOT Pie Chart



VISIPLLOT Advantages

The most outstanding feature of VISIPLLOT is its user-friendliness. Even if the wrong key or an incorrect option is selected, the program provides a graceful escape on every level. Except for the entry of titles or labels, there is no keyboard entry required. The space bar, the right/left arrow keys and the carriage return function as a locator and a pick. As each menu item is highlighted by the cursor, an

English-phrased description of the command is also displayed.

VISILOT Limitations

The main disadvantage to VISILOT is its complexity. With so many options available, a user can spend extra time choosing and redrawing his graph. Once a graph has been created and saved, the graph cannot be reloaded and changed. To create a new graph, the current graph must be saved, printed or destroyed. The graph then cannot be recalled and modified.

Some limitations to the system are not mentioned in the user's manual. For example, a user cannot plot one year's sales and do a projection for the next year's sales (all by month) because the limit is sixteen periods. (An extensive editing procedure can solve the problem.) When entering pie charts, only experimentation will reveal that eight slices are the maximum allowed. Another minor inconvenience is the excessive number of trials required to determine distinguishable color combinations for a black and white printout. Even a hint in the user's manual would be most appropriate (AHL81). These limitations are not unreasonable. The shortcomings are inconveniences rather than hinderances.

VISILOT'S Interaction Techniques

Finally, this lesson was developed to illustrate interactive computer graphics concepts to students. VISILOT provides an

excellent example of four good interaction techniques.

1. A good interactive package should allow a user to use the system to obtain desired results with minimum prerequisite knowledge (MOZEB2). VISIPLLOT leads the user through the program with its extensive but simple menu. Figure 4a and Figure 4b illustrate the VISIPLLOT menu.

FIGURE 4A
VISIPLLOT Control Menu

PLEASE CHOOSE GRAPH TYPE				
CONNECT POINTS IN A LINE				
LINE	BAR	AREA	PIE	HI-LO
SCATTER	NONE			

FIGURE 4B
VISIPLLOT Main Menu

PLOT THE CURRENT SERIES				
PLOT	SELECT	WINDOW	PRINT	PIXSAVE
OPTIONS	->MAIN	OVERLAY	NEW	
BAL.XXX/LINE				W1/B1

Notice that each (common-sense) command is accompanied with an English phrase describing the command.

2. Another important interaction technique is to provide

simple, consistent interaction sequences (FOLEB1). At each level of VISIPLLOT there is a sub-menu for the procedure selected. The menus are arranged the same, interact the same way and give the same error messages for the same mistakes. The right-left arrows, the space bar and return key are the only keys required for interaction.

3. Having feedback during each sequence is of extreme importance for the confidence and anxiety of the user. During long loading sequences, VISIPLLOT flashes messages to the user: "Loading", "Still loading", "Standby". The messages reduce the anxiety of the user since he knows he performed the correct sequence and is now waiting for the program to execute. When the VISIPLLOT program draws a graph in several stages (segments), the program signals the user when the graph is complete by an audio tone.

4. Probably the most important interactive principal to follow, is to give the user a method for graceful recovery from mistakes (FOLEB1). The VISIPLLOT user's manual states, "Anytime you seem to be at a dead end with no way to continue, press any key except reset, shift or control." Any key pressed returns you to a menu to try again. Other cursor positions allow you to return to a higher level menu or to simply end the session. At no point in the software are you left with out options.

In summary, VISIPLLOT is an extremely good example of proper interaction techniques. These examples are highlighted

for the students during the lesson. These examples will provide an excellent teaching vehicle for the principles of interactive computer graphics. VISIPILOT is a well designed, easy-to-use software package. The ease of data interchange with VISICALC and other software routines makes it even more flexible. For many types of graphical communication, to include stock market charting, projections and forecasts plus budget analyses, VISIPILOT is an indispensable tool. VISIPILOT is the most powerful graph generating program available for Apple computers (RAM82).

CHAPTER 4

LESSON DEVELOPMENT METHODOLOGY

GENERAL

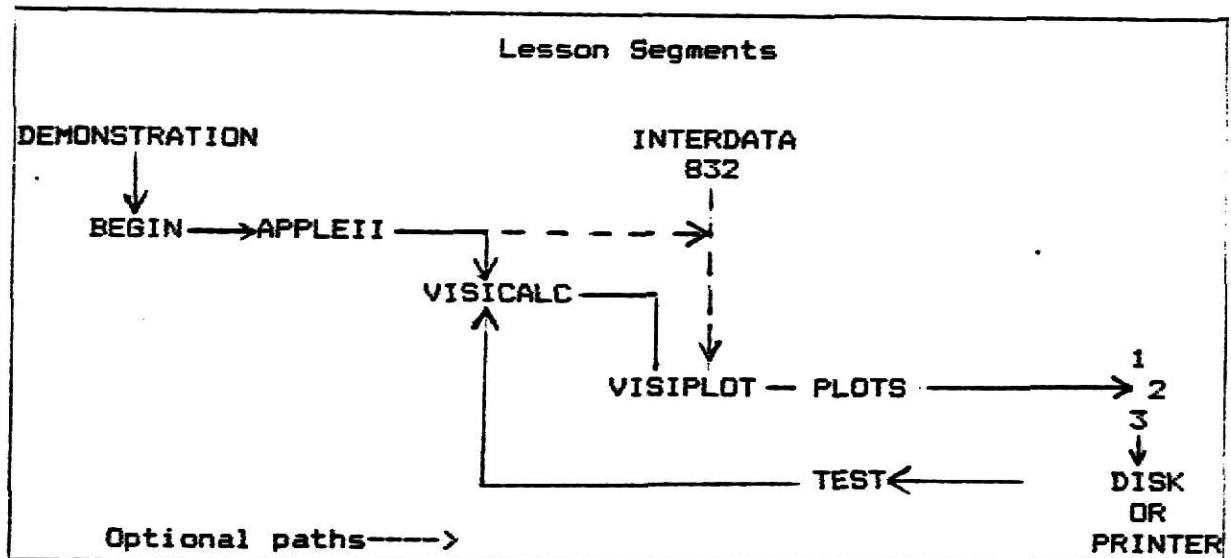
This chapter will present the methodology used to develop the computer assisted instruction (CAI) lessons for VISICALC and VISIPLLOT. The next section will outline the concept of the lesson. Then the analysis of the learning environment and the instructional purpose derived from this analysis will be presented. After the analysis of the environment and the determination of the lesson's purpose, broad but attainable lesson goals are given. From these goals the development of specific teaching objectives are stated. The methodology to produce these objectives are given in this chapter and the specific objectives are present in Appendix C. Finally, an evaluation by students of the lesson concludes the chapter.

CONCEPT OF LESSON

Complete Lesson

The concept of the lesson is shown graphically in Figure 5.

FIGURE 5



The lesson is actually a complete package with options. First, the students will receive a one hour classroom demonstration. The demonstration lesson plan is located at Appendix E. This demonstration will provide all students an introduction to business and business graphics software. The demonstration will also provide a foundation for those students selected to complete the lesson.

Once the students begin the lesson, they will first learn how to use the Apple II microcomputer. Next data entry and data manipulation is learned using the VISICALC software. The students then learn how to format the data for transfer to the VISIPILOT program. With VISIPILOT the students will learn how to use the software to create graphs of the VISICALC data. Then they will store the graph and learn to print the plots on a

graphics printer. Finally, the students will complete an exercise to demonstrate their ability to perform each step discussed above.

Lesson Options

The students' professor may desire a shorter or different option for him. The option can be to go directly to VISIPLLOT and use previously created data for plotting. Another option allows the student to use the INTERDATA 832 and enter a data file for transfer to VISIPLLOT. Either of these options may necessarily include the Apple II module prior to VISIPLLOT. Next is a discussion of the development of the lesson presented above.

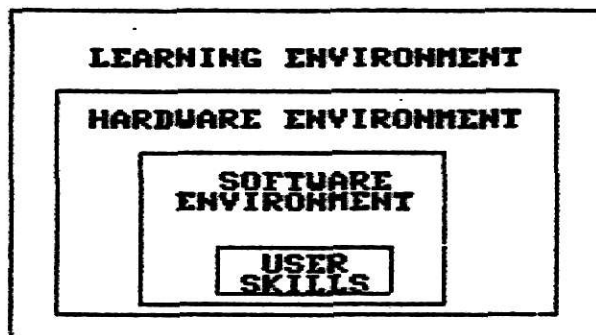
LEARNING ENVIRONMENT

Assessment of the Learning Environment

When planning a CAI lesson, or any type of lesson, it is important to clarify the goals and assumptions in the planning phase. This step is vitally important because the probability of survival of CAI projects is more related to their reason of establishment than to the quantity or quality of their work (MISS80). To determine the goals or assumptions for the computer graphics lesson, it was necessary to access the environment or structure in which the lesson was to be used.

Figure 6 portrays this environment.

FIGURE 6
The Computer Learning Environment



Lesson Implementation Environment

The "learning environment", which this lesson is designed to augment, currently consists of one Computer Graphics course. The catalog listing of this course provides several topics to be taught during the semester. The topic of man-machine interaction is the primary area where the VISICALC and VISIPILOT software can provide the tools for teaching these concepts. The lesson is expected to provide one of many activities that occur in the course. This variety should be guided by certain principles for implementing CAI. These principles are:

1. Course objectives should overlap so that the student is required to integrate many concepts regardless of

the final objective.

2. A course about computers should provide students with hands on experience.
3. The classroom portion of an integrated course (CAI and lecture) should provide a variety of learning activities (L'ALL80).

These principles were the framework for the design of the lesson within the learning environment.

Hardware Environment

The "hardware environment" must be considered because users with widely divergent backgrounds will be potential users of the lesson. Even though the computer graphics course is an upper-level course, students from other university departments enroll in the course. Additionally, a Computer Science major might receive his first exposure to a personal computer in this lesson. Even though the total number of personal and other computers is growing, the number of new and inexperienced users requiring access to a computer is also growing. Therefore, in any CAI course a hardware lesson component is a necessity (MOZE82).

Software Environment

The "software environment" encountered while teaching a computer skill can be very simple or quite complex. On a mini-

or mainframe computer, the only software skill required is usually the operating system. On a microcomputer each new set of software presents a new set of skills required for the use of the software.

The Apple II running VISICALC and VISIPILOT is no exception. Certain commands, procedures and conventions must be taught in order for the student to progress to the level where he begins to learn the skills desired.

Software should be based on a concept of "stepwise learnability". This concept breaks up the amount of information the student must assimilate into a series of unimimidating steps. Each step provides either the output intended or it provides enough information to progress to the next phase of the lesson (MOZE82). Finally, after mastering the preresquisite hardware and software skills, the student is ready to learn, display or practice the skills for which the lesson was designed.

PURPOSE

Determination of Lesson Purpose

To be able to properly establish the direction of a lesson or to estimate the outcome of a teaching session, the teacher (course designer) must be able to chart a course for the lesson. Above, the layers of the learning environment

encountered in mastering a computer skill were discussed. Now the specific implementation of the lesson within those environments will be developed. The structure used in the course design is as follows:

STATE PURPOSE OF LESSON

IDENTIFY GOALS OF THE LESSON

IDENTIFY THE TEACHING OBJECTIVES FOR EACH GOAL

Unless a suitable analysis is performed when instruction is developed, it is very possible to develop a good course that doesn't help anybody at all. It is possible to develop a course that nobody needs, either because the course is unrelated to the problem that gave rise to it or because it teaches things the students already know. Techniques such as those above, goal analysis and performance analysis can help avoid such wasteful practices (MAGE75).

Therefore, the overall purpose of the lesson is to:

Teach an individual to be to use VISICALC
and VISIPLLOT software in order to produce business
graphics in an interactive computer graphics mode.

This purpose embodies all the discussion points that have preceded it in this paper. The goal supports the course description. It puts the student in a hands-on mode for the lesson, and it gives him experience with techniques being in

the commercial world.

GOALS

General

Now that the purpose of the lesson has been devised, the lesson must be divided into segments and a goal(s) for each part must be stated. This division aids in the "stepwise learnability" mentioned before, plus it allows flexibility for the instructor.

Goals for Lesson Segments

The goals for the lesson segments presented in Figure 5 were presented in the first section of this chapter. Having stated broad but attainable goals for each block of the lesson, the development of the objectives necessary to accomplish these goals are presented next.

OBJECTIVES

General

An objective is a description of instructional outcome rather than a description of an instructional process or

procedure. It describes results, not the means of achieving those results. Objectives are useful for the following: (1) designing of instructional content and procedures, (2) evaluating or assessing the success of the instruction, and (3) organizing the students' and instructors' efforts and activities for the accomplishment of the instructional goal (MAGE75).

Background

From the goals developed in the last section, the learning objectives necessary to attain those goals will be developed. First, the criteria for the measurement of the objectives is an important concept to define before continuing. The degree of proficiency necessary for the users of this lesson must be minimal because of time constraints. As previously mentioned, several books and numerous articles have been written on the use of VISICALC. The tutorial manual provided with the software is over 200 pages in length. While researching this topic and developing the lesson and demonstration, it required the author eight hours to become reasonably proficient with VISICALC. Another five hours were required to learn VISIPLLOT. To complete the proposed lesson a student should only spend an average of three hours. Therefore, the objectives developed for learning the mechanics of the hardware and software will require only that the student be able to proceed to the next

point with all references needed to do so.

Objectives for Computer Graphics Techniques

The objectives developed for the computer graphics techniques are more exacting. Prior to beginning the CAI lesson, the student will have completed readings and will have attended lectures covering the techniques. Therefore, a proficiency demonstrating the ability to list, identify or discuss the techniques could be required by the professor.

The above methodology, with assumptions, was used to develop the objectives. At Appendix C are listed the objectives for each goal.

Measurement Criteria

Once the student has reached the end of the lesson he is not finished. Note on Figure 5 that an activity arrow returns to VISICALC. This activity is labeled "self-test". When developing a teaching objective, the instructor has only described to the student what he wanted him to do. The effectiveness of the lesson can be increased by requiring the student to demonstrate how well he can do the task assigned. Also, this step will assist the instructor by indicating to him the effectiveness of the lesson. This step is called the criterion of measurement. A criterion is the standard by which performance is evaluated or the yardstick by which achievement

of the objectives is assessed (MAGE75).

Therefore, once the student has worked through the manual and has successfully plotted three graphs, he will be given a problem to complete with VISICALC and VISIPLLOT. He will also be given a completed VISICALC worksheet and a completed plot which will be the minimum expected criteria for his completed project. Those students entering the lesson at the VISIPLLOT mode or entering the lesson from the Interdata 832 will be given problems individually by the instructor.

The evaluation of the student's grasp of the interactive graphics techniques will be left to the discretion of the professor. These techniques, as displayed by the VISICALC and VISIPLLOT software, are a good discussion topic for the classroom. Also, these techniques are well suited for course examinations. Regardless of the evaluation method, the student will have the opportunity to see and use the interactive graphic techniques so vital to the implementation of computer graphics.

Evaluation

The lesson was evaluated by three students and one faculty member. Overall, the evaluators completed the lesson in three to four hours. The format, figures and data examples were found easy to use and appropriate for the lesson concept. The graphics techniques and concepts in the lesson were felt to be

well presented and were clearer in meaning to the evaluators after completing the lesson. Several editorial changes were made to the lesson after the evaluation.

The classroom demonstration was presented once to a computer graphics class by the author. No further evaluation of this demonstration was conducted.

The main purpose of this report has been to present a methodology for the development of a computer assisted instruction (CAI) lesson for computer graphics. The methodology included the use of commercially available software where the intended purpose of the software is utilitarian, not instructional. In addition to demonstrating the feasibility of this approach, the paper also provided rationale for this project.

BIBLIOGRAPHY

- APPL81 Apple II Reference Manual. Apple Computer, Inc: Cupertino, CA, 1981.
- AHL81 Ahl, David H. "Evaluation of VisiTrend and VisiPlot From Personal Software," Creative Computing, 7:12, (December 1981): 98-104.
- BELL82 Bell, Donald H. The VisiCalc Book Apple Edition. Reston, VA:Reston Publishing Co.,1982.
- BOET81 Boettcher, Elaine G. and others. "A Comparison of the Effects of Computer-Assisted Instruction On Student Learning in the Cognitive Categories of Knowledge and Application." Journal of Computer-Based Instruction. 8:1(August 1981):13-18.
- BRUN80 Bruno, Kristin J. Evaluating a Remote Teaching Environment for Computer Science Students. Master's Report, Department of Computer Science, Kansas State University,1980.
- CHAM80 Chambers, Jack A. ,and Sprecher, Jerry W. "Computer Assisted Instruction: Current Trends and Critical Issues." Communications of the ACM. 23:6(June 1980): 332-342.
- DUNC80 Duncan,F.G., and Muhlbacher, J.R. "Personal Computing in Computer Science: How to Solve the Educational Paradox." Computing Reviews. 36,444,July 1980.
- DVOR78 Dvorak, Robert W. "An Experiment in Architectural Instruction." Journal of Computer-Based Instruction. 4:4(May 1978):93-96.
- DWYE73 Dwyer, T.A. A Perspective On Technology and Education. Technical Report Number 73-5. Department of Computer Science, University of Pittsburg, March 17, 1973.
- FOLE82 Foley, James, and Van Dam, Andries. Fundamentals of Interactive Computer Graphics. Menlo Park,CA: Addison-Wesley Publishing Co.,1982.

- GURW81 Gurwitz, Robert W. and Fleming, R.T. "Microprocessor Display and Animation System." IEEE Transactions On Education. E-24:2(May 1981):129-132.
- HABE82 Haber, Ralph N., and others. "Perceptual Components of Computer Displays." IEEE Computer Graphics and Applications. 2:3(May 1982):23-24.
- HAMI82 Hamilton, Peter S., Barr, Ronald E., and Juricic, T. "Implementation of Computer Graphics Exercises in Freshmen Engineering Graphics Education." Computing and Graphics. 6:1(1982):29-34.
- KEAR82 Kearsley, Grey. "Authoring Systems in Computer Based Education." Communications of the ACM. 25:7(July 1982): 429-437.
- L'ALL80 L'Allier, James J., and Tennyson, Robert D. "Principles of Instructional Design Applied to an Introductory Course on Educational Computing." Journal of Computer-Based Instruction. 2:26(November 1980):26-32.
- MAGE75 Mager, Robert F. Preparing Instructional Objectives. Palo Alto, CA: Fearon Press, 1975.
- MESE82 Meserve, Everett T. "The Future of Rabbits." Datamation. 28:1(January 1982):130.
- MOZE82 Mozeico, Howard. "A Human/Computer Interface to Accomodate User Learning Stages." Communication of the ACM. 25:2(February 1982):100-104.
- NEID82 Neiderjohn, Russel J., and Schmitz, Ronald J. "The Case for Project-Oriented Courses With 'Educationally Useful Student Design Projects." IEEE Transactions On Education. E-25:2(May 1982):65-69.
- DIF80 "Programmer's Guide to the Data Interchange Format." Cambridge, MA: The DIF Clearinghouse. Software Arts, Inc., 1980.
- RAMS82 Ramsdell, Robert E. "The Flexibility of VisiPlot." BYTE 7.2 (February 1982):32,34,36.
- RAMS80 Ramsdell, Robert E. "The Power of VisiCalc:Product Review." BYTE 5, 11(November 1980):190-192.
- YASA82 Yasaki, Edward K. "A House Is Still A Home."

Datamation. 2: (February 1982):74.

REFERENCES

Bricklin, Dan, and Frankston, Bob. VisiCalc Computer Software Program for Apple II and Apple II Plus . Software Arts, Inc. Sunnyvale, CA: Personal Software Inc., 1979.

Bricklin, Dan, and Frankston, Bob. VisiTrend + VisiPlot Computer Software Program for the Apple II Plus . Software Arts, Inc, Sunnyvale, CA: Personal Software, 1981.

Foley, James, and Van Dam, Andries. Fundamentals of Interactive Computer Graphics . Menlo Park, CA: Addison-Wesley Publishing Co., 1982.

O'Neil, Harold F., Jr., and others(eds.). Procedures for Instructional Systems Development . New York: Academic Press, 1979.

APPENDIX A

APPLE II PLUS MICROCOMPUTER

Introduction

The Apple II Plus microcomputer was the hardware selected for the lesson implementation. The Apple was chosen because of its availability in the Computer Science Department and because of its compatability with VISICALC and VISIPILOT. This appendix will present the technical characteristics of the Apple II, especially the Apple's graphics characteristics.

General

The Apple II Plus microcomputer is powered by a Synertek/Mos Technology 6502 microprocessor. This microprocessor runs at a rate of 1,023,000 machine cycles per

second and can do over five hundred thousand addition or subtraction operations per second. It has an addressing range of 65,536 eight-bit bytes. The microprocessor can issue 56 instructions with 13 addressing modes. The Apple memory consists of 12 K bytes of read-only-memory (ROM) and 48 K bytes of random access memory (RAM). The ROM stores the Applesoft II version of BASIC and the autostart-from-reset function.

AppleII Memory Configuration

The Apple II's memory configuration and usage is listed in Figure 1.

PAGE NO.	USED FOR
0	System Programs
1	System Stack
2	Input Buffer
3	Monitor (Autostart -from-reset) ROM
4	Text and Lo-Res Graphics Primary Page Storage
5	
6	
7	
8	Text and Lo-Res Graphics Secondary Page Storage
9	
10	
11	
12 THRU 31	Free RAM
32 THRU 63	Hi-Res Graphics Primary Page Storage
64 THRU 95	Hi-Res Graphics Secondary Page Storage
96 THRU 191	Free RAM

NOTE: One page = 254 bytes of memory.

Figure 1
APPLE II Memory Map

The Applesoft BASIC program lines occupy the low end of the Free RAM around page 31. Simple numeric values and string pointers are stored directly above the program lines. Arrays

and string array pointers are stored above the string variables. The string "values" are stored at the top of the other Free RAM space at page 96.

Each numeric variable and string pointer uses seven bytes of memory. A real variable uses two ASCII codes (two bytes) for the variable name. The value is stored in scientific notation with one byte for the exponent and four bytes for the mantissa.

Integer variables also use two ASCII codes (two bytes) for the variable name and two bytes for the variable's value.

AppleII Graphics

The screen or video output of the Apple is of great interest for graphics applications. Three types of representations can be displayed on the Apple's video display. First, text can be displayed in 24 lines with 40 characters per line. These characters are formed in a dot matrix: 7 dots high and 5 dots wide. Second, low-resolution graphics can be presented by 1,920 colored squares in an array 40 blocks wide and 48 blocks high. Colors for each block come in 16 varieties. Third, high resolution graphics are displayed at a resolution of 280 x 192 separately addressable locations. In this mode there are six colors available. The graphical functioning of the Apple in the Hi-Res mode will be discussed

in detail next.

The video display system of Apple generates a screen display from the RAM memory. The text and Low-Res graphics modes both use a 1-K byte area of memory for the generation of characters or for character graphics. In the Hi-Res graphics mode, two separate memory areas of 8K bytes each are used. These Hi-Res areas are called "pages", and the entire area reserved for Hi-Res graphics is often called a "picture" or "frame" buffer. The first page is the primary page and the other is the secondary page. Each dot on the screen represents one bit in the picture buffer. Seven of the eight bits in each byte are used to generate the character or position on the screen. The eighth bit is used to select the color of the dots in that byte. The first bit, or least significant bit of the first byte, is displayed on the extreme left of the screen followed by the other bits. Forty bytes are displayed on one horizontal line.

For color generation the eighth bit is not displayed but is turned "on" or "off" to control the color. If a bit of a byte is "turned -on" and it is in an even numbered column and the eighth bit is "off", the bit will appear violet. Similarly, if a bit is in an odd-numbered column, it will appear green. If two bits are placed side-by-side, they will both appear white. If the eighth bit is turned "on", the colors of red and blue are substituted for green and violet

respectively. Thus there are six colors available to Hi-Res graphics.

The Apple uses 4K and 16K dynamic RAMS for its main storage. This RAM is used by both the microprocessor and the video display circuitry. These two interleave their use of the RAM. The microprocessor reads from or writes to RAM during one cycle and the video display refreshes its screen from RAM memory during alternate cycles. The dynamic RAMs are refreshed automatically by the video generator circuitry. Since the video screen always displays at least 1K of memory, it needs to refresh, or cycle through, every memory location in that 1K range sixty times every second.

Peripherals

The Apple II Plus can support a wide variety of peripheral devices. The most significant devices for the purposes of this report are graphics or communications related. A graphics printer is included for printouts of graphs, plots or other graphics generated in black and white only. A communication package is included in the form of an asynchronous modem with a maximum capacity of 300 baud.

Graphics Input Devices

The graphics input devices available for the Apple are also quite numerous. Joysticks, game paddles, light pens,

graphics tablets and many other peripherals are widely available for the Apple. These devices will not be discussed as they are not used in developing the graphics courseware (APPL79).

The Apple II is a very flexible machine capable of text, graphics and the handling of various input and output devices. Higher-level languages such as PASCAL expand the Apple's capabilities. Through PASCAL, many graphics subroutines are intrinsic in the language by a utility known as Turtlegraphics. Turtlegraphics is a graphics routine that provides many graphics subroutines and functions to make graphics programming simpler. The Apple II also has thousands of software products developed for it. These software packages cover almost any application from farming to music.

APPENDIX B

LETTER FROM VISICORP



VISICORP[®]
PERSONAL SOFTWARE[™]

October 21, 1982

Mr. Donald Loftis
928-A Dondee Dr.
Manhattan, KS 66502

Dear Mr. Loftis:

Thank you for your recent inquiry and interest in our products.

Unfortunately, I cannot release the type of information you are requesting. I have referred your request to my technical advisors. If I receive any information from them I will contact you by letter.

Once again, thank you for your request.

Sincerely,

Jackie Ethier
Technical Support Representative

JE/js

2895 ZANKER ROAD, SAN JOSE, CA 95134
TEL 408/946-9000, TELEX 172159 (PERSOFT SNI)

APPENDIX C

TEACHING OBJECTIVES

APPLE II

Goal: The student should be able to properly operate the Apple II with a degree of proficiency required to load VisiCalc, data disks, and VisiPlot.

Objective 1: The student will be able to properly handle disks in accordance with the Apple II DOS Manual.

Objective 2: The student will be able to initialize (boot-up) a disk on the Apple II in accordance with the Apple II DOS Manual.

Objective 3: The student will be able to exit and properly remove the Apple II from operation in accordance with the Apple II DOS Manual.

VISICALC

Goal: The student should be able to enter at least two sets of values, label them and store them for use with VisiPlot. He should also be able to identify and discuss the computer graphics techniques used in VisiCalc.

Objective 1: The student should be able to move the

cursor to any position on the VisiCalc worksheet in accordance with the lesson manual.

Objective 2: The student should be able to enter a column and a row of labels appropriate to provide a definition of the columns and rows of data in accordance with the lesson manual.

Objective 3: The student should be able to enter columns and rows of values on the VisiCalc worksheet in accordance with the lesson manual.

Objective 4: The student should be able to use at least one, two-variable formula and one function in manipulating the data on the worksheet. This accomplishment should be in accordance with the lesson manual.

Objective 5: The student should be able to store his created worksheet on a data disk in the DIF format that will properly function with the VisiPlot software in accordance with the lesson manual.

Objective 6: The student should be able to print his completed VisiCalc worksheet on a printer in accordance with the lesson manual.

Objective 7: The student should be able to discuss the computer graphics techniques of window, viewport and clipping as implemented by the VisiCalc software. These techniques should be discussed in accordance with their definitions as presented in the course textbook, Fundamentals of Interactive Computer Graphics.

VISILOT

Goal: The student should be able to load a DIF file and plot a fully labeled line, bar, area and pie graph. Additionally, he should be able to identify and discuss the computer graphics techniques used in VisiPlot.

Objective 1: The student should be able to load (boot-up) the VisiPlot program in accordance with the lesson manual.

Objective 2: The student should be able to use the VisiPlot menu in order to load DIF files and then to move to the PLOT program in accordance with the lesson manual.

Objective 3: The student should be able to use the menu in the Plot mode to: display the data series; select a series for plotting; plot the series in either a line, bar or area graph; and label the graph. These operations should be done in accordance with the lesson manual.

Objective 4: The student should be able to store the created graph on a disk for later recall or for printing, in accordance with the lesson manual.

Objective 5: The student should be able to print a line graph on a graphics printer in accordance with the lesson manual.

Objective 6: The student should be able to discuss the computer graphics techniques as displayed by the VisiPlot software. These techniques are: Segmentation; menu-driven picks, window, viewport, dragging, and fill operations. These

techniques should be discussed according to the definitions
- found in the course textbook Fundamentals of Interactive
Computer Graphics.

APPENDIX D

LESSON MANUAL

FOR

VISICALC and VISILOT

BY

DONALD D. LOFTIS

1982

INTRODUCTION

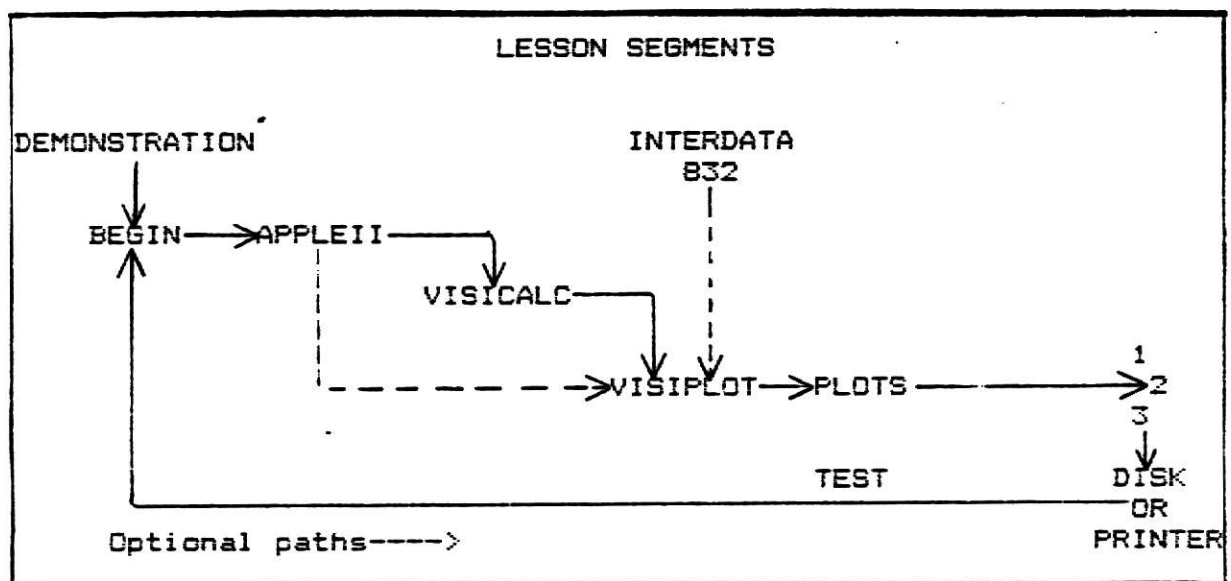
I. PURPOSE

The purpose of this manual is to allow computer graphics students to learn the applications of interactive computer graphics as implemented by commercial software on a microcomputer. In addition to learning these techniques, you will learn how to use the software and create your own graphs on the screen and then print them on a graphics printer.

II. GOALS OF THE LESSON

The goals of the lesson can be best presented by viewing a diagram of the entire lesson.

FIGURE 1



First, you should have recently attended a demonstration for the Apple II, VISICALC and VISIPLLOT. You will not have the background to know exactly where we are going if you have not attended the demonstration.

The next step is the BEGIN step. You should have been given a goal to complete for this lesson. If not, just follow the lesson plan and the goals and objectives for you. If you were given a goal, it may be different than those found in this lesson.

For example, you may be creating a data file on the Interdata 832 and only wish to use VISIPLLOT. In that case go to Module 1 first to learn about the Apple II. Then you can move on to Module 3 for VISIPLLOT. You may also have been assigned the goal of just using VISIPLLOT to draw some plots. If so, go to Module 3, VISIPLLOT after you master the Apple in Module 1.

Finally you may be assigned the goal of completing the entire lesson. If so, stay here. Here are the goals of each of the blocks you see in Figure 3. First, the Apple II block is to insure you know how to operate the Apple II. The VISICALC block teaches you how to use the VISICALC software. You will not become an expert, but you will learn enough to enter data and later plot it. In the next block, you will learn how to take the file you created in VISICALC and plot a line, bar or area graph. Next, you will move to the printer block where you will output your graph to the graphics printer.

When you complete learning the mechanics, you will be given a sample problem and you will be on your own. You will be shown what the answer should look like, but it will be up to you to create the solution.

MODULE 1

HOW TO USE THE APPLE II

I. GOAL: At the conclusion of this module you should be able to properly operate the Apple II with a degree of proficiency required to load a program disk, run a program and exit from the Apple II.

II. OBJECTIVES

A. Objective 1. You will learn how to properly handle disks according to the module instructions.

B. Objective 2. You will learn how to initialize (boot-up) a disk on the Apple II according to the module instructions.

C. Objective 3. You will learn how to exit from and how to remove the Apple II from operation in accordance with the module instructions.

NOTE: IF YOU KNOW HOW TO DO THE ABOVE OBJECTIVES GO TO MODULE 2.

III. TOOLS YOU NEED TO BEGIN THIS MODULE

A. Apple II computer with 2 disk drives, a video monitor

and a graphics printer.

B. The Apple II System Master Disk.

IV. OBJECTIVE 1: You should be able to properly handle disks in accordance with the Apple II DOS Manual.

A. Only a few simple rules are necessary for using disks.

They are:

- * Always keep the protective cover on the disk when it is outside the disk drive.

- * Keep the disk away from magnetic fields which means keep them away from magnets, electric motors and television sets—including the monitor.

- * Do not place the disk near extreme heat.

- * Keep the disk away from dust or ashes.

B. Inserting and Removing Disks.

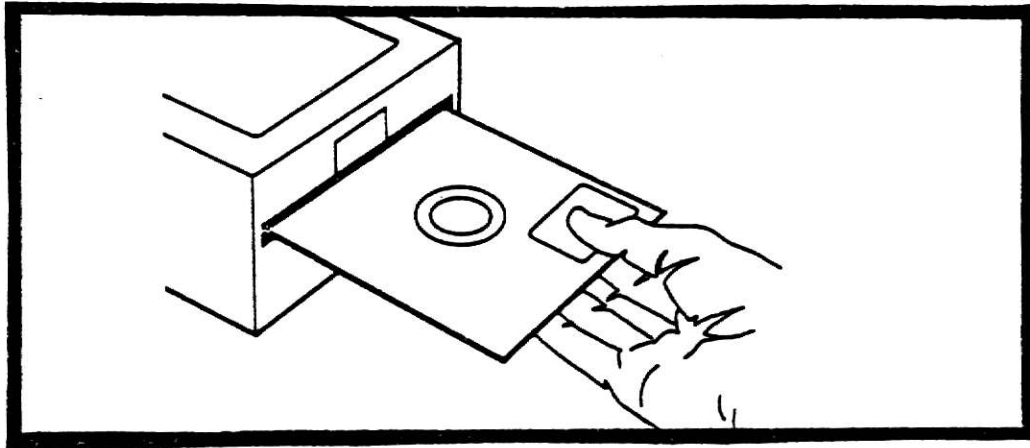
- * The disk drive door is opened by pulling outward and upward on the bottom edge of the door.

- * Remove the disk from the cover by holding your thumb over the label and your fingers just beneath the thumb.

- * Never touch the exposed portions of the disk.

See the figure below.

FIGURE 1-1



- * Holding the disk, label up as above, push the disk gently into the drive. Do not bend it.
- * When it is completely in the drive, close the door by pushing it down.
- * To remove a disk, open the door, and pull the disk straight out. (Remember to put it back in the cover).
- * Never remove a disk while the IN USE light on the drive is lit or your data will be destroyed.

C. The above instructions were very short. If you are a beginner in Computer Science and have never used a microcomputer, read Chapter 1 of The DOS Manual for the Apple II.

V. OBJECTIVE 2: You should be able to initialize (boot-up) a disk on the Apple II in accordance with the Apple II DOS

Manual.

- A. Locate the Apple II System master disk.
- B. Open the disk drive door for Drive 1 and insert the system master disk and close the door.
- C. Make sure the video monitor is turned on.
- D. Reach to the back left hand side of the Apple II and locate the power switch. Push it up/on. (or turn on the key located at the front of the Apple to your right).
- E. The power light on the keyboard should come on and the disk drive's In Use light should come on. The drive will whirl a minute or two. Do not attempt to do anything at anytime while the In Use light is on.
- F. Right after you turn the power on the video screen should display:

DOS VERSION 3.3	SYSTEM MASTER
APPLE II PLUS OR ROMCARD	08/25/80
(LOADING INTEGER INTO LANGUAGE CARD)	

This message indicates that the disk operating system has been loaded. This particular Apple has an additional 16K bytes of memory in a card. The message in parentheses refers to loading the integer BASIC language. The Apple II has another version of BASIC called APPLESOFT Basic resident in the Apple's memory.

- G. Now type in CATALOG and press RETURN. After the first list is on the screen and you have scanned it, hit the SPACE bar. The rest of the listing appears and you get the cursor prompt "[" at the bottom. This is the listing of files on

this particular disk. Now let us run one of the programs.

Type RUN COLOR DEMOSOFT. Press RETURN.

Now just follow the directions. Be sure to do the last one called SKETCHING screen. This program shows you the coordinates of the Apple and the sound levels available. (Note: You cannot run this option without the joy stick.) If you do not have a joystick, choose one of the other programs.

H. Go back to the menu. How do you get out of the program? It does not tell you does it? This is an example of poor interaction. The program does not allow you a graceful method of escape.

I. Press the CTRL key and the RESET key simultaneously. You hear a beep and you get the "[" cursor back. This method of exit should always be your last resort. In some instances this procedure can cause you to lose data in the memory or on the disk. YOU SHOULD NEVER USE THIS METHOD OF EXITING WITH VISICALC AND VISIPILOT.

J. Now it is time to leave the Apple II.

VI. OBJECTIVE 3: You should be able to exit and properly remove the Apple II from operation in accordance with the Apple II Reference Manual.

A. First, THINK! Are there any data or programs that must be saved before I exit? Now there are none, but later in VisiCalc and VisiPlot you will have data to save. You must save data that you type in before turning off the Apple. If you don't, the data will be lost forever.

B. We do not have any data to save so turn the key or the on/off switch to shut off the power and turn the Apple off.

C. Next turn off the monitor unless it works with the key for the Apple.

D. Now reach over and open the disk drive, remove the SYSTEM MASTER Disk and put it back in the cover.

VII. CONCLUSION

You have completed the first module. You should now know how to:

- * Handle and care for a disk.
- * Insert and remove a disk from the Apple disk drive.
- * Turn on the Apple and "boot-up" a disk.
- * Exit from a program in a crude manner.
- * Recognize one form of poor interactive technique.
- * Exit from the Apple II.

CONTINUE TO MODULE 2

MODULE 2

VISICALC

I. INTRODUCTION

What is VISICALC? VISICALC is one of the most popular software packages ever. Since its introduction in 1979, over 300,000 copies have been sold. It was developed by Dan Bricklin and Bob Franston of Software Arts, Inc. and it was marketed by VISICORP (Personal Software), Inc. The program sells for \$200 and consists of a program disk, manual and a reference card. VISICALC is a powerful individual or business tool written for a number of personal computers besides the Apple II. Its power lies in the replacement of our pencils, calculators and sheets of paper. An "electronic sheet" gives us the power of the computer and with "user friendliness" VISICALC gives us great flexibility. The best uses of VISICALC are budgeting and forecasting. We will learn only a small fraction of the power and flexibility of VISICALC. In the Bibliography to this manual is a list of books that go a great distance beyond this manual. The users manual with the disk will also give you more capabilities.

II. GOAL

When you finish this module, you should be able to correctly enter at least two sets of values, label the values and then store the values and labels for use with VISIPLLOT. You will also understand some of the interactive graphics techniques that are used by VISICALC.

III. OBJECTIVES

A. Objective 1. First you will learn how to move the cursor to any position on the VISICALC worksheet.

B. Objective 2. Next you will enter rows and columns of labels in order to define what the worksheet and the numbers on the worksheet are used for.

C. Objective 3. Then you will enter some values, like a budget or profits and losses.

D. Objective 4. To really learn the power of VISICALC, you will then learn how to use formulas to manipulate the values which you have entered.

E. Objective 5. The steps above should have created a small worksheet with values which should be saved for graphing or for recall later. Therefore, you will learn how to save the worksheet on a disk that you can later transfer to VISIPLLOT for graph plotting.

F. Objective 7. Finally, you should be able to discuss how VISICALC uses the concepts of a "window", a "viewport" and

"clipping" in the software functioning.

IV. GETTING STARTED

Since you completed the last module you already know how to get started, but let us review. You will need the following items:

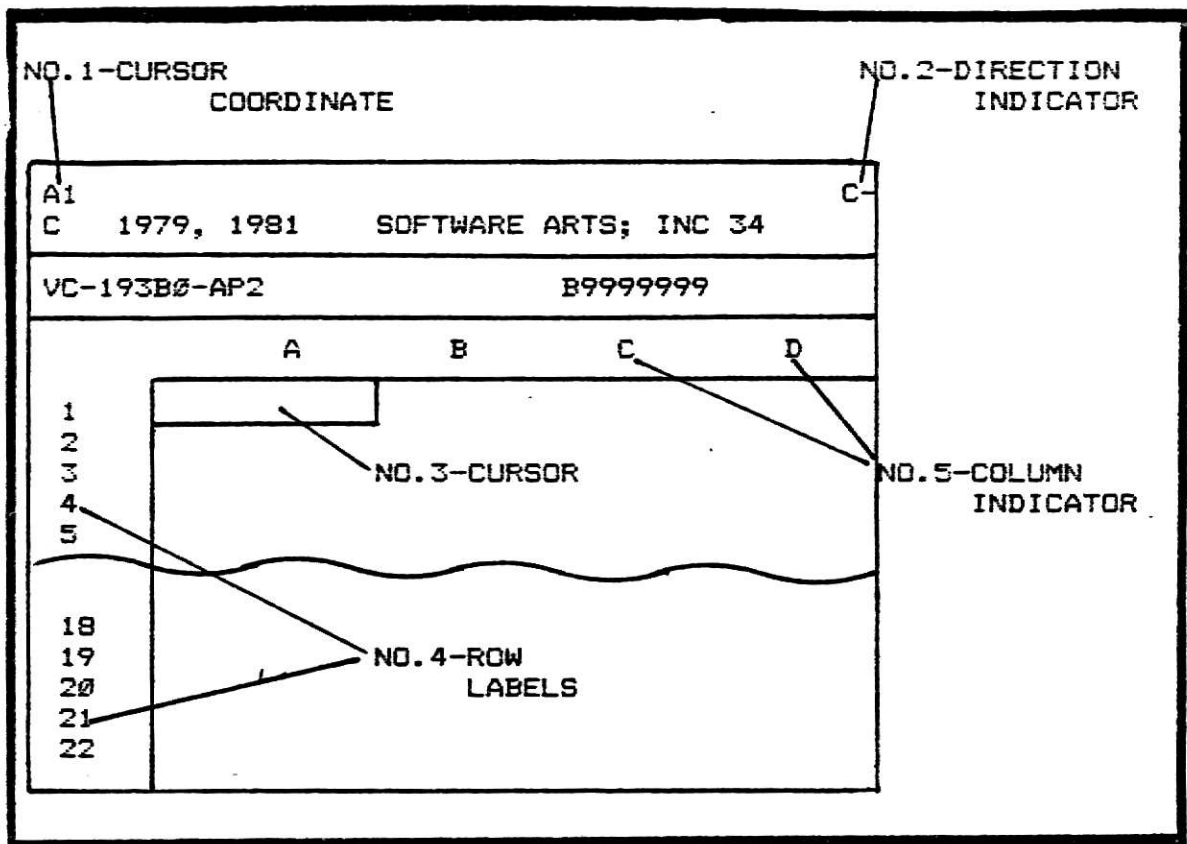
- * Apple II microcomputer with video monitor and graphics printer.
- * VISICALC disk.
- * Student data disk.

Now take out the VISICALC disk and put it in Drive 1. Put the student data disk in Drive 2.

Turn on the power to the Apple II and make sure the video monitor is also on. In about 15 seconds you will see the VISICALC worksheet. First, remove the VISICALC disk and put it away. The program is loaded in the Apple's memory. We don't want to leave the disk in because it will only shorten its useful life.

You have now successfully "booted" VISICALC. Continue to the first objective.

Figure 2-1



V. OBJECTIVE 1

Now, you will learn how to move the cursor around the worksheet. Figure 2-1 above shows the way the screen looks after you have successfully loaded VISICALC. The worksheet has been labelled to show you some of the important locations.

Location 1 shows the current location of the cursor. Now look at location 3. It is under column "A" and beside row "1". This white or inverse block is the cursor. As you may have guessed, location 4 and location 5 indicate the row and column labels respectively.

We almost forgot location 2 way up in the right hand corner. This is the cursor direction indicator. When it looks

like it does now "C-", the cursor will move right with the "->" and left with the "<-" arrow keep. Let's try it.

PRESS <— three times.

You got a beep and the cursor flashed. This means that you cannot move any further in that direction. You have reached the edge of the "viewport".

PRESS —> three times

You moved the cursor to position "D1". Now look up at the cursor location on the top left of the screen. Now, press the SPACE BAR. Note the cursor direction indicator looks like this "C!" This will allow the cursor to move up and down. Let's try it.

Press <— three times

Your cursor moved up.

Press —> three times

Your cursor moved down. You should be at position D4.

Press SPACE BAR (to get cursor indicator back to C-)

Press <— and hold down REPEAT key.

you should be bumping against the left edge and you should hear a beep. The program treats this edge as the limit of your "window". A "window" is that area in the world coordinate system that this program has defined as the specific boundaries of your workspace.

Now for your first test. Move the cursor from its present position as far right as you can go. You should be bumping into the right edge of the "window" at BK4. Did you notice new coordinates entering the screen from the right as you scrolled?

What technique is used to bring these new positions in view and erase the positions exiting to the left? "Clipping" is the technique. "Clipping" allows the coordinates lying outside to be scissored off at some place. This program uses the width of one cursor location (9 spaces) as the unit of measurement. One cursor location in its entirety is clipped when the program moves it off the screen. But clipping allows the objects clipped off the screen to remain in memory for fast positioning back on the screen when its coordinate position is called.

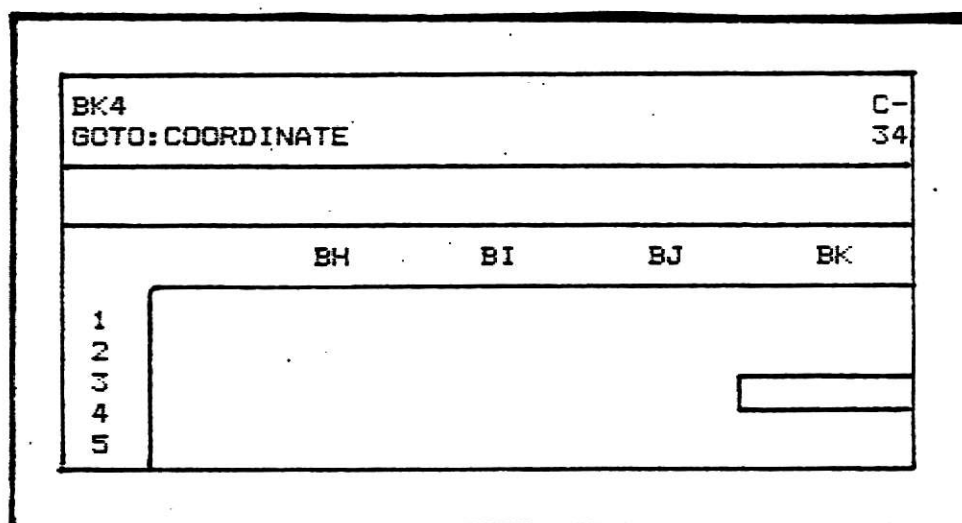
If our work area is our "window", what are the outer edges where the labels scroll back and forth. There is another term called "viewport" to assist us here. A "viewport" is a rectangular portion of the screen onto which a "window" and the window's contents are mapped. Multiple viewports can be on one sheet. That is our case here. A 1 x 20 viewport exists on the left-hand side for the numbered coordinates and a 1 x 36 viewport exists for the column labels at the top. Our work sheet area (or our viewport) is 20 x 36 spaces.

Meanwhile, back at BK4, we can get back to the beginning a lot faster.

PRESS >

Look at the top portion of the screen. Your screen should look like Figure 2-2.

FIGURE 2-2



Here we see how the top three lines function for us. The second line below our cursor location (Bk4) is called the "prompt line". The > command you issued caused the program to prompt: "GO TO COORDINATE". In other words where do you want to go?

The dark line where the flashing cursor is located is called the "Edit line". This is where our typed in information is displayed.

Now we want to return to where we first started.

ENTER B4

Wait a minute! We first started at A1 so we made a mistake. Let's correct it.

Press ESC three times.

Notice it erased our error but also erased our command. You can use "ESC" to get out of a wrong command, if you go all

the way to the left with it, or you can just erase an incorrect letter by "ESC" to that letter or number. Now, let's try again.

PRESS >

ENTER A1

PRESS Carriage Return (Here after known as "CR")

Now we are back at A1. Let's see what you learned. To see how large our sheet is we'll go to the extreme right-hand corner. We know "BK" is as far right as the sheet goes. The sheet is 254 rows long. So I want you to go to BK254. Did you get there? If you didn't go back and reread the paragraph.

Now that you are at "BK254", try out the <- and -> arrows to verify that we can't move any further down or right.

Now move back to A1 any way you can. If you are back at A1 you have learned how to move around the worksheet. If you are not at A1 go back through the first objective a little slower.

VI. OBJECTIVE 2.

In this objective you will learn how to enter labels for rows and columns in order that the numbers we enter in the next objective will make some sense.

Before we get started let us describe a small real-life financial problem to use in the rest of the lesson.

You have \$4000 and wish to determine how much spending money you will have each month during next semester. You have decided that if you don't have \$50 per month left, you will get a job with the Computer Science Department. Here are the numbers.

Tuition	\$1000
Books	75
Supplies	25
Car	50 each month
Rent	150 each month
Food	125 each month
Clothes	25 each month

Now how would we like our financial statement to look.
Here's my choice in Figure 2-3.

FIGURE 2-3

SEM. INC.	4000						
TUIT/BOOK	1100						FINAL BAL
SEM. BAL.							
MO. EXP.	JAN	FEB	MAR	APR	MAY		TOTAL
CAR	50	50	50	50	50		
RENT	150	150	150	150	150		
FOOD	125	125	125	125	125		
CLOTHES	25	25	25	25	25		
MO. TOTAL	350	350	350	350	350		
SPEND-\$							

Let's begin. With your cursor at A1,

ENTER: SEMESTER INCOME

Notice the prompt line says "LABEL". This will distinguish between numeric entries which will say "VALUE". Notice how the cursor position only fits the word "SEMESTER" in that position. Before we change it let's see what happens when we enter it.

PRESS: CR

FIGURE 2-4

A1 (L) SEMESTER INCOME				C-34
	A	B	C	D
1	SEMESTER			
2				
3				
4				
5				

The top line contains the cursor line but it also shows the entire entry. The "(L)" stands for "LABEL". Let's change it so when we print it out we will get a better idea what the label means.

ENTER: /

Now on the prompt line you should see.

COMMAND: BCDEFGIMPRSTVW-

These are the various commands available for VISICALC. We will not cover all of the commands because that would take too much time. But we'll cover the number of commands you need to work the exercise. At the end of this module is a synopsis of all the commands you need to complete the lesson. If you wish to become more proficient with VISICALC, get the User's Manual and practice.

Let's use a command to erase the entry at A1 so we can start over.

ENTER: B

The prompt line says: BLANK

PRESS: CR

"A1" went blank at all worksheet positions. The entry also was erased on the cursor position line. Now abbreviate SEMESTER INCOME.

ENTER: SEM.INC.

PRESS: CR

The next entry is even longer so let's put the following in:

PRESS: SPACE BAR (must move the cursor to up and down)

PRESS: -> (moves cursor to A2)

ENTER: TUIT/BOOKS

PRESS: CR

Now it is your turn. Enter the rest of the vertical labels and leave a blank for the horizontal lines shown on our format. When you complete those entries, go to position B-5 and enter the horizontal labels. Refer back to Figure 2-3 for the correct labels.

REMEMBER: If you make a mistake "ESC" to back-up the cursor and erase. If you want to redo the entire entry: Press: "/" then "B" and then "CR".

FIGURE 2-5

A1 (L) SEM. INC.							
		A	B	C	D	E	F
1	SEM. INC.						
2	TUIT/BOOK						
3	SEM. BAL						
4							
5	MO. EXP	JAN		FEB	MAR	APR	MAY
6	CAR						
7	RENT						
8	FOOD						
9	CLOTHES						
10							
11	MO. TOTAL						
12							
13	SPEND-\$						
14	MO. TOTAL						
15							
16	SPEND-\$						

If you were successful your worksheet should look like the one in Figure 2-5. If your worksheet does not look the same, go back to Objective 2 and start over. If your sheet is totally a mess and you want to start completely fresh do the following.

PRESS: /

PRESS: C

The prompt line says: CLEAR TYPE "Y" TO CONFIRM

If you want to completely erase your sheet, type "Y". If you don't, press "CR" and go back to the second objective.

VII. OBJECTIVE 3

You will now learn how to enter values on the worksheet.

Locate the values for entering a few pages back, and we'll enter them. First, move the cursor to B1.

ENTER: 4000

PRESS: Space Bar for Cursor Direction of "!"

PRESS: -> (Note: we don't have to use CR as ->
enters data and cursor simultaneously.)

ENTER: 1100

PRESS: ->

Now your cursor should be at position B3. We want the balance for use in the semester so that would be semester income minus the money spent for tuition/books and supplies.

Therefore:

ENTER: +B1-B2 (Notice the "+" preceding B1 allows the entry to be a value. If we entered just the "B", the position would be a label and would not show values.)

PRESS: CR

You should now be at position B4. Here you should have left a blank row for the entry of a horizontal line. If you did, great. Skip the next three commands. If you didn't, don't worry we'll make a space.

PRESS: /

PRESS: I

The prompt says: INSERT: R C

PRESS: R (for a row)

Now that we have a blank row let us enter a horizontal line. Move cursor to position A4.

PRESS: / (Note last command "--")

PRESS: -

Prompt line says: LABEL: REPEATING

PRESS: -

PRESS: CR

Now, we have a horizontal line, but we want it to go completely across the worksheet.

We can use a very powerful command called "REPLICATE".

Here we go.

PRESS: /

PRESS: R

Prompt line says: REPLICATE: SOURCE RANGE OR RETURN

The source range is only this cursor position so:

PRESS: CR

Prompt line says: REPLICATE: TARGET RANGE

We want the horizontal line to be replicated from the next cursor position to the last on our worksheet. Therefore,

ENTER: B4

ENTER: .

EDIT line says: A4...A4: B4...

We must now enter the far right coordinate, but I forgot it.

PRESS: SPACE BAR (To get cursor direction "--")

PRESS: -> to go to G4.

This point is where we want to end the horizontal line.

You could go back to B4 and type it in, or you can do something easier. Look at the EDIT line. "G4" is already on the sheet so rather than going back just:

PRESS: CR

Notice the line was replicated all the way to G4, and since we began at position A4, the cursor automatically jumps back to that location.

Don't forget this command as we'll use it several more times.

Now move the cursor to B6, and we'll enter the rest of the values.

ENTER: 50

Of course we could enter the 50 for each of the five months or ---? You guessed it we could use the "REPLICATE" command.

I'll help you once more then it is your turn.

PRESS: /

PRESS: R

Prompt line says: REPLICATE: SOURCE RANGE OR RETURN

Edit line says: B6

Again we want to replicate this position and the value at only this position. Therefore,

PRESS: CR

Prompt line says: REPLICATE: TARGET RANGE

Edit line says: B6...B6:

Now we want our replication to happen (target) in the next position through to the last position under the month of May.

Let's use the cursor only this time.

PRESS: SPACE BAR (To get cursor direction
indicator to "-")

PRESS: -> (Cursor at C6)

ENTER: . (cursor jumps back to B6)

Edit line says: B6...B6: C6...

Now for the last point:

PRESS: -> to F6

PRESS: CR (Cursor returns to B6)

Now you should have "50" entered in all five columns under each month. Next, as you probably guessed, you enter the values for "RENT", "FOOD", and "CLOTHES". Don't forget to replicate the other blank values at 10 and 12.

Don't enter in all positions manually - use the REPLICATE command. Refer to Figure 2-3 for the values.

When you are finished your worksheet should look like the one in Figure 2-6.

FIGURE 2-6

A1 (L) SEM. INC.							
	A	B	C	D	E	F	G
1	SEM. INC	4000					
2	TUIT/BOOK	1100					
3	SEM. BAL	2900					
4							
5	MO. EXP	JAN	FEB	MAR	APR	MAY	TOTAL
6	CAR	50	50	50	50	50	
7	RENT	150	150	150	150	150	
8	FOOD	125	125	125	125	125	
9	CLOTHES	25	25	25	25	25	
10							
11	MO. TOTAL						
12							
13	SPEND-\$						
14							
15							

If your sheet doesn't look like this one go back to the beginning of Objective 3 and step thru the commands slowly. If you are complete and your chart looks like the one in Figure 2-6 then let's go on.

VIII. OBJECTIVE 4

Here you will learn how to enter formulas and use functions for entering values.

Move the cursor to B11.

Here we have a row called MO.TOTAL, and we want the total of the expenses for each month. To do this we can use the SUM function.

ENTER: @SUM

PRESS: -> (To B9)

ENTER: .

PRESS: -> (To B6)

PRESS: CR

Magically the sum of the column from Position B6 to B9 appears as 350.

Now also note the cursor position location reads "B11 (v) @SUM (B9..B6"

Next we must get the total for each of the other columns. Guess what, we can use the REPLICATE command. It's a little more complicated this time because we have more elements to replicate, but I'll go faster.

PRESS: / R CR

PRESS: -> (To C11)

PRESS: .

PRESS: -> (To F11) and CR

Now we see something different on the prompt line. Look at Figure 2-7.

FIGURE 2-7

B1: (V) @SUM(B9...B6							
REPLICATE:N=NO CHANGE,R=RELATIVE							
B11:C11...F11:@SUM(B9							
	A	B	C	D	E	F	G
1	SEM. INC	4000					
2	TUIT/BOOK	1100					
3	SEM. BAL	2900					
4							
5	MO. EXP	JAN	FEB	MAR	APR	MAY	TOTAL
6	CAR	50	50	50	50	50	
7	RENT	150	150	150	150	150	
8	FOOD	125	125	125	125	125	
9	CLOTHES	25	25	25	25	25	
10							
11	MO. TOTAL						
12							
13	SPEND-\$						
14							
15							

The program wants to know if the position B6 is relative or will it remain the same throughout the replication. Obviously, we want the coordinate to change to B7, B8...etc. So:

PRESS: R

Prompt line says: same question except cursor is now at B6.

PRESS: R

Move the cursor to Position G6. It's now your turn. Enter in a formula for the total of this row and replicate the formula down to position G13. I realize there are no numbers

in row 13 yet, but it does not matter. As soon as numbers are entered in row 13, the function will total the values. When you are complete, your sheet should look like Figure 2-8 on the below.

FIGURE 2-8

A1 (L) SEM.INC.						
	A	B	C	D	E	F
1	SEM. INC	4000				
2	TUIT/BOOK	1100				
3	SEM. BAL	2900				
4						
5	MO. EXP	JAN	FEB	MAR	APR	MAY
6	CAR	50	50	50	50	50
7	RENT	150	150	150	150	150
8	FOOD	125	125	125	125	125
9	CLOTHES	25	25	25	25	25
10						
11	MO. TOTAL	350	350	350	350	350
12						
13	SPEND-\$					0
14						
15						

Again if you were successful your worksheet should look like that one in Figure 2-8. You should have noted that the horizontal lines had to be replaced when your formula caused values to be entered in their place.

We are almost finished. Move the cursor to Position B-13. It is now time to calculate our spending money. Being very

prudent and wise you read somewhere that you should allow only 10% of your disposable income to be used for entertainment. Therefore, we'll take 10% of our semester balance each month for spending.

ENTER: +B3/10 (Remember the "+" allows the letters to be entered in order to calculate values)

PRESS: CR

We see that our spending money for January can be \$290. Now, go over to G13. Remember in the last step we replicated a formula there but nothing is present. Now we have a value in the row so we have a total. Return to B13.

Even though we have no values for the other balances in row 3 we know that we can replicate for the remainder of row 13 and as values are calculated for Row 3 (Balance), we will get values on our current row. I'll do it for you quickly.

PRESS: / R CR -> . -> (to F13) CR

We want the values to be relative at each coordinate so:

PRESS: R

Again without values in all positions of the C row will result in 0's on our current row until we complete the C row.

Now go to position C3. We want to calculate the balance for each month. The balance for the first month was the remainder after tuition, books and supplies. For the rest of the semester the balance will be our previously monthly balance minus the total expenses and entertainment. Translating those words to our sheet for February, the formula is: B3-(B11+B13).

Now enter the formula at C3.

ENTER: +B3-(B11+B13) CR

You guessed it! Now replicate the formula for the rest of the months. Try it yourself. The sequence is:

PRESS: / R CR -> (To D3) . -> (to G3) CR

All values will be relative.

PRESS: R R R

Finally our sheet is complete. Before we print it or save it, let's tidy it up a bit.

Notice the way the months are right justified? It is hard to tell what numbers go where. Therefore,

PRESS: / F

Prompt line says: D G I L R \$ *

PRESS: R

Now it is right justified. Do the rest in this row. Do not attempt to use REPLICATE or you will have JAN all the way across.

Now let's be extremely accurate and place our values in a dollar format. Here we want it for the entire sheet. Move the cursor to B1 and:

PRESS: / G

Prompt line says: GLOBAL: C O R F

Here we want a global format so

PRESS: F

PRESS: \$

And, we have dollar values exposed in all locations.

Our final worksheet should look like the one in Figure

FIGURE 2-9

A1 (L) SEM.INC.							
	A	B	C	D	E	F	G
1	SEM.INC	4000.00					
2	TUIT/BOOK	1100.00					
3	SEM.BAL	2900.00	2260.00	1684.00	1165.60	699.04	279.14
4							
5	MO.EXP	JAN	FEB	MAR	APR	MAY	TOTAL
6	CAR	50.00	50.00	50.00	50.00	50.00	250.00
7	RENT	150.00	150.00	150.00	150.00	150.00	750.00
8	FOOD	125.00	125.00	125.00	125.00	125.00	625.00
9	CLOTHES	25.00	25.00	25.00	25.00	25.00	125.00
10							
11	MO.TOTAL	350.00	350.00	350.00	350.00	350.00	1750.00
12							
13	SPEND-\$	290.00	226.00	168.40	116.56	69.96	870.96
14							

If you had difficulty with this module or the last section, go back and try again. Remember you can blank out a line with "B". You can type over a cursor position and you can clear the entire worksheet.

It is now time to store and print the worksheet.

IX. OBJECTIVE 5

In this module you will learn how to print and store your worksheet. You will store your worksheet for later recall and you will store certain rows for transferring to VISIPLLOT.

PRINTING

We will print first. Move the cursor to position A1.

Stand up and look at the printer (EPSON). There is a large black wheel on the right-hand side of the printer. This wheel is used to roll paper up and back. DO NOT ROLL THE PAPER WHEN THE POWER LIGHT IS ON.

Now reach just forward of the black wheel and flip on the power switch. The "POWER" light, the "READY" light and the "ON LINE" lights should all be on. If not, see if it is unplugged. If it is and the power does not come on or the correct lights do not light up, get help. If you can't find help, move past this section to the storage section.

Now go back to the Apple with the cursor at A1.

PRESS: /

PRESS: P

Prompt line says: FILE, PRINTER, #(OF SLOT)

ENTER: 1

PRESS: CR

Prompt line says: PRINT LOWER RIGHT, "SETUP,-,&

Now move the cursor to the lower-right hand coordinate which you want printed. It should be G13. With the cursor at

G13:

PRESS: CR

The printer should start printing out your worksheet. If not, seek help.

When the printer stops printing, move to the printer. Press the "ON-LINE" BUTTON. The light will go out. Now, press the "LF" button and advance the paper until you get a perforation out far enough to tear off the printout. Tear off your printout and turn off the printer. Your printout should look like Figure 2-10.

FIGURE 2-10

SEM. INC.	4000.00						
TUIT/BOOK	1100.00						FINAL BAL
SEM. BAL.	2900.00	2260.00	1684.00	1165.60	699.04	279.14	
MO. EXP.	JAN	FEB	MAR	APR	MAY	TOTAL	
CAR	50.00	50.00	50.00	50.00	50.00	250.00	
RENT	150.00	150.00	150.00	150.00	150.00	750.00	
FOOD	125.00	125.00	125.00	125.00	125.00	625.00	
CLOTHES	25.00	25.00	25.00	25.00	25.00	125.00	
MO. TOTAL	350.00	350.00	350.00	350.00	350.00	1750.00	
SPEND-\$	290.00	226.00	168.40	116.56	69.90	870.86	

STORAGE

First, we shall save the sheet for later recall. Make sure you have the STUDENT DATA DISK in Drive 2.

PRESS: / S

Prompt line says: STORAGE: L S D I Q #

ENTER: S

Prompt line says: STORAGE: FILE FOR SAVING

ENTER: A file name of your initials followed by

.VC,D2

The disk will whir, the screen will flash, the cursor will return to last position, and the prompt line will be empty.

Now, let's see how to get the file back once saved.

PRESS: / C Y -Clear the worksheet.

Now clean the worksheet.

PRESS: / S

Prompt line says: STORAGE: L S D I Q H

PRESS: L

Prompt line says: STORAGE: FILE TO LOAD

ENTER: ,D2

Edit line shows: first file on the disk

PRESS: -> to page through files until your file appears on the EDIT line.

PRESS: CR

The disk will clatter and your file will appear complete and back on the screen.

Finally, we will store some of our data for use with VISIPLLOT. We must use a common file structure called a Data Interchange Format or DIF file to use with VISIPLLOT. This format arranges our data so it can be graphed.

We will not store all of our data since much of the data has the same value throughout the chart.

Let's just take our spending money and our monthly balance for plotting. Move the cursor to A3.

PRESS: / S #

Prompt line says: DATA: SAVE LOAD

PRESS: S

Prompt line says: DATA SAVE: FILE FOR SAVING

ENTER: BAL. (your initials)

PRESS: CR

Prompt line says: DATA SAVE: LOWER RIGHT

PRESS: -> (To move cursor to G3)

PRESS: CR

Prompt line says: DATA SAVE: R, C OR RETURN

Of course we want just the row saved.

PRESS: R

The disk will whir and then the prompt line will clear and the cursor will move back to A3.

Let us now save the spending money data. Move the cursor to A13. I'll give you the sequence fast this time.

PRESS: / S # S

ENTER: SPEND. (your initials)

PRESS: -> to F 13 (Don't enter the total as your graph will be distorted.)

PRESS: CR

PRESS: R

You now have two files for plotting VISIPLLOT DATA.

The next paragraph is optional. If you are out of time go on to the conclusion. A good use for the VISICALC sheet is for

"what if". In our example, "what if" we received \$5000 for the semester? What would our spending be and how much would we have left at the end of the summer? Go to position B1 and type in \$5000 and watch the values change when you press the CR. You can go to any position where the data is interrelated through formulas and modify the value or even the formula and then look at the change to the data.

Turn off the Apple and leave the Student Data Disk in place for the VISIPILOT program.

X. CONCLUSION

You have now completed the VISICALC Module. You learned how to take some raw data, create a worksheet format and enter the data. Then you printed the worksheet and saved the data to a disk. At Appendix A to this manual is a synopsis of the commands used. For your test lesson you can refer to this synopsis plus follow the sequences in the manual for the more difficult sequences.

We also saw several examples of graphics techniques throughout the VISICALC program. You should be familiar with how VISICALC implements these techniques. Specifically, we saw examples of the window and viewport concepts plus clipping. We also saw numerous examples of how to use the keyboard and the cursor to implement the logical input devices of a locator and a button.

Most obvious to us during the lesson were the examples of the rules for good interaction. You should remember these

examples for contrast with VISIPLLOT.

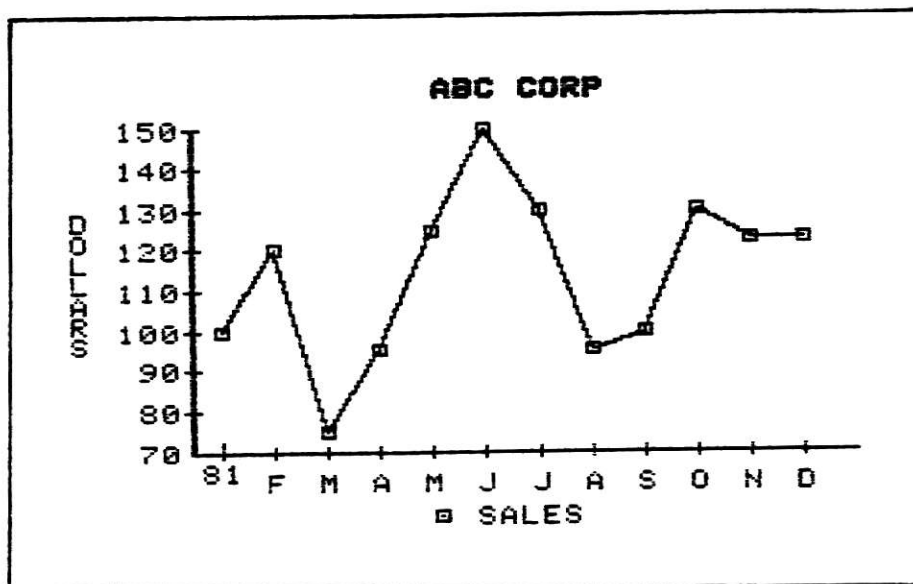
MODULE 3

VISIPLLOT

I. INTRODUCTION

VISIPLLOT is a graphing program designed as a companion software program to VISICALC. We can transfer our VISICALC data to VISIPLLOT and plot line, area, bar, scatter, high-low and pie graphs. Once we have created a graph we can change the colors, change the scale and range, add labels and titles and even overlay graphs of the same range. When we have our graph like we want it, then the graph can be saved for later use. The graph can also be printed out on a printer. Figure 3-1 shows a sample VISIPLLOT graph.

FIGURE 3-1



The companion software package located on the same disk

with VISIPILOT IS VISITREND. VISITREND is a program for doing analyses and forecasting. The methods it uses include derivation of moving averages, smoothing data, percent of change, leading, lagging and cumulative total functions. It will also do linear and multiple regressions. If you are familiar with these techniques and wish to use VISITREND, go to the VISIPILOT+ VISITREND Reference Manual.

II. Goal: The student should be able to load a DIF file and plot a fully labeled line, bar, area and pie graph. Additionally, he should be able to identify and discuss the computer graphics techniques used in VisiPlot.

III. OBJECTIVES

A. Objective 1: The student should be able to load (boot-up) the VisiPlot program in accordance with the lesson manual.

B. Objective 2: The student should be able to use the VisiPlot menu in order to load DIF files and then to move to the PLOT program in accordance with the lesson manual.

C. Objective 3: The student should be able to use the menu in the Plot mode to: display the data series; select a series for plotting; plot the series in either a line, bar or area graph; and label the graph. These operations should be done in accordance with the lesson manual.

D. Objective 4: The student should be able to store the created graph on a disk for later recall or for printing, in

accordance with the lesson manual.

E. Objective 5: The student should be able to print a line graph on a graphics printer in accordance with the lesson manual.

F. Objective 6: The student should be able to discuss the computer graphics techniques as displayed by the VisiPlot software. These techniques are: Segmentation; menu-driven picks, window, viewport, dragging, and fill operations. These techniques should be discussed according to the definitions found in the course textbook Fundamentals of Interactive Computer Graphics .

IV. GETTING STARTED

By now you are an expert at getting started, but we need to think of the disks we need. You will need the following:

- * Apple II microcomputer with video monitor and graphics printer.
- * VISITREND + VISIPLLOT disk
- * Student data disk
- * Student graphics disk

V. OBJECTIVE 1

You should be able to load (boot-up) the VISIPLLOT program in accordance with the lesson manual.

Insert the VISITREND + VISIPLLOT disk into Drive 1. Put the Student Data Disk into Drive 2.

Turn on the power to the Apple II and make sure the video

monitor is also on. In about 30 seconds you will see the VISITREND + VISIPILOT menu beginning to appear. This step takes a minute to complete so just wait until the red light on Drive 1 goes out. When it is out, your screen should look like Figure 3-2.

FIGURE 3-2

LOAD SERIES				
LOAD	->PLOT	LOOKUP	CLEAR	<MORE>
EDIT	->TREND	SAVE	QUIT	DRIVE
VISITREND/VISIPILOT 1.00				
C 1981 MICRO FINANCE SYSTEMS				
* USE ARROW KEYS, SPACE TO MOVE CURSOR				
* PRESS RETURN TO SELECT A MENU ITEM				

VI. OBJECTIVE 2

In this objective you will learn to use the VISIPILOT menu for loading the VISICALC files and then to move to the PLOT program.

One of the principles of interactive computer graphics is:

PROVIDE SIMPLE, CONSISTENT INTERACTION SEQUENCES

Now contrast the VISIPILOT MENU WITH THE Visicalc menu.

Remember the long alphabetical command line? Let's look at how much simpler and easier it is to follow VISIPILOT.

PRESS: -> (and move through each menu position
and notice the description of each
position on the top line)

PRESS: SPACE BAR (to make the cursor jump down or up)

We will only use the LOAD and PLOT functions on this menu.

Place cursor on LOAD

PRESS: CR

The menu will say READING DIRECTORY and then the catalog of the Student Data Disk will appear. In VISICALC you saved SPEND. (your initials) and BAL. (your initials). There may be other files here so look for yours.

If you don't see your file, but at the bottom of the list see the entry "MORE", use the "->" and/or "<-" to go to MORE. Then press space bar. When you reach your file (when the white cursor indicator is over it):

PRESS: SPACE BAR or CR

The disk drive will whirl and then you will hear a beep. The menu will then look like Figure 3-3.

FIGURE 3-3

LOAD SERIES	
PERIODICITY	CURRENT:1
SLOT 6 DRIVE 2	

PERIODICITY refers to the range (usually in limits of time) as measured on the X-axis. We used 5 months as our time period, plus a final balance, when we entered our data in VISICALC. Therefore:

ENTER: 6

Just as in VISICALC, if you entered the wrong number use the ESC key to erase your mistake.

PRESS: CR

Then the program will ask - MAJOR START (YEAR)?

ENTER: 1983

Then you are asked: MINOR START(YEAR)? We are only dealing with a portion of one year so we do not have a smaller period. Therefore:

PRESS: CR

The program will complete storing the file and then stop. Your screen will look like Figure 3-4.

FIGURE 3-4

LOAD SERIES				
CONTINUE PRINT				
NAME	PER	START	END	#
SEM.BAL	6	1983 1	1983 6	6
SERIES 1/16		DATA POINTS 6/645		

At the top of the screen we are told that we are still in the LOAD module and our next option is to CONTINUE or PRINT. An explanation of the bottom portion of the screen will come when we are through loading. Let us continue:

PRESS: CR to continue

You should be back at the main menu. Next we need to load our SPEND file. Go ahead and load it just as we did the

balance file. The only difference is that our PERIODICITY is six even though our data only covers 5 months. We must match the balance period (6) in order to plot combined graphs. You will see this later.

After you have completed loading SPEND you should be back at the main menu with the cursor placed on LOAD. We are going to load another file in order to plot pie graphs.

PRESS: CR

When the catalog appears, look for the file: PREFPIE.DIF. Place the cursor on this file and press CR. Note the file completely loads without any stops for additional entries. This file was previously loaded and then saved. Once saved the periodicity and dates are also saved. Your screen should now look like Figure 3-5.

FIGURE 3-5

LOAD SERIES				
CONTINUE PRINT				
NAME	PER	START	END	#
SEM.BAL	6	1983 1	1983 6	6
SPEND-\$	5	1983 1	1983 5	5
BROWN	1	Ø	1	2
GREEN	1	Ø	1	2
UNDECIDEDØ		Ø	1	2
2MAN RACE1		Ø	2	3
3MAN RACE3		Ø	2	4
SERIES 8/16		DATA POINTS 26/645		

The term "series" refers to a set of data points necessary

to plot one graph. The files we created in VISICALC and loaded in this program were each one series. But this last file contained six series of data. This is about the same number we could have expected if we had loaded our entire VISICALC worksheet. Notice how the series are made up of one period. This is a requirement for a pie chart as it does not compare over time but instead compares one single series value against other series.

If your screen does not look like Figure 3-5 and you need to reload a series do the following:

PRESS: CR

Now back at the main menu;

PRESS: -> to go to CLEAR

PRESS: CR

Now move the cursor to the series you want to clear and:

PRESS: CR

Now go back to the last section and reload the series again.

Return to the main menu.

PRESS: -> to go to PLOT

PRESS : CR

The program asks you to type "Y" to confirm that we want to go there.

PRESS: Y

The program will move to the plot program. This will take about 2 minutes. While it is loading notice the sequence of messages: "LOADING PLOT PROGRAM", PLEASE WAIT", etc. These

messages are another example of good interaction techniques.

The interaction principle implemented here is:

GIVE APPROPRIATE FEEDBACK TO THE USER.

The messages keep our anxiety low. If we were loading this program for the first time and had to wait this long without any feedback we would surely think we had made a mistake. But the messages keep us informed and happy.

While using the first menu we encountered some logical graphic input devices which were implemented by physical devices. The keyboard logical input device was physically implemented by itself, but the keyboard was used to simulate a pick and a button. When you looked for a menu function to use you moved the cursor to the chosen function, or you picked-it. Then you used the carriage return as a button to indicate your choice.

VII. OBJECTIVE 3

In this section you should be able to use the PLOT menu to display data series, select a series for plotting, and plot the series in either a line, bar, area or pie graph.

Your program should have now reached the plot mode. The new menu should look like the one in Figure 3-6.

FIGURE 3-6

PLEASE CHOOSE GRAPH TYPE				
CONNECT POINTS IN A LINE				
LINE	BAR	AREA	PIE	HI-LO
SCATTER	NONE			

This menu functions the same way the main menu functioned. Go ahead and go through each location and read the options. Again good interaction. The program provides simple yet consistent interaction sequences.

Let us first draw a line graph.

PRESS: CR

Now you should see your series directory on the screen. The cursor should be on BAL.XXX. We will plot a line graph of our balance first.

PRESS: CR (used a "button" again)

Now you get a new menu which should appear as Figure 3-7.

FIGURE 3-7

PLOT THE CURRENT SERIES				
PLOT	SELECT	WINDOW	PRINT	PIXSAVE
OPTIONS	->MAIN	OVERLAY	NEW	
BAL.XXX/LINE				W1/B1

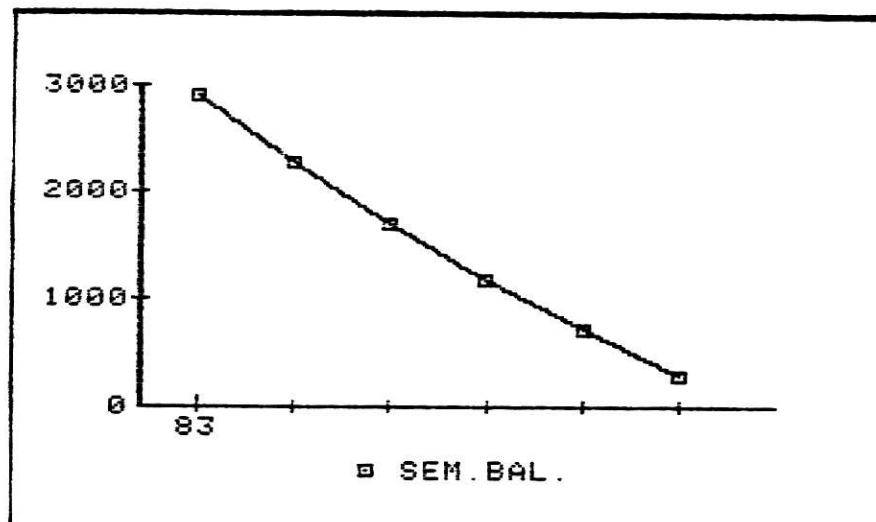
The bottom menu line lets you know which series is active in memory for plotting. We will use most of these commands

later so let's go ahead and plot. With the cursor on PLOT:

PRESS: CR

The program will beep and say "SCALING". Then your graph will appear in "segments" and will finally appear as seen in Figure 3-8.

FIGURE 3-8



Press the SPACE BAR and the menu will reappear. That graph was extremely easy so let's do another. Move the cursor to NEW:

PRESS: CR

Again you get the select menu. We will now draw a bar graph.

MOVE: CURSOR to BAR (You are using cursor as a "pick")

PRESS: CR

Then you are asked for NORMAL, Left or Right Bars. Let's keep with NORMAL.

PRESS: CR

The series catalog reappears. This time we will place two series on the same graph. The cursor should be on BAL.XXX.

PRESS: SPACE BAR (you should get a * by BAL.XXX)

PRESS: -> (to move to SPEND.XXX)

PRESS: CR

We used the asterisk to tell the program to load both series for plotting. Earlier we made the periodicity 6 for both our series. We did that so that we could plot these two plots together. Now return to the main plot menu. Let's explore some other functions and place them on our graph.

MOVE: CURSOR to OPTIONS

PRESS: CR

You should see another new menu that functions exactly like the others. This menu should look similar to Figure 3-9.

FIGURE 3-9

ADD TITLES TO GRAPH				
TITLE	RANGE	FORMAT	GRID	UNLABEL
RESCALE	BACKGR	COLOR		
SEM.BAL				W1/B1

For the first option, we will change the background color.

MOVE: CURSOR to OPTIONS

PRESS: CR

MOVE: CURSOR to BACKGR

PRESS: CR

MOVE: CURSOR to WHITE 1

This color will cause the bars to turn black against the white background.

PRESS: CR

The main menu now appears.

PRESS: CR with CURSOR on PLOT

Now let us add some titles to the graph. We will put the label "dollars" on the y-axis.

PRESS: SPACE BAR to get Plot Menu

MOVE: CURSOR to OPTIONS

PRESS: CR

MOVE: CURSOR to TITLES

PRESS: CR (with cursor on TITLE)

MOVE: CURSOR to LEFT

PRESS: CR

ENTER: DOLLARS

PRESS: CR

Now we will label the entire graph "SPRING 83"

MOVE: CURSOR to MOVEABLE

PRESS: CR

ENTER: SPRING 83

PRESS: CR

You should see Spring 83 flashing in the center of the graph. We are going to "drag" this text around the screen. Use the following key sequence to position the title:

I-UP

LEFT-J

K-RIGHT

M-DOWN

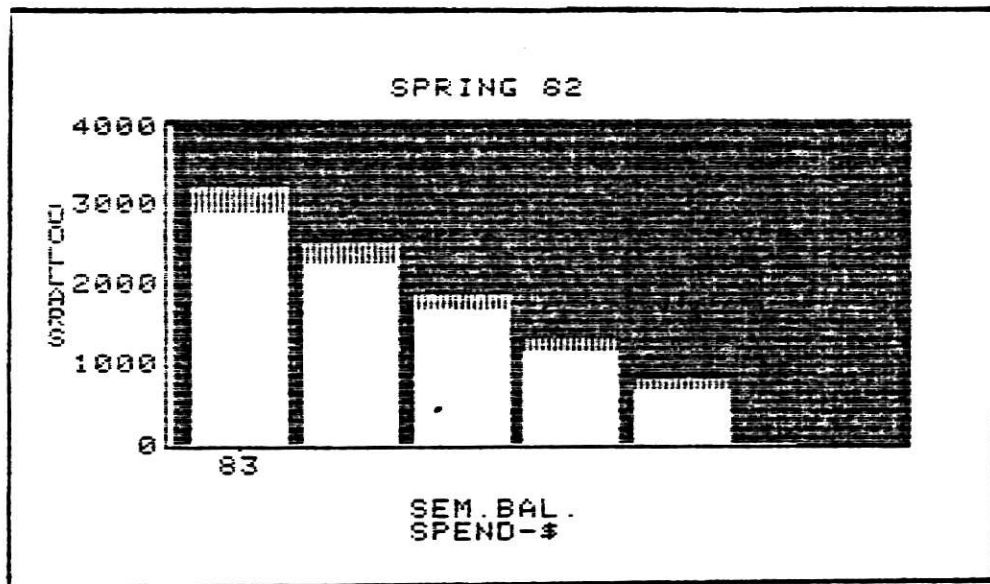
To speed up the movement press higher digits (5-9), to slow down press the lower digits (1-3). When you reach the edge of the window, you will get a beep. Press the space bar to freeze it in place when it is where you like it. Then press the carriage return.

PRESS: CR (to get menu back)

This last option used a computer graphics technique called "dragging". To implement the "dragging" concept we first moved the flashing cursor around as a logical "locator". You could also think of this action as having "picked" the title and then moved it. We implemented the locator through the keys on the key board. Next, we indicated our choice of location by pushing the carriage return which implemented a logical button. Finally we saw the effect on the program when we selected a background color which was the same color as the foreground. The program tested this color combination and changed the foreground colors to the "inverse" color for contrast.

This graph should look something like the one in Figure 3-10. It is too good to destroy so let us save the graph for later printing on the printer.

FIGURE 3-10



VIII. OBJECTIVE 4

You will be able to store your graph on a disk for later recall or printing after you complete this section.

NEXT LOCATE THE STUDENT GRAPHICS DISK AND PLACE IT IN DRIVE 2.

PRESS: CR (to get the main PLOT menu in view)

MOVE: CURSOR to PIXSAVE

PRESS: CR

The program now requests you enter a file name.

ENTER: BAR (your initials or your choice)

PRESS: CR

The disk will whir a while and then will return the main menu. The program will add the "PIX" suffix to the file so

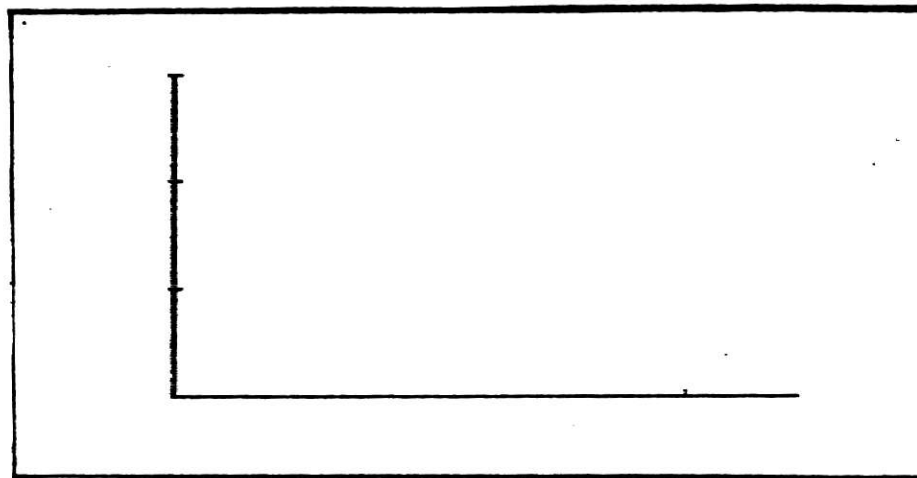
remember this file name for later when we print the graph. It will read BARXXX.PIX.

Next we will create two more graphs and look at the concept of segmentation.

First as a test of what you've learned, go ahead and create an area graph using any series you like. As the graph is plotting watch the order in which the portions of the graph are drawn.

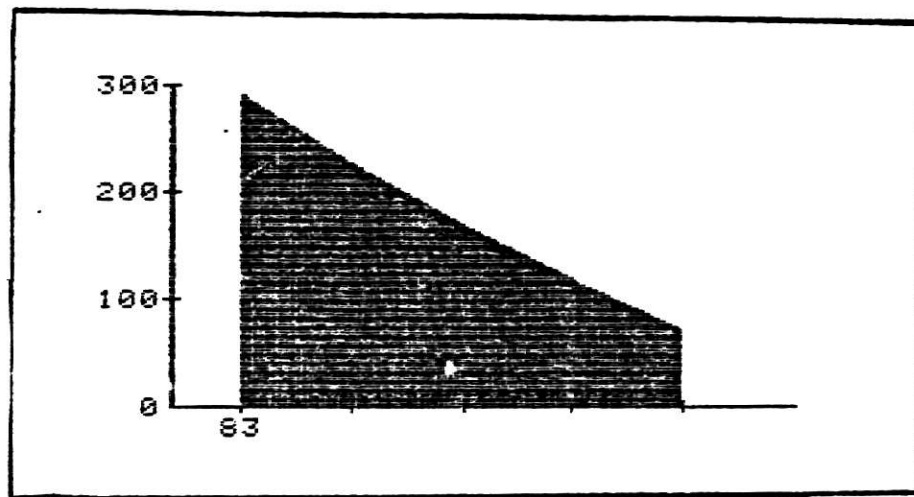
The graph being drawn in separate pieces illustrates the graphics technique of "segmentation". When the graph first comes on the screen you see the X and Y axes drawn.

FIGURE 3-11



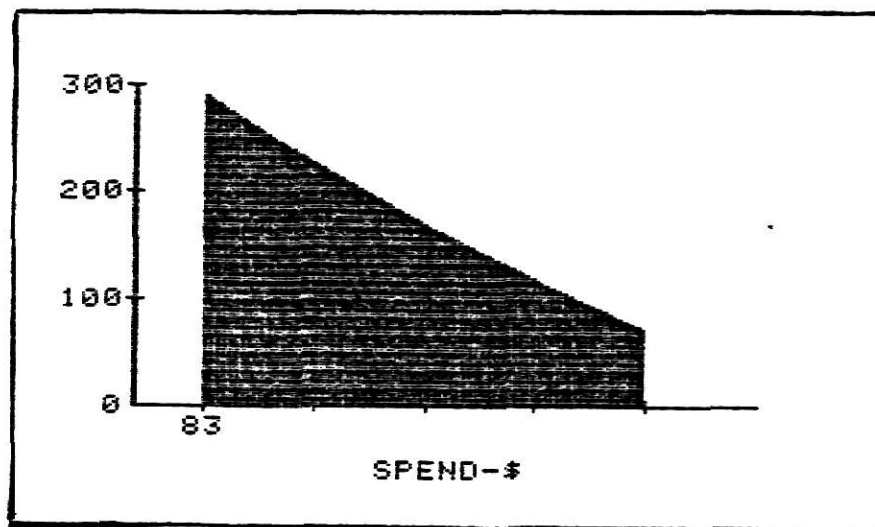
Next you see the axes labeled, and then the plot of the data is made.

FIGURE 3-12



Finally our title is drawn.

FIGURE 3-13



Each of the above operations act on one data structure at a time. When you have time you can enter the OPTIONS block and exercise several of the options. Each option acts on just one of the segments. For example, the UNLABEL will just delete the label segment.

Finally let's draw a pie graph. Get the SELECT menu by going to the SELECT on cursor position on the main plot menu (you can also go to NEW).

MOVE: CURSOR to PIE

PRESS: CR

You should see the series catalog again. By using the arrows and space bar, move the BROWN, GREEN and UNDECIDED series to the plot program.

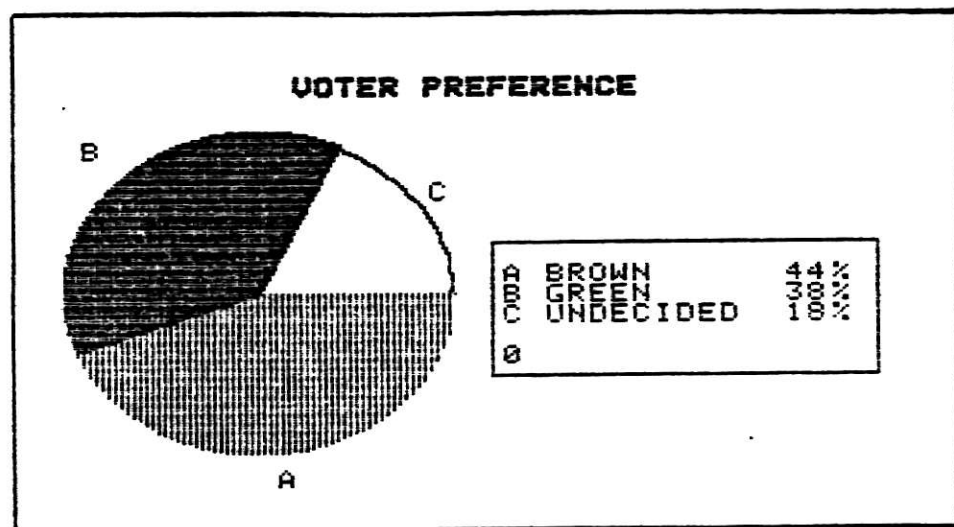
When you get asked "Major Start Year", enter "0".

When you get the main PLOT menu back, just press CR as we have done for the other graphs. Once the graph is drawn and you press the space bar, instead of the PLOT menu you will first get the TITLE menu. I am going to enter "Voter Preference" at the top of the graph.

After you have entered your titles EXIT, and you will be asked to shade the blocks or return. I am going to shade each block starting with: "A"- GREEN, then "B"- DEFAULT and "C"- NONE.

I used the above color scheme so they could be in contrast for printing on a black and white printer. The result is at Figure 14.

FIGURE 3-14



This completes our plotting section. If you want to

experiment with some of the other options, go ahead. Annex B gives a summary for most of the options, especially important are the sequences to follow for doing overlays and two different series split into horizontal or vertical windows.

Our next section will use the graphics disk to make a print-out of our bar graph.

IX. OBJECTIVE 6

This last step will teach you to use the graphics printer for getting a print-out of your bar graph.

Turn off the Apple II and remove the VISIPILOT disk. Move the Student Graphics Disk from Drive 2 and put it in Drive 1.

Turn on the computer in order to "boot" the Student Graphics Disk. While it is whirring, reach over to the printer and first make sure the paper perforation is just clearing the silver bar across the roller at the perforation. Then turn on the printer.

After the Apple logo leaves the screen you should now see a disk catalog. Locate your file name and jot it down for later entry. Next, locate the file STUDENT PLOT.

ENTER: RUN STUDENT PLOT

The program next asks you to enter your graph name.

I named mine:

ENTER: BAR XXX.PIX

PRESS: CR

The bar graph will be drawn on the screen and as it is completed, the program will begin printing it on the printer.

When you finish, your graph should look like Figure 3-10 (except it will be twice as large).

X. CONCLUSION

You have finished. In this module you learned how to load VISICALC data and then use the data to create line, bar, area and pie graphs. You also learned how to add labels and colors to them and how to change colors. Finally you learned how to save the graphs to a disk and then to print the graph on a graphics printer.

Equally important, you should have a better understanding of how certain physical graphic input devices can be used to implement the logical input devices. You should have learned the concept of segmentation and the concept of dragging as used by VISIPLLOT. Also, you should have gained an appreciation for good interactive graphics techniques.

XI. HOUSEKEEPING

If you are through with the files on the Student Data Disk and on the Student Graphics Disk, go back and boot the disk. After you get the disk catalog,

TYPE IN: DELETE (your file name)

If you are going to come back to the manual and work on your project later, get the catalog and

TYPE IN: LOCK (your file name).

When you come back to use the file later, type in UNLOCK (your file name). This locking operation will protect your

file while other students also use the disks.

MODULE 4

TEST

I. GENERAL

In order to see that you met the goals set out in the introduction to this lesson, you should be able to complete a practical exercise using the skills just learned.

FIGURE 4-1

PERIOD	1	2	3	4	5	6	7	8	9	10	11	12	TOTALS	AVG
SALES	100	120	75	95	125	150	130	95	100	130	123	123	1366	113.83
EXPENSE	75	100	60	75	75	75	55	55	80	110	110	113	983	81.92
PROFIT	25	20	15	20	50	75	75	40	20	20	13	10	383	31.92

NOTE: TO GET AVG, USE THE FUNCTION: @AVG

II. REQUIREMENT

The print-out below in Figure 4-1 gives you some data with labels which you should:

1. Enter data into VISICALC worksheet.
2. Create an exact print-out.
3. Create a DIF file of the data.
4. Load the DIF file into VISIPLLOT.
5. Create a line or bar graph that resembles the

two graphs in Figures 4-2 and 4-3.

FIGURE 4-2

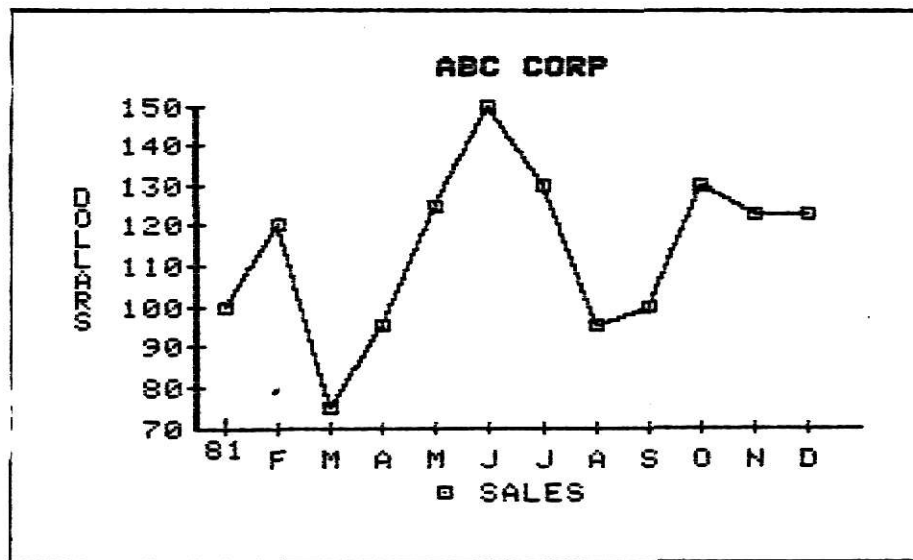
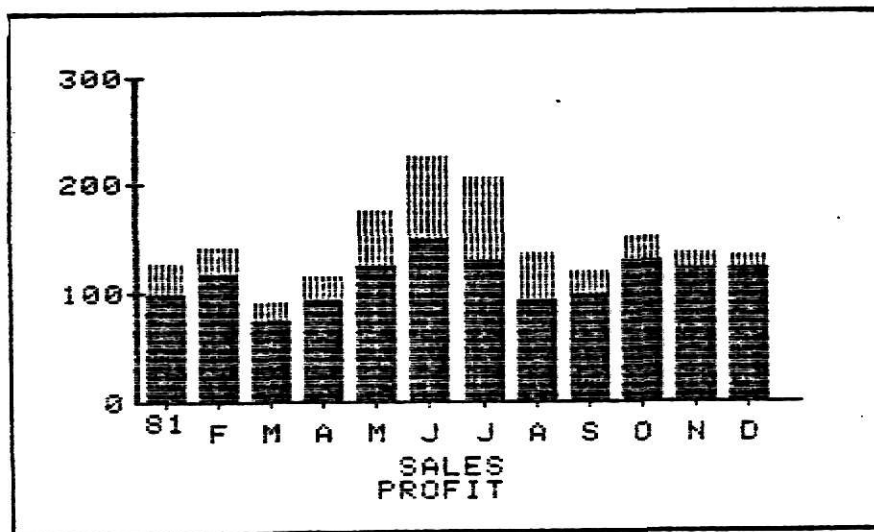


FIGURE 4-3



III. AIDS

Remember there are Annexes A and B which provide command summaries for VISICALC and VISIPLLOT.

ANNEX A

VISICALC GUIDE

8010:COORD ENTER COORD CR				LABEL ANY CHAR CR OR (-) TO ENTER		VALUE ANY DIGIT ESC OPERATORS ERASES CR OR (-) ENTRY TO ENTER
COMMANDS: B BLANK CR OR (-)	C CLEAR V: TO CON	D DELETE R OR C	F FORMAT G I L R \$	P PRINT # OF SLOT 1 LOWER RIGHT MOVE CURSOR FROM START TO LOWER RIGHT TO BE PRINTED-PRINTER ON?	R REPLICATE CR ESC CR ESC CR ESC CR ESC	COMMANDS: S L S # LOAD SAVE DIF ,D2 FOR ENTER CORRECT FNAME DRIVE OR ->TO READ ->TO CATALOG SCROLL CR FOR CATALOG CHOICE Y TO WRITE POSN FOR OVER SAVE TO CURRENT LAST POSN FILE FOR SAVE CR R C OR CR SAVE BY ROW OR COLUMN OR AS SPECIFIED-CR- SAVED AS DIF
COMMANDS: CLEAR ENTIRE SHEET	CLEAR ENTIRE SHEET	DELETES ROW OR COLUMN	GENERAL INTEGER LEFT RIGHT DOLLARS	CR ENTERS CURRENT COORD AS SOURCE RANGE LAST ENTRY	ENTER S FOR SAVE CR REPEATED ACROSS CURSOR WIDTH, USE REPLICATE TO COVER ENTIRE COLUMN	CR REPEATED ACROSS CURSOR WIDTH, USE REPLICATE TO COVER ENTIRE COLUMN
COMMANDS: CR OR (-)	CR OR (-)	CR OR (-)	CR OR (-)	CR ENTERS COORDS IF ASKS:CHANGE:NO OR RELATIVE:ENTER N OR R FOR EACH COORD	CR ENTERS COORDS IF ASKS:CHANGE:NO OR RELATIVE:ENTER N OR R FOR EACH COORD	CR ENTERS COORDS IF ASKS:CHANGE:NO OR RELATIVE:ENTER N OR R FOR EACH COORD

ANNEX B

VISI PLOT GUIDE

```

graph TD
    VM[STORAGE MANAGEMENT MENU] --> CLEAR
    VM --> LOAD
    VM --> PLOT
    PLOT --> PM[PLOT PROGRAM MENU]
    CLEAR --> CR1[CR]
    CR1 --> DC[DISK CATALOG]
    DC --> SF1[SELECT FILE OR SERIES TO DELETE]
    SF1 --> CR2[CR]
    CR2 --> CONT[CONTINUE]
    LOAD --> CR3[CR]
    CR3 --> DC2[DISK CATALOG]
    DC2 --> SF2[SELECT FILE]
    SF2 --> CR4[CR]
    CR4 --> P1[PERIOD?   
 (NO OF TIME PER)]
    P1 --> MY1[MAJOR YR?]
    P1 --> MY2[MINOR YR?]
    MY1 --> CONT
    MY2 --> CONT
    PM --> SM[SELECT MENU]
    SM --> BAR
    BAR --> BM[BAR MENU]
    BM --> NRL[NORMAL RIGHT LEFT]
    SM --> LA[LINE, AREA HILO, SCTR]
    LA --> MP[MAIN PLOT MENU]
    MP --> OVERLAY
    OVERLAY --> PLBS[PLOT LBST SCALED SERIES FIRST]
    PLBS --> SST[SELECT SAME TYPE GRAPH FOR 2ND SERIES]
    SST --> APN[AT PLOT MENU CHOOSE OVERLAY]
    MP --> WINDOW
    WINDOW --> WSM[SPLIT VERTICAL OR HORIZONTAL WINDOWS]
    MP --> FIXSAVE
    FIXSAVE --> FN[FILE NAME]
    FN --> SG[STUDENT GRAPHICS]
    SG --> DISK
    DISK --> PRINT
    MP --> OM[OPTIONS MENU]
    OM --> GRID[GRID MENU]
    OM --> UNL[UNLABEL MENU]
    OM --> FMT[FORMAT MENU]
    OM --> TIT[TITLE MENU]
    OM --> RAN[RANGE MENU]
    OM --> COL[COLOR MENU]
  
```

APPENDIX E

LESSON PLAN
FOR
**VISICALC & VISIPILOT
DEMONSTRATION**
BY
DONALD D. LOFTIS
1982

LESSON PLAN
for
VISICALC-VISIPLOT DEMONSTRATION

1. This lesson plan is designed to demonstrate computer graphics techniques as implemented by commercial software, and to provide an example of the computer graphics capabilities of microcomputers. The target audience is computer graphics graduate students. The demonstration may also serve as a prerequisite for students who are assigned homework using the same software and hardware demonstrated.

2. TERMINAL TEACHING OBJECTIVES: At the conclusion of the demonstration the students should:

- A. Be familiar with the Apple II microcomputer to include its operation and graphics capabilities.
- B. Be familiar with the utility and capability of the VisiCalc(VC) software package for handling tabular data.
- C. Be familiar with the graphics techniques used in the VC menu and by the VC cursor.
- D. Be familiar with loading and unloading the VC and the VisiTrend+VisiPlot(VT+VP) software.
- E. Be familiar with drawing plots and graphs with the VP software package.
- F. Be able to discuss the graphics techniques used in the VC and VT+VP software.

3. DEMONSTRATION OUTLINE: The demonstration will follow the sequence as follows:

- A. Purpose and content of the demonstration.
- B. AppleII microcomputer hardware.
- C. AppleII memory organization to include mapping of graphics commands.
- D. Apple II "boot-up" procedures and loading of VC.
- E. VC worksheet and entry of values, labels and functions.
- F. VC commands using a stored file showing windows, scrolling and format modification.
- G. VP loading and function of menu.
- H. Plotting of line, bar, and area graphs and the plot of pie charts.

***** OPTIONAL *****

I. Presentation of the student objective or goal for the homework using the tutorial manual and the VC and VT+VP software.

4. EQUIPMENT REQUIRED FOR DEMONSTRATION:

- A. AppleII(Plus) microcomputer to include:
 - 1) 2-disk drives
 - 2) 2-color monitors

(NOTE: THE TWO MONITORS MAY BE DRIVEN BY THE SINGLE APPLEII; A MALE TO 2-FEMALE STEREO ADAPTER WILL ALLOW THIS. IF NOT IN THE DEPARTMENT, RADIO SHACK-\$2.00)

- B. VisiCalc and VisiTrend+VisiPlot disks
- C. Slave-VisiCalc disk
- D. AppleII-System Master disk
- E. Printed copy of the VisiCalc worksheet. To print, wait until you have completed the VisiCalc portion of the lesson during your REHEARSAL. Then do the following:
 - 1) After you have SALES.VC loaded; press "/" and then "P"; the program will ask you for a slot number, enter "1", and press "return"; then you must select the bottom right corner of the printout you require; in this case enter "D0"; press "return"; (of course the printer should be on); you will get a printout of the worksheet's contents.
 - 2) For a more complete set of instructions see pg.3-40 of VisiCalc Users Manual.

F. Printed copy of a VisiPlot line graph. To get a printout do the following:

- 1) Get a copy of the Apple Graphics disk; load the disk and do a CATALOG command; find the file, SALES.VP and the file named THE;
- 2) Rename THE to another file name as appropriate; then RENAME SALES.VP, THE; then type RUN GOODPLOT; of course the printer should be on; finally leave a pencilled note that THE is SALES.VP.

5. CLASSROOM SET-UP FOR DEMONSTRATION:

- A. Set-up computer in center of a table with a monitor on either side. Position one monitor where you can see the screen but so can part of the class. Position the other monitor so that it can be seen by the remainder of the class.
- B. Write the memory diagram on a blackboard visible to the entire class. (This diagram will be provided in the text of the lesson plan)

6. LESSON PLAN TEXT: The text of the lesson plan which follows will have the following format:

COMMAND	*CURSOR*	*REMARKS*
-----------	----------	-----------

A. The "COMMAND" column will contain the actual keyboard commands to be entered to run the demonstration.

B. The "CURSOR" column will indicate what portion of the menu is at the cursor or what has been entered. In the case of VisiCalc there is a cursor position and a command line. If a command line entry is listed in this column it will be listed, ie. ">GOTO". If the entry in this column refers to a cursor location then the location will be listed, ie. "B24". In VisiPlot, the entries will be the actual entry in the cursor or what you see on the screen.

C. When a discussion away from the keyboard is to be given, then "****" will precede the text of the discussion.

D. The following guide will assist you in interpreting the commands:

- 1) CR-carriage return
- 2) CTRL-control key
- 3) SP-space bar
- 4) ->-right arrow, or->
- 5) <--left arrow
- 6) ->REPT-arrow and repeat both depressed for scrolling,

or

->(5), to indicate number of times to press

7) -to! or !to- in the *CURSOR* column, shows what direction

of cursor movement you are changing in the VC program portion.

E. Before beginning the demonstration INSURE you know how to "boot-up" the AppleII and how to care and handle the disks. If you don't then study the AppleII-The DOS Manual,pgs. 5-7 and 10-12.

LESSON PLAN
TEXT

WARNING

DO NOT ATTEMPT TO FOLLOW THE LESSON PLAN WITHOUT THE
SOFTWARE AND HARDWARE

NOTE: System master disk should be running in the AppleII with the program Brian's Theme on the screen.

"THE PURPOSE OF THIS DEMONSTRATION IS TO DEMONSTRATE COMPUTER GRAPHICS TECHNIQUES AS IMPLEMENTED BY THE COMMERCIAL GRAPHICS PACKAGES OF VISICALC AND VISITREND+VISIPILOT. ALSO, YOU WILL BE INTRODUCED TO THE GRAPHICS CAPABILITIES OF THE APPLEII MICROCOMPUTER.

THIS IS THE APPLEII MICRO. IT IS A 48K RAM MICRO WITH A 16K CARD INSTALLED FOR 64K OF RAM. IT USES 2 FLOPPY DISK DRIVES FOR MEMORY STORAGE AND A COLOR MONITOR FOR DISPLAY. THE SYSTEM ALSO HAS A DOT MATRIX PRINTER FOR BLACK AND WHITE COPIES, TO INCLUDE GRAPHICS OUTPUT.

THE MEMORY USAGE FOR THE APPLEII IS:

(NOTE: REFER TO THIS DIAGRAM ON THE BLACKBOARD:

BYTES	USAGE
49K	*
	*DOS
40K	*-----
	*
30K	*FREE SPACE
	*-----
	*HR GRAPHICS-PAGE 1
20K	*
	*-----
	*HR GRAPHICS-PAGE 2
10K	*-----
	*FREE SPACE
1K	*-----
	*SYSTEM
0K	*-----

REFER TO APPLEII REFERENCE MANUAL, PG. 67-73 FOR BACKGROUND.)

THE APPLE HAS 2 MODES FOR GRAPHICS-A LOW RESOLUTION MODE AND A HIGH RESOLUTION MODE:

THE LOW-RES GRAPHICS REPRESENTS THE SAME 1,024 LOCATIONS OF MEMORY AS IN THE TEXT MODE. IN THIS MODE EACH BYTE IS DISPLAYED NOT AS AN ASCII CHARACTER, BUT AS TWO COLORED BLOCKS, STACKED ONE ATOP THE OTHER. THE SCREEN CAN SHOW AN ARRAY OF BLOCKS 40 WIDE AND 48 HIGH. EACH BLOCK CAN BE ANY OF SIXTEEN COLORS.

COMMAND	*CURSOR*	*REMARKS*
ESC		(EXIT BRIAN'S THEME-MOVE TO COLOR DEMOSOFT)
RUN		
COLOR		
DEMOSOFT-CR	MENU FOR COLOR	THIS NEXT DEMO SHOWS APPLE'S
COLOR		
	DEMO	
1-CR		(SHOW APPLE'S 16 COLORS)
ESC	MENU FOR COLOR	
	DEMO	
4-CR	INSTRUCTIONS	(NOTE: DO THIS ONLY WITH A JOYSTICK THIS WILL DEMONSTRATE THE LOW-RES SCREEN AND SOUND OF THE APPLEII. MOVE JOYSTICK AROUND SHOWING SCREEN. THE "0" BUTTON CHANGES THE COLORS; THE "1" BUTTON CLEARS THE SCREEN. ALSO, X AND Y COORDINATES ARE DISPLAYED IN LEFT CORNER OF SCREEN.)
ESC	MENU FOR COLOR	
	DEMO	
CTRL		
RESET	I	(EXIT PROGRAM)

"THE HIGH RESOLUTION GRAPHICS CAN DISPLAY 53,760 DOTS IN A MATRIX 280 DOTS WIDE AND 192 DOTS HIGH. ONLY 8 COLORS ARE AVAILABLE FOR HI-RES.

THE HI-RES GRAPHICS TAKES ITS DATA FROM AN 8,192 BYTE AREA OF MEMORY CALLED A "PICTURE BUFFER". THERE ARE TWO SEPERATE PICTURE BUFFERS: ONE FOR THE PRIMARY PAGE AND ON FOR THE SECONDARY PAGE. BOTH OF THESE BUFFERS ARE INDEPENDENT OF AND SEPERATE FROM THE MEMORY AREAS FOR TEXT AND LOW-RES GRAPHICS. EACH DOT ON THE SCREEN REPRESENTS ONE BIT FROM THE PICTURE

BUFFER."

(NOTE:FOR MORE BACKGROUND ON THE ABOVE DISCUSSION REFER TO THE APPLE REFERENCE MANUAL-PG 17-21.)

COMMAND	*CURSOR*	*REMARKS*
		(NOTE: REMOVE THE SYSTEM MASTER DISKETTE AND INSERT THE VISICALC DISK)
PR#6		"WE WILL NOW BOOT THE VISICALC PROGRAM ON THE APPLE"

VISICALC IS ONE OF THE MOST POPULAR SOFTWARE PACKAGES DEVELOPED TO DATE. SINCE 1979 OVER 300,000 COPIES HAVE BEEN SOLD. IT WAS DEVELOPED BY DAN BRICKLIN AND BOB FRANSTON OF SOFTWARE ARTS, INC. AND IT IS MARKETING BY VISICORP (PERSONAL SOFTWARE), INC. PROGRAM IS SOLD FOR \$200 AND CONSISTS OF A PROGRAM DISKETTE, MANUAL AND A REFERENCE CARD. VISICALC IS A POWERFUL TOOL WRITTEN FOR A NUMBER OF PERSONAL COMPUTERS BESIDES THE APPLE II. ITS POWER IS IN THE REPLACEMENT OF OUR PENCILS, CALCULATORS AND SHEETS OF PAPER. AN "ELECTRONIC-SHEET" GIVES US THE POWER OF THE COMPUTER AND WITH THE USER FRIENDLINESS, GIVES US GREAT FLEXIBILITY. THE BEST USES FOR VISICALC ARE BUDGETING AND FORECASTING. I WILL SHOW YOU ONLY A SMALL AMOUNT OF THE POWER OF THE SYSTEM TODAY.

COMMAND	*CURSOR*	*REMARKS*
	A-1	(NOTE:THE BLANK VC WORKSHEET IS ON SCREEN.)
		"NOTE THE NUMBERS AND ALPHABETIC ROWS AND COLUMNS. THE TOP IS A MENU AND COMMAND LINE. HERE IN FAR RIGHT HAND CORNER IS THE CURSOR DIRECTION INDICATOR FOR
SP		MOVEMENT.
	- TO !	"NOTE CHANGE"
SP	! TO -	
->REPT	TO BK1	(HOLD REPEAT DOWN TO MOVE TO FAR RIGHT HAND SIDE OF WORKSHEET)
		"NOW WE ARE AT THE R-HAND SIDE OF THE WORKSHEET. TO MOVE TO THE BOTTOM RIGHT CAN BE DONE FASTER.
SHIFT>	>GO TO...	
A254	A-254	"THIS IS SIZE OF THE WORKSHEET NOW BACK TO THE TOP."

SHIFT>	GO TO...
A1	A-1

NUMBERS

LABEL

CR
SP
->
1 CR

NUMBERS
- TO !
A-1
VALUE-1

BCDEFGIMPRSTVW-

"LET'S NOW ENTER SOME LABELS AND NUMBERS ON THE WORKSHEET."
"WHEN WE ENTER A LETTER WE GET A "LABEL" INDICATION.

"NOW ENTER A NUMBER."
(NOTE THE 1 HAS BEEN ENTERED ON WORKSHEET.)

"IF WE WANT TO ENTER 50 NUMBERS DOWN THIS COLUMN IT WOULD BE MANY STEPS. SO, LETS USE A FORMULA. 1+A1 WILL GIVE US 2 AT A3."

FORMAT COMMAND WHICH ALLOWS L AND R JUSTIFICATION, INT, REAL OR DOLLAR FORMATS OF DIGITS. "G" LETS THE FORMATS BE GLOBAL. "I" IS FOR INSERTING A ROW OR A COLUMN WHICH WE HAVE SEEN. "M" MOVES AN ENTIRE CURSOR ENTRY FROM ONE POSITION TO ANOTHER.

"P" IS TO PRINT OUT CONTENTS OF WORKSHEET (HAND OUT COPY OF VISICALC PRINTED WORKSHEET).

"R" IS OUR HANDY REPLICATE COMMAND WHICH WE HAVE USED. "S" IS THE STORAGE COMMAND WHICH WE HAVE SEEN. "T" IS A TITLES COMMAND WHICH WE USE FOR THE PURPOSE OF FIXING THE TITLES WITHOUT HAVING TO CREATE A WINDOW. "W" IS WINDOW COMMAND WHICH WE HAVE USED. FINALLY, THE "-" IS THE REPEAT LABEL WE USED TO DRAW VERTICAL LINE BENEATH THE PERIOD ROW.

ARE THERE ANY COMMANDS YOU WISH DEMONSTRATED BEFORE WE MOVE ON TO VISIPILOT?

COMMAND	*CURSOR*	*REMARKS*
-> 1+A2 CR	A-3 VALUE..1+A2 2 AT A-3	(NOTE 2 AT POSITION A3.) "NOW TO DO THIS ALL THE WAY DOWN WILL STILL BE A LOT OF KEYSTROKES. SO, LETS USE A COMMAND- REPLICATE.
/	COMMAND:BCD...	(NOTE THE COMMAND LINE.)
R	REPLICATE, SOURCE RANGE OR RETURN	
CR	A3...A3:	NOW WE MUST ENTER THE POSITIONS TO BE EFFECTED BY THE FORMULA.
A4..A51 CR	NORMAL OR RELATIVE?	TO ADD TO OUR PREVIOUS VALUE THE VALUE SHOULD BE RELATIVE EACH TIME.
R	A-3	NOTICE OUR VALUES ARE CALCULATED ALL THE WAY DOWN.
SHIFT> A51	GO TO...	NEXT LETS SEE HOW WE CAN USE A FUNCTION TO CALCULATE THE SUM OF OUR COLUMN.
-> @ SUM SP A2..A51 CR	A-54 SUM: ... 1275	VERY FAST!

"SO FAR WE HAVE SEEN HOW TO MOVE AROUND THE WORKSHEET; ENTER
LABELS AND VALUES; AND TO USE FORMULAS AND FUNCTIONS. WHAT KIND
OF GRAPHICS TECHNIQUES HAVE WE SEEN USED BY THE SOFTWARE?

VIEWPORT-INSIDE THE VIEWPORT WE CAN INTERACT-OUTSIDE IS
THE STATIC TEXT UNDER THE CONTROL OF THE SOFTWARE.

WINDOW-OUR WORKSHEET IS THE WINDOW.

CLIPPING OR WRAPAROUND? WHICH DOES THE PROGRAM USE?
CLIPPING.

WHAT LOGICAL INPUT DEVICES ARE USED BY THE PROGRAM?
KEYBOARD AND BUTTON(IMPLEMENTED THROUGH THE KEYBOARD)

LET US NOW LOAD SOME DATA PREVIOUSLY CREATED AND USE THIS DATA
TO SEE SOME OTHER FEATURES OF THE SOFTWARE.

COMMAND	*CURSOR*	*REMARKS*
/C	TYPE Y TO	"CLEAR COMMAND ALLOWS US TO ERASE
	CONFIRM	WORKSHEET AND NOTE HOW WE CAN
Y	[RECOVER IF WE HIT COMMAND BY
	CLEAR	ACCIDENT.
/ S	WORKSHEET	
	LSDIQ#	THIS IS THE STORAGE COMMAND WHICH
		ALLOWS US TO STORE, LOAD AND
		DELETE FILES, PLUS INITIALIZE
		DISKS AND TO QUIT THE PROGRAM.
L	FILE TO LOAD	
,D2		MUST TELL SYSTEM WHICH DISK.
	SALES.VC	THIS IS OUR FILE.
CR	LOADING	
		(NOTE FILE IS LOADED WITH CURSOR
		AT FILLED IN POSITION A1)
->REPEAT	WORKSHEET	"NOTICE THE FUNCTION FOR AVERAGE.
	01	
SP	-TO!	
->N2	02	AGAIN SUM FUNCTION. VISICALC HAS
		30 DIFFERENT FUNCTIONS
		AVAILABLE. SOME ARE PI,
		TAN, LOG, COS, SQRT, AND LOGICAL
		OPERATORS.
SHIFT>	GO TO COORD	
A2		
CR		NOTICE HOW THE PERIOD LINE
		CONFUSES THE CHART. SPLIT THE
		PERIOD ROW FROM THE REST OF THE
		CHART
/ I	INSERT R C	
R	INSERTS BLANK	(NOTE BLANK ROW)
	ROW	NOW PUT A DASHED LINE ACROSS.
/-	LABEL	
	REPEATING	
- CR	-----	BUT ONLY ONE CURSOR POSITION IS
		FILLED.
		WE CAN USE THE REPLICATE COMMAND
		TO TAKE IT ACROSS.
/R	A2..	
CR	A2....A2:	
B2.N2		
CR		NOW THE LINE IS ALL THE AWAY
->REPT		ACROSS. NOTE THAT WHEN WE SCROLL
<-REPT		WE LOSE THE LABELS IN COLUMN A-
		LETS FIX THEM IN PLACE
	STOP AT B2	

COMMAND	*CURSOR*	*REMARKS*
/W	WINDOW:HV1SU	WE USE THE WINDOW COMMAND. NOW A WINDOW HAS BEEN CREATED AND WE CAN SCROLL IN IT (CURSOR IN LEFT).
->-> <-<-	PUT LABELS BACK IN VIEW.	
;	JUMP TO OTHER WINDOW.-B2	
->(5 TIMES)		NOTE THE LABELS IN LEFT WINDOW REMAIN IN VIEW. IF WE WANT TO SRCOLL VERTICALLY 50 COLUMNS WE WOULD LIKE THE COLUMNS TO REMAIN TOGETHER.
/W	WINDOW HV1SU	
S		
SP	-TO!	
->REPT		(SCROLL TO BOTTOM MAKING COLUMNS DISAPPEAR, THEN BACK TO TOP BRINGING COLUMNS BACK INTO VIEW.)
<-REPT		
/	BCDEFGIMPRSTVW-	"BEFORE WE LEAVE VISICALC I'LL BRIEFLY COVER OTHER COMMANDS. LOOK AT THE COMMAND LINE. "B" INSERTS A BLANK IN THE CURSOR LOCATION. "C" CLEARS THE WORKSHEET. "D" DELETES AN ENTIRE ROW OR COLUMN. "E" ALLOWS EDITING OF INPUT ON ANY LINE. "F" IS THE FORMAT COMMAND WHICH ALLOWS L AND R JUSTIFICATION, INT, REAL OR DOLLAR FORMATS OF DIGITS. "G" LETS THE FORMATS BE GLOBAL. "I" IS TO INSERT A ROW OR A COLUMN WHICH WE HAVE SEEN. "M" MOVES AN ENTIRE CURSOR ENTRY FROM ONE POSITION TO ANOTHER. "P" IS TO PRINT OUT CONTENTS OF WORKSHEET (HAND OUT COPY OF VISICALC PRINTED WORKSHEET). "R" IS OUR HANDY REPLICATE COMMAND WHICH WE HAVE USED. "S" IS THE STORAGE COMMAND WHICH WE HAVE SEEN. "T" IS A TITLES COMMAND WHICH IS FOR THE PURPOSE OF FIXING THE TITLES WITHOUT

CREATING A WINDOW. "W" IS THE WINDOW COMMAND WHICH WE HAVE ALREADY USED. FINALLY, THE "-" IS THE REPEATING LABEL WE USED TO DRAW THE VERTICAL LINE BENEATH THE PERIOD ROW.

ARE THERE ANY COMMANDS YOU WISH DEMONSTRATED BEFORE WE MOVE ON TO VISIPLLOT?

**

TURN POWER OFF. REMOVE VISICALC DISK FROM DRIVE ONE AND INSERT VISITREND+VISIPILOT. DRIVE TWO SHOULD STILL HAVE THE VISICALC SLAVE DISK INSERTED.

TURN POWER ON-VISITREND+VISIPILOT WILL TAKE APPROXIMATELY 2 MINUTES TO BOOT.

THE VISITREND PORTION OF OUR SOFTWARE WE WILL NOT DEMONSTRATE. BRIEFLY, VISITREND ALLOWS US TO TAKE VISICALC DATA OR ENTER NEW DATA AND DO FORECASTING AND TREND ANALYSIS. SOME OF THE TECHNIQUES USED BY VISITREND ARE:

DERIVATION OF MOVING AVERAGES

SMOOTHING DATA

PERCENT OF CHANGE

LEADING, LAGGING AND CUMULATIVE TOTAL FUNCTIONS.

THE PROGRAM PERFORMS LINEAR REGRESSION ANALYSIS USING THE LEAST SQUARES METHOD. IT ALSO CALCULATES AND DISPLAYS THE MAJOR STATISTICAL MEASURES OF A MULTIPLE REGRESSION INCLUDING REGRESSION AND STANDARD ERRORS OF THE COEFFICIENTS, AMONG OTHERS.

YOU CAN DO THE ABOVE ANALYSIS AND THEN PLOT THEM USING THE VISIPILOT PORTION OF THE SOFTWARE. THE RETAIL COST OF THE PACKAGE IS ABOUT \$250.

WE WILL NOW GO INTO THE VISIPILOT PROGRAM. THIS SOFTWARE WAS DEVELOPED BY THE SAME PERSONS WHO DEVELOPED VISICALC, BUT 3 YEARS LATER IN 1981. NOTICE THE DIFFERENCE IN THE USER FRIENDLINESS.

(NOTE YOU SHOULD NOW HAVE THE MAIN MENU FOR THE PROGRAM.

COMMAND	*CURSOR*	*REMARKS*
	MENU	"FIRST, WE WILL EXPLORE THIS MENU.
->(10 TIMES)	MOVES CURSOR AROUND MENU	"NOTICE THE ENGLISH DESCRIPTION OF EACH COMMAND. TO SELECT AN ITEM YOU PUSH THE CARRIAGE RETURN WHEN THE CURSOR IS ON AN ITEM WHICH YOU DESIRE. WHAT GRAPHICS TECHNIQUE IS BEING USED? THE CURSOR IS BEING USED AS A "PICK" AND THE RETURN AS A

COMMAND	*CURSOR*	*REMARKS*
	LOAD	"BUTTON". (MOVE CURSOR TO "LOAD") "FIRST WE MUST LOAD THE VISICALC DATA FOR OUR PLOTS."
CR	LOAD SALES.VC	"THIS IS OUR VISICALC FILE BUT NOT THE FILE WE USE FOR VISIPLT. THE VISICALC PROGRAM ALLOWS US TO CREATE A FILE FORMATTED FOR PLOTING CALLED A DIF FILE"
-> CR	SALES.DIF PERIODCITY	"WE WANT MONTHLY FIGURES SO WE ENTER 12."
12 CR	MAJOR START YEAR?	"FOR 1981"
1981 CR CR	MINOR START.. LOADING CONTINUE	"NONE" "YES WE WANT TO CONTINUE AS WE NEED OUR PROFITS."
CR CR ->-> CR CR 1981 CR CR CR	LOAD PROFIT.DIF PERIODICITY MAJOR START YEAR MINOR START... LOADING CONTINUE	 "AGAIN 12" "ALSO 1981" "WE MUST ALSO LOAD A FILE FOR DOING PIE CHARTS."
CR ->(5 TIMES) CR	LOAD PREFFIE.DIF LOADING CONTINUE	
CR ->	LOAD PLOT	"LETS MOVE TO THE PLOT PORTION OF THE PROGRAM."
CR	TYPE Y TO CONFIRM	"SINCE THIS PROGRAM TAKES 2 MINUTES TO LOAD,THE PROGRAM WILL NOT LET YOU GO TO PLOT BY ERROR.
Y	LINE LINE	"AT LAST, THE PLOT PROGRAM.
->(7times)	MOVE THRU MENU LINE	(STOP AT EACH MENU LOCATION AND READ INSTRUCTIONS) "LET US FIRST LOOK AT OUR SALES

CR	SALES	DATA IN A LINE GRAPH." (NOTE A LIST OF ALL THE SERIES LOADED)
CR	PLOT SUB-MENU	"HERE IS THE SUB-MENU OF PLOT AND WE SIMPLY WANT A PLOT OF SALES
COMMAND	*CURSOR*	*REMARKS*
CR	SCALING GRAPH APPEARS	"NOTICE HOW OUR DOLLAR VALUES WERE PLACED ON THE X-AXIS AND SINCE WE CHOSE MONTHS THE PROGRAM AUTOMATICALLY LABELLED OUR MONTHS."
CR	PLOT SUB-MENU	"IT WOULD BE BETTER TO HAVE OUR PROFITS ON THE SAE LINE FOR COMPARISON."
->	SELECT	(TO CHOSE ANOTHER GRAPH)
->	BAR	"LETS USE A BAR GRAPH TO DEMONSTRATE ANOTHER GRAPH."
CR	NORMAL BARS	"YES,NORMAL."
CR	DATA SERIES	"WE WANT SALES., AND PROFITS."
SP	*SALES	
->	PROFITS	
CR	PLOT	"BEFORE WE PLOT IT LETS TRY SOME OPTIONS."
SP	OPTIONS	
CR	OPTIONS SUB- MENU	"WE'LL CHANGE SOME COLORS."
SP		
->	BACKGR	
CR	DEFAULT	"LETS MAKE OUR BACK GROUND GREEN."
->->	GREEN	
CR	PLOT	"O.K. PLOT IT."
CR	SCALING	"NOTICE HOW THE RASTER PAINTS THE IMAGE ON THE SCREEN. THE PROGRAM USES SEGMENTS TO CALL ONE PORTION OF THE GRAPH AT A TIME. NOTICE THE AXIS ARE DRAWN, THEN THE BACKGROUND, THEN THE GRAPH AND FINALLY THE LABELS. LETS LOOK AT ONE OTHER OPTION.
CR	PLOT MENU	
SP	OPTIONS	
CR	TITLE	"WE'LL PUT A TITLE ON THE GRAPH.
CR		
SP->->	MOVEABLE	
CR	ENTER	WE'LL PUT OUR COMPANY NAME."
ABC CORP		

COMMAND	*CURSOR*	*REMARKS*
CR	FLASHING ON GRAPH	"BY USING THE TECHNIQUE OF DRAGGING WE CAN MOVE IT ACROSS THE GRAPH." (USE I,J,K,M TO CONTROL DIREC- TION; USE 1-9 TO CONTROL SPEED. WHEN IT IS IN DESIRED LOCATION PRESS SPACE BAR TO FREEZE IT- THEN HIT RETURN OT FIX IN PLACE." "FOR OUR FINALE LET'S DRAW A PIE CHART."
CR	EXIT	
CR	PLOT	
SP->->->	NEW	(NOTE CLEARS SCREEN AN RETURNS TO SELECT)
CR	LINE	
->->->	PIE	
CR	DATA SERIES	
->->	BROWN	
SP->	GREEN	
SP->	UNDECIDED	"THIS IS A VOTER POLL RESULT."
CR	MAJOR START YEAR	"NO YEAR SO ZERO"
0		
CR	SCALING	
	PIE CHART	LOOKS GOOD BUT LACKS COLOR."
CR	TITLE	
CR	SHADING LETTER(PICK A,B, OR C FROM PIE)	"LETS ADD COLOR TO OUR PIE."
B		
CR		
->->->	VIOLET	
CR	SHADES B SHADING LETTER	
A		
CR		
->->	GREEN	
CR	(SHADES A) SHADING	

	LETTER	
COMMAND	*CURSOR*	*REMARKS*
C		
CR		
SP->	ORANGE	
CR	(SHADES C)	
	SHADIING	
	LETTER OR	
	RETURN	
CR	DONE SHADING	
	TYPE Y	
Y		
	EXIT	
CR		
SP		
->->	MAIN	
CR		
	TYPE Y TO	
	CONFIRM	
Y		

THAT CONCLUDES OUR DEMO OF THE PLOT PROGRAM. I AM PASSING AROUND PRINT OUT OF ONE OF THESE PLOTS. YOU CANNOT GO DIRECTLY FROM THE PLOT ROUTINE TO THIS PARTICULAR PRINTER. YOU MUST SAVE THE PLOT IN A FILE AND THEN RUN IT THROUGH A PRINTER DRIVER TO GET A PRINT OUT. IN OTHER WORDS IT IS NOT A COMPLETE SYSTEM WHERE YOU CAN GO DIRECTLY FROM THE SCREEN TO THE PRINTER.

WE HAVE SEEN A GOOD EXAMPLE OF A COMMERCIAL SOFTWARE PACKAGE THAT HAS ILLUSTRATED MANY OF THE GRAPHICS TECHNIQUES WE HAVE STUDIED IN CLASS. THE PLOT PACKAGE HAS TAKEN MUCH OF THE TEDIUM OF GRAPHICS DESIGN AND HAS MADE IT INVISIBLE TO THE USER. IN ADDITION YOU HAVE HAD AN OPPORTUNITY TO SEE A SYSTEM THAT IS AVAILABLE TO SMALL BUSINESSES AND TO INDIVIDUALS. ALSO, WITH THE ADVANCE OF SMART TERMINALS FOR DISTRIBUTED PROCESSING, YOU SHOULD HAVE A BETTER APPRECIATION OF THE CAPABILITIES OF MICROCOMPUTERS.

DEVELOPING A MICROCOMPUTER GRAPHICS

LESSON USING COMMERCIAL SOFTWARE

by

DONALD DELWYN LOFTIS

B.A., UNIVERSITY OF TEXAS AT EL PASO, 1968

AN ABSTRACT OF A MASTER'S REPORT

submitted in partial fulfillment of the

requirements for the degree

MASTER OF SCIENCE

Department of Computer Science

KANSAS STATE UNIVERSITY

Manhattan, Kansas

1983

The state of Computer Assisted Instruction (CAI) has been described as being ten years behind in its growth. The high cost of computer hardware and software has been the primary reason for CAI's tardy development. Another major detractor of CAI has been the misapplication of the CAI process. Before embarking on CAI development, determine the placement of CAI and the reasons for CAI use. Recently, the introduction of microcomputers and the lowering of hardware costs in general has renewed interest in CAI. Therefore, the major problem facing CAI implementation in the near-term is software development and the subsequent portability of software.

Many educators want to use CAI but cannot program themselves or they cannot afford the lengthy preparation time for required for CAI. Computer-driven lesson authoring systems have not fully provided the solutions of lesson development. This report provides a method for developing a CAI lesson using commercial software. The method uses text to guide the lesson and the commercial software to provide the examples of the concepts desired to be taught. The developed lesson manual uses the Apple II microcomputer and the software packages of VISICALC and VISIPLOT. The concepts to be taught are the principles and techniques of interactive computer graphics.

A discussion of the advantages of student design projects and their inherent value to the student and to the institution is provided. With the growing interest in CAI and the increase in CAI for computer graphics, the report serves as an elementary example for a significant area of educational innovation at Kansas State University in the near future.