Computer Applications in Textiles & Clothing

ACPTC Special Publication #2

1990

Edited by

Nancy J. Rabolt
San Francisco State University

Copyright 1990
Association of College Professors of Textiles & Clothing, Inc.
PO Box 1360
Monument, CO 80132
(719) 488-3716
Preface

The purpose of this publication is to provide readers with current information regarding computer use in industry and textiles and clothing curriculum. We hope this material will be helpful in illustrating the types of software, hardware, and specific applications that are being used. Not all ACPTC members using computers in curriculum or knowledgeable of industry applications are represented in this document. A review of the ACPTC Proceedings from the 1986 through 1989 meetings shows 31 presentations related to this topic. The Clothing and Textiles Research Journal shows only four articles. (See Appendix for titles and authors.) It appears we are not sharing course materials and information through the journal and detailed information is not always distributed at meetings. This document has provided an opportunity for that sharing.

Content

The preface will discuss what the reader will and will not find in this publication. Some software packages not included here are mentioned throughout the preface because they just happened not to be reviewed by these authors but they are important to know about. See appendix for contacts and addresses for all software discussed in this preface and body of this document.

Applications discussed in this document include: an electronic information transfer system, word processing, computer-assisted programs, paint programs, databases (interactive and retrieval usage), spreadsheets, statistical programs, authoring systems, and computer-aided design (CAD) which are used in the classroom, in curriculum development, and in sharing information.

In the first part of this publication you will find a list of computer resources including newsletters, periodicals, and organizations by Dilbeck, and the results of a recent study on general computer usage in clothing and textiles curriculum by Knoll.

CAD seems to be the avenue for computers entering many textiles and clothing classrooms and a majority of the material in this document applies to CAD in the apparel design and merchandising areas. "Affordable" CAD systems seem to be the norm in university classrooms, although Gerber, Microdynamics, Lectra, Investonica, and other sophisticated and more expensive CAD programs for IBM compatibles are being used (for example Gerber at Los Angeles Trade Tech College; Microdynamics at the University of Delaware and Kent State; Lectra at Virginia Tech), and some faculty have developed their own packages on mainframes such as Iowa State’s Bodice Editor on the VAX computer. One answer to the high cost of setting up some CAD systems is sharing with other universities in the same location. Presently Ohio State design students use Microdynamics stations at Kent State.

AutoCAD, an affordable and the most used CAD program in the United States by engineers and architects, is being adopted by many apparel and merchandising professors. Tutorials, course materials, and descriptions of pattern development utilizing AutoCAD in the design area are presented here by Steinhaus, Knoll, and Grosenick; and in the merchandising area by both Mehlhoff and Bell. These all are presently being used on the IBM although AutoCAD is now available for the Macintosh.

Since AutoCAD has the capability to be customized for specific applications, we see third-party, or add-on, apparel software on the market which simplifies otherwise cumbersome applications for apparel design and illustration. Descriptions of three third-party software packages that are used in conjunction with AutoCAD are included in this publication. Lott’s PC Pattern and Miller’s Apparel-CAD both have been developed as specific applications to apparel illustration and design utilizing customized menus. Grosenick’s Cadlerns, using AutoCAD and Lotus 1-2-3, develops customized slopers. Other third-party packages are available, but not presented here: 1) PatternMaker, by Jim Pickrell from UCLA, was developed for theatrical costume designers and is available through Whiskware; and 2) BETACAD by Bernard Rueschhoff at Kansas State University incorporates a library of designs which snap together for quick illustration. Rueschhoff also has design evaluation modules for student practice. These are all presently available.
for IBM compatible computers; however, since AutoCAD is available for the Mac, Mac versions of some of these add-ons are being developed.

Rudd illustrates the use of other software used on the IBM, Microsoft Paintbrush (PC Paintbrush) and Microdynamics, for illustration of apparel for people with special needs. Also of interest to some are the Proceedings, edited by Ledwith and Holloway, from a meeting at West Valley College, Saratoga, CA in conjunction with the Palo Alto Veteran's Administration held in June 1989. Papers at this meeting addressed computer-aided design for people with special needs.

CAD software used on the Macintosh is also reviewed in this document. Sheldon demonstrates entering slopers into AuraCAD (formerly MGM Station) and describes her design evolution assignment for students. Koch discusses the usage of MacPaint, SuperPaint, MacDraw, Aldus Freehand, and VersaCAD.

Van De Bogart, a designer, describes other software for the Mac including Andros software, developed for home sewing, and several sophisticated industrial CAD systems: AVL Looms, Pointcare, and ModaCAD. ModaCAD, an integrated CAD package of pattern making, grading & marker making, textile design, knitting, textile manufacturing, and data management is more expensive than other CAD packages and requires extended RAM. California State University, Northridge was one of the first schools to adopt a full laboratory of ModaCAD stations. Also utilizing ModaCAD are Community colleges such as San Joaquin Delta College in Stockton, CA and private design schools such as Louise Saltiner in San Francisco. ModaCAD was developed for the Macintosh; however, it was introduced at the 1990 Bobbin Show for the IBM platform to accommodate university DOS-based laboratories.

AVL Looms is another sophisticated textile design CAD system for the Macintosh. It has been present in industrial settings for years and has just recently become available for schools; it is presently being used at The Fashion Institute of Technology in New York City. AVL Looms soon will add apparel design and grading capabilities to their system. A first-time educational exhibit at the American Home Economics Association in June 1990 at San Antonio brought much interest from participants.

In the merchandising area, CAD is applied to store layout by Bell and by Mehlhoff. In addition, Kotsiopoulos & Kang-Park present their modules to teach merchandise math via computer. Heitmeyer discusses how Florida State uses word processing, spreadsheets, and database management systems in teaching merchandising principles. Other merchandising programs and applications not presented here have been developed by: 1) Cindy Regan, Cal Poly, San Luis Obispo; and 2) a new textbook by Jack Gifford, Strategic Retail Management: A Lotus 1-2-3 Based Simulation, through SouthWest Publications in Cincinnati.

Additional computer applications used in curriculum appear here under the "other" category. Cerny and Welts have used an authoring system to develop a tutorial, MacFashion, on twentieth century fashion. Flynn outlines her use of a database and statistics to document fashion on campus. Scholl discusses Penn State's on-line electronic mail and text system used by Cooperative Extension to share and manage textiles and clothing information. Heaton and Hackler's CLOCARE system does not appear here, but may be of interest to Extension agents and other educators. CLOCARE is a storage and retrieval database pertaining to clothing care and maintenance developed for Extension use; however, applications to problem-solving could be used in the classroom. Another unique application not presented here is a tutorial using Hypercard on the Macintosh called Stitchstack developed by LaBat. Used in an apparel manufacturing class at the Minneapolis College of Art and Design, it allows students to flip through electronic cards pertaining information about stitch types.

Software Information

A list of software applicable to textiles and clothing curriculum (those reviewed in this publication in addition to others mentioned) is provided with contact addresses and approximate prices at the end of this publication for your information.

Future Publications

It is the hope of the editor that this type of publication be repeated in the future as computer technology and applications change and improve rapidly. As educators we must keep up-to-date with these changes, incorporate them into the curriculum, and communicate new ideas to our colleagues.
Thanks

I am pleased to have had the opportunity to gather articles by my colleagues for this publication. I also teach a computer-aided design class at San Francisco State University and am excited about using one, and soon two, add-on packages to AutoCAD to streamline apparel applications. It's an exciting field with tremendous potential for growth and new opportunities both in industry and the classroom.

Many thanks go to the Publications Committee, the authors, the reviewers of the abstracts and manuscripts, and Sandra Hutton, ACPTC Executive Director, for their cooperation in providing materials and services for a fast turnaround of this publication. The proposal was presented to Peg Rucker, ACPTC V.P. for Publications at the 1989 ACPTC meeting in Atlanta with the goal of attaining initial distribution of this material by the 1990 ACPTC meeting in Denver. A call for papers and reviews of the abstracts and manuscripts resulted in the articles, tutorials, and information which are found in this Special Publication. Thanks also to Nancy Mason, San Francisco State University graduate student, for her assistance in formatting this document.

Nancy J. Rabolt, editor
Table of Contents

I. PREFACE

II. GENERAL INFORMATION/TRENDS

Computer Resources for Clothing and Textiles
Nina J. Dilbeck ............................................................... 1

Computers in the Study of Clothing and Textiles: Current Use and Future Trends
Diane Knoll ................................................................. 3

III. COMPUTER APPLICATIONS/COURSE DEVELOPMENT

A. DESIGN

CAD in the Clothing and Textile Classroom: One Approach to Course Development
Kathryn E. Koch ............................................................. 5

Entering Apparel Slopers to Scale Using CAD
Gwendolyn Sheldon .......................................................... 9

Design Evolution Assignment Using CAD
Gwendolyn Sheldon ........................................................ 12

Using the Macintosh Computer for Textile and Fashion Design
Willard Van De Bogart .................................................... 15

Computer-Aided Design Applications to Apparel for Special Needs
Nancy Ann Rudd .......................................................... 21

Pattern Alterations with AutoCAD
Nancy H. Steinhaus ......................................................... 26

AutoCAD in the Curriculum: Pre-production Design
Diane Knoll ................................................................. 30

B. THIRD-PARTY APPAREL CAD APPLICATIONS FOR AUTOCAD

Overcoming Problems in Apparel Drafting Using PC Pattern
Isabelle M. Lott and George E. Lott .................................... 33

Customizing AutoCAD for Apparel With ApparelCAD Software
Phyllis Bell Miller ......................................................... 40
Computer Generated Custom Slopers Using AutoCAD And Cadterns
Lauraline M. Grosenick ................................................................. 45

C. MERCHANDISING

Computer Applications in a Merchandising Curriculum
Jeanne R. Heitmeyer ................................................................. 52

Computer-aided Experimental Learning for Visual Merchandising: Using AutoCAD for Retail Store Planning, Layout, and Design
Carol E. Mehlhoff ................................................................. 54

AutoCAD Streamlines Store Layout and Merchandising
Phyllis Bell Miller ................................................................. 58

MERCHMATH.EZY: Teaching Basic Merchandising Mathematics Using Computerized Drill and Practice
Antigone Kotsiopulos and Jikyeong Kang-Park ....................................... 61

D. OTHER

MacFashion: A Computer Tutorial on Twentieth Century Fashion
Catherine A. Cerny and Linda Weiters ........................................... 64

Fashion Documentation and Analysis by Computer
Judy Zaccagnini Flynn ............................................................ 69

Electronic Information Transfer to Improve Curriculum Productivity and Use
Jan Scholl ............................................................................ 74

IV. APPENDIX

Software Directory ................................................................... 79

Computer Related Presentations: ACPTC Meetings 1986-1989 .............. 82

Computer Resources for Clothing and Textiles

Nina J. Dilbeck
California State University, Fresno

With the computer age apparel merchandising and production curricula have expanded to keep abreast of the cutting edge of technology. The availability of up-to-date technical information has not always increased at the same rate. Currently there are a few organizations and publishers who are trying to remedy this situation.

Organizations/Associations

The Association for the Development of Computer-Based Instructional Systems (ADCIS) is an interdisciplinary organization whose membership represents educators from elementary and secondary schools; college and universities; business and industry; and military and government agencies who are involved in Computer Based Instruction (CBI). The stated purposes in the ADCIS bylaws are to: 1) advance the investigation and utilization of Computer Based Instruction and Management; 2) promote and facilitate the interchange of information, programs, and materials in the best professional and scientific tradition; 3) reduce redundant effort among developers; and 4) specify requirements and priorities for hardware and software development, and encourage and facilitate their realization. (ADCIS, 1989).

The ADCIS News is published semi-monthly and The Journal of Computer-Based Instruction quarterly. The Journal is refereed and achieves a balance of subject matter from all disciplines in research and practical applications. An annual International Conference promotes the sharing of research, experience, and technology. The theme of the 1990 conference, to be held in San Diego, October 29-November 1, 1990, is "Restricting Education and Training through Technology." Types of membership in ADCIS are: Institutional, $100 per year; Associate, $500 per year; and Individual, $45 per year. Send inquiries to ADCIS International Headquarters, 229 Ramseyer Hall, 29 West Woodruff, Columbus, OH 43210-1116, (614) 292-4324.

Of particular interest to individuals are the thirteen ADCIS Special Interest Groups (SIGs). Led by Elaine Muller, the Home Economics SIG (SIG/HomeEco) is an active group of college and university instructors and publishes a quarterly newsletter. Clo Wilse, Editor, keeps members up-to-date on Home Economics CBI activities around the country with reviews and listings of new materials applicable to the discipline. The Home Economics section of ADCIS presents an opportunity for sharing of common information and techniques. At the international conference there is an opportunity for presenting papers. Home economics presentations are available at 20-40 minute intervals during the three days. There is also the opportunity to view and review computer application in other academic disciplines which have possible applications to home economics and to clothing and textiles.

The National Computer Graphics Association (NCGA) aim is to assist education and industry with the various aspects of graphic design. National and regional meetings include: trade shows, demonstrations, seminars, and workshops. The official membership publication of NCGA is the NCGA Forum. Also, a free subscription to Computer Graphics World accompanies the membership. In May of 1991, NCGA will sponsor a one-day seminar in Paris titled: "Achieving World Class Manufacturing through CAD/CAM Technologies*. Many U.S. university campuses host student chapters, providing students with industry contacts as well as special status at the national conferences. A variety of equipment companies allow special discounts to association members for software and hardware purchases. For more information contact NCGA, 2722 Merrilee Dr., Suite 200, Fairfax, VA 22031.

The San Francisco Bay Area hosts a new concept in sharing computer information which potentially will spawn similar groups all over the U.S. The Textile Computer User's Group (TCUG) had its first meeting in March, 1989, and is publishing the quarterly newsletter Computer Textile Exchange (CTE). As stated by organization president, Margaret Copeland, "The newsletter covers machine knitting, weaving, needlework, tapestry, surface design (Copeland, 1989). Members of the group represent all types of computers format and meet bi-monthly. The CTE reviews the latest textile software and hardware available for personal computers. Due to the newness of the organization, it is difficult to assess the value for those outside the San Francisco Bay Area; but within that
region, this is an excellent and unique opportunity to network ideas, information, and expertise. Contact Margaret Copeland, President, Computer Textile Exchange, PO Box 1065, Lafayette, CA 94549 for information.

Gerber Garment Technology, Inc., Lectra Systems, Microdynamics, and ModaCAD are the largest CAD systems used in the industry and by educational institutions. Systems include software for design, pattern making, and merchandising, to name a few. While these companies offer training on their own systems with purchase, they do not have other training available.

During the first week of August each year, the Academic Sales Department of Microdynamics invites educators to Dallas for their Annual Academic Seminar. This two day seminar is used not as an effort to sell the system but rather as an opportunity to update educators and to share industry information. Individuals from the industry in the Dallas area and educators using CAD in the area are guest speakers. The second day is devoted to a hands-on experience. For further information call Daria Box, Academic Sales, Microdynamics, 10461 Brockwood Rd., Dallas, TX 75238, (214)343-1170.

ModaCAD, Lectra Systems, and Gerber Garment Technology, Inc. have regional facilities throughout the U.S. which are equipped with demonstration equipment for individuals and groups. Contact Ed Schmidt, Technical Training, Gerber Garment Technology, Inc., P.O. Box 769, Tolland, CT 06084, (203)871-8082; ModaCAD, 1954 Cotner Ave., Los Angeles, CA 90025, (213)312-6632; Lectra Systems, 844 Livingston Court, Marietta, GA 30067, (404)422-8050.

Additional Newsletters and Periodicals

*The Home Economist’s Computer Newsletter* includes software and hardware reviews, educational opportunities, and articles of interest to instructors using computers in the university/college classroom. The newsletter is aimed at helping home economists make computers viable for them. A one year subscription rate of $12 brings you four issues. It is the only publication targeted to Home Economists and their particular needs. Information is applicable to all levels of educators as well as those in business. The information included is pertinent and of good quality. Elaine Muller is Editor and Publisher. Write E. M. Enterprises, 3 Hickory Rd., Denville, NJ 07834.

Apparel production and manufacturing updates are the focus of *Bobbin* publications. *Bobbin* is designed to keep abreast of top management problems and solutions and marketing trends in retailing, manufacturing apparel, and textiles. *Apparel Manufacturer* contains information in the technical area, managerial levels, and the executive levels of manufacturing. Each publication deals extensively with computer application for manufacturing, a subject which is necessary for inclusion in apparel merchandising and production programs. For the individual teaching apparel production, these publications are a must. Others will find the information excellent as supportive documentation in the areas of clothing and textiles. The articles presented are excellent.

*Bobbin* is published monthly with two issues in January at a subscription cost of $36 per year. *Apparel Manufacturing*, a monthly publication, is free to educators. Subscriptions can be obtained by writing Bobbin Blenheim Media Corp., 1110 Shop Road, P. O. Box 1866, Columbia, SC 29202-9961 or calling (800)845-820.

Many software packages are on the market and excellent for instruction, but are too numerous to review at this time. The publications, groups, and other resources discussed here are especially helpful to the novice. Much support is available to assist anyone expanding their knowledge of computers. The experienced computer user is most valuable to the resources discussed for research and information sharing.

References


Copeland, Margaret (1989). *Computer Textile Exchange, TCUG Notes, 1.*
Computers in the Study of Clothing and Textiles: Current Use and Future Trends

Diane Knoll
Colorado State University

The apparel industry is being revolutionized by computer technology. The use of this technology exists in all phases of the soft goods chain—from design through production to distribution and retailing. Furthermore technology is blurring the traditional distinctions in manufacturing and distribution, while questioning the discrepancy between industry and the educational institutions that train students (Feldman, 1984).

Related to this, Sheldon (1988) conducted a survey of designers working for apparel manufacturers to assess current and projected use of computerized design and production equipment. The major implication of the study was that colleges educating future apparel designers must prepare their graduates to work not only in a creative capacity, but also in a technologically sophisticated workplace. Sheldon's recommendation was for educators to update curriculum and computing facilities in order to keep abreast with an increasingly computerized apparel industry.

The Problem

The purpose of the study discussed below was to collect data that described current computer use in clothing and textile programs in higher education. Specifically, four factors influencing computer usage were analyzed: 1) the types of computer software in use; 2) the types of computer hardware in use; 3) the sources of student computer instruction; and 4) predictions of future computer use in textiles/clothing.

The Sample Respondents

A sample population of faculty members teaching in college clothing and textiles programs were identified. The sample was taken from the membership of the Association of College Professors of Textiles and Clothing (ACPTC). A systematic random sample of N=175 was drawn from the 1987 membership directory. The sample was mailed a questionnaire containing relevant questions dealing with the research problem stated above. A follow-up questionnaire was sent to all non-respondents, and both mailings yielded a final working sample of N=137 respondents, an 87% response rate. (Open-end questions were used, hence percentage analyses can exceed 100 percent, as some respondents may have answered in multiple categories.)

Findings

Types of Software in Use

A percentage analysis revealed that, overall, word processing software is the most frequently stated usage by sample respondents. Specifically, the analysis showed that of the N=137 respondents: 76% stated they used word processing software; 23% use database software programs; 23% use computer spreadsheet software; 17% stated use of Computer-Aided Design (CAD) software; 10% stated use of telecommunications programs; and finally, 11% of the sample stated the use of the computer for instructional purposes. The finding that word processing is stated as the dominant computer application is consistent with Law's (1983) study of computer applications among home economics educators.

Types of Hardware in Use

An important issue on all college campuses is the question of computer hardware standardization (Mayhew, 1980; Loker, 1984). If, for example, preferred types of computer hardware exist, this information would be useful to a college textiles/clothing department considering acquisition of equipment.

The percentage analysis revealed that IBM or IBM compatible equipment was the overall leading choice. Specifically, 65% of the sample respondents stated a preference for IBM or IBM compatible equipment, 16% stated preference for Apple Macintosh computer hardware, 14% preferred Apple II computers, three percent stated preference for Texas Instrument equipment. Twelve percent of the respondents chose 'other' as their response, and 12% did not respond. These last two percentages are important, since if combined they represent fully one-quarter of the sample...
respondents statements. This suggests that a large fraction of textiles/clothing college faculty are, in effect, not part of the IBM-Apple technology diad.

Source of Student Computer Instruction

The sample respondents in the study were asked to identify the sources of student computer instruction that were available at the time the study was conducted. Results are summarized as follows: 70% of students received computer instruction in science/math; 39% in textiles/clothing; 33% in business; 13% in interior design; 13% in 'other'; 5% in education; and 3.6% had no response.

It is clear that science/math curricula remains at present the main arena of computer training for textile/clothing students. However, the data suggest that the textile/clothing curricula does provide a large fraction of computer instruction.

Predictions of Computer Use in Textiles/Clothing

The sample respondents were asked to predict the highest growth area for computer technology in the textiles/clothing arena; a complex set of changes were suggested. They are contained in table one.

Table 1. Predicted Changes In Textile/Clothing Computer Use, Next Five Years (N=110)

<table>
<thead>
<tr>
<th>Predicted Change, Increase In:</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Course Curricula</td>
<td>51.81</td>
</tr>
<tr>
<td>Laboratory Facilities</td>
<td>27.27</td>
</tr>
<tr>
<td>Faculty Use</td>
<td>4.54</td>
</tr>
<tr>
<td>University Support</td>
<td>4.54</td>
</tr>
<tr>
<td>Design Students trained in CAD</td>
<td>3.63</td>
</tr>
<tr>
<td>Telecommunications</td>
<td>3.63</td>
</tr>
<tr>
<td>Costume Collection Computerized</td>
<td>1.81</td>
</tr>
<tr>
<td>Students are Computer Literate</td>
<td>1.81</td>
</tr>
<tr>
<td>No Growth</td>
<td>.90</td>
</tr>
</tbody>
</table>

Conclusions

The results summarized above suggest that substantial growth in computer use in textiles and clothing college programs can be expected during the decade of the 1990s. While the clear trend today in computer software use is in the word processing area, the near future likely will see increased faculty literacy via computer technology, training in CAD and telecommunications, among other specific areas. In terms of future applications, the most significant increases will be a rising percentage of students who leave college and enter the business world well-trained in computer technology for the 1990s.

These suggested trends will be greatly influenced by college financial support for computer usage, in the form of software/hardware acquisitions. Without access to the crucial technologies, advances will be attenuated. This is also the case in college-business liaisons and agreements to fund the appropriate computer technologies in textiles/clothing research. There are substantial gains in this arena already in existence; and future advances rest on these cooperative ventures.

References


CAD in the Clothing and Textile Classroom: One Approach to Course Development

Kathryn E. Koch
Central Michigan University

To meet the demands of Quick Response the U.S. apparel industry continues a steady move toward computerization of the design and manufacturing functions. This strong industry trend necessitates an examination of apparel design curricula to assess the degree to which these programs are meeting the demand of the apparel industry for educated personnel in computer system applications. Designers, patternmakers, and production managers surveyed by Fraser (1985) agreed that it was difficult to find people trained to use computers. Her study concluded that education is a necessary tool for those dealing with computerization in the apparel industry. Designers surveyed by Sheldon (1988) predicted that by the mid-1990s designers entering the industry will need an understanding of the capability of all computerized apparel equipment and have hands-on experience with design/illustration and patternmaking equipment as well as grading, costing, and color matching equipment.

To meet the demand of the apparel industry for educated personnel in computer systems applications, it is critical that university programs develop curricula that address the need for training in computer-assisted design and manufacturing. However, course development has been limited due to scarce resources and lack of faculty expertise. The purpose of this paper is to discuss one approach to the development of a CAD course which addresses the need for training at the undergraduate level yet does not entail the expenditure of large amounts of money to get started. The course not only exposes students to computer applications in apparel design and manufacturing but it also illustrates how CAD concepts can be utilized in even the smallest of apparel firms.

Initial Planning

The realization of the course as it is now offered at Central Michigan University was the result of over four years of planning and preparation. The process began with the hiring of a faculty member who was very interested in initiating a CAD program and was committed to achieving the expertise needed. Over a period of three years this faculty member took courses, attended seminars and workshops, and visited companies using CAD for apparel, all for the purpose of gaining information as well as hands-on experience with CAD. During this same period, plans were made for the purchase of hardware and software as well as designing a space for a CAD lab that could accommodate up to 15 terminals and other peripherals as the program developed.

Making a decision about software and hardware was challenging and time consuming. After exploring a number of apparel specific software and the hardware needed to run it, it was decided to base the lab around Macintosh computers. The rationale for choosing the Macintosh was: 1) its user friendliness which maximizes the time spent utilizing the computer and minimizes the time spent learning to use the computer; 2) its superb graphics and the availability of a number of software programs that can be easily adapted to apparel use as well as the availability of some very advanced apparel specific software, e.g. ModaCAD; and 3) its cost which is a closer fit with university budgets and within the range of many small apparel manufacturers who may not be able to afford more expensive turnkey systems.

Finding the budgetary resources to purchase the necessary equipment called for some creative thinking on the part of our faculty. The solution for our program was to combine monies from the dean's office, the department development fund, and from allocations to the department for equipment from our annual planning report. One thing that helped in getting money from a variety of university sources was to designate the CAD lab as an interdisciplinary lab which would be used by students in Interior Design and Food Service Management, as well as Clothing and Textiles.

Considerable planning and experimentation also went into the selection of software applications. We knew that initially we would not be able to afford apparel specific software;
therefore, we needed software that was easily adaptable to apparel applications. Over several years a number of senior students interested in computer-aided design for apparel did independent studies in which they explored various software applications to assess their usefulness for apparel design. These applications were available through our Computer Services Department so no purchase was required. MacDraw, MacPaint, and SuperPaint were found to be most useful for the illustration of basic garment designs and pattern pieces. For more complicated procedures especially related to pattern design, VersaCAD software was chosen. VersaCAD is a standard engineering software package comparable to AutoCAD and was selected instead of AutoCAD because VersaCAD had been available for the Macintosh for a much longer time. Also, at the time we purchased the package, VersaCAD was formatted to be much closer to the Macintosh in its user friendliness than was AutoCAD. For experiences related to fashion illustration and textile design, Aldus Freehand software was acquired. This software allows for sophisticated freehand drawing and extensive color applications.

Course Development And Objectives

The course that has evolved is called "Computer-Aided Design for Apparel." It is a 3 credit semester course which meets 2 hours twice a week. It is offered once each semester and has been limited to 8 students per semester until more terminals are purchased. Prior experience with garment design is not required and therefore no comparison or evaluation can be made between design projects completed in the traditional manner and those done on the computer. The only prerequisite is that students have completed an advanced apparel construction course so that they are familiar with pattern terminology, shape, and an understanding of the link between garment and pattern design.

It was originally thought that only apparel design students with a knowledge of flat pattern techniques would find the course beneficial. However, for its initial two offerings as a special topics course, both fashion merchandising and apparel design majors were permitted to enroll. As a result, we began to realize how important it is that all clothing and textile majors have some experience with CAD. Soon retailers and designers will work closely through electronic graphic interchange and a knowledge of CAD will be critical to both areas. Students from both fashion merchandising and apparel design programs have achieved a greater understanding of the linkages within the entire garment industry, especially the critical relationship between the manufacturer and the retailer. The lab now has several Macintosh IIcx's with color monitors and 4 MB of RAM, a Macintosh Plus on loan from our Computer Services Department, and an Apple Laser Printer IINT.

The objectives of the course as well as the course outline follow:

Course Objectives

1. Understand the purpose of CAD in the apparel industry
2. Locate and utilize sources of information which relate to the development of CAD technology in the apparel industry
3. Use correct terminology related to CAD technology and applications.
4. Identify and evaluate a variety of software packages suitable for use in the apparel industry.
5. Create basic textile and apparel designs and patterns using selected software packages.

Course Outline

I. Introduction to Computer-Aided Design (1 week)
   A. Terminology and equipment
   B. Applications to apparel industry
   C. Impact on future of apparel industry

II. Bit-oriented computer programs (4 weeks)
   A. Applications within MacPaint and SuperPaint to apparel design
   B. Evaluation of programs
   C. Development of a basic wardrobe library
   D. Designing over a body form

III. Object-oriented computer programs (7 weeks)
   A. Applications within MacDraw, Freehand, and VersaCAD to apparel design
   B. Evaluation and comparison with bit-oriented programs
   C. Development of industry pattern slopers
D. Pattern design from basic sloper patterns
E. Designing textile prints
F. Pattern markers
G. Pattern grading
H. Advanced wardrobe design

IV. Current CAD technology in the apparel industry (1 week)
A. Computer Design, Inc.
B. ModaCAD
C. Microdynamics
D. Gerber Garment Technologies
E. Lectra
F. Independent company investigation and class reports

V. CAD research paper
A. Identify problems in the computerization of the apparel industry
B. Locate resources that address the problem
C. Prepare outline
D. Develop research paper to address the problem, assess situation, propose solutions

Software Evaluations

The following evaluations of the software used will touch on advantages and disadvantages as well as how it is applied to apparel design.

MacDraw

The version of MacDraw which we use is an early edition which has limited use for pattern drawing and garment illustration. As an object-oriented program, images are entered as lines or arcs rather than as a series of pixel points. As such, revisions of an illustration can be done only by manipulation of entire line segments or total graphic entities. An advantage of object-orientation is it produces clear, sharp lines in laser printouts. A disadvantage of this early version is difficulty in achieving precise line adjustments and intersections. The current upgraded version of MacDraw may have improved on these shortcomings. This program is a good way to introduce the concept of object orientation and to make comparisons with the bit-oriented programs.

Aldus Freehand

This is an excellent object-oriented program for use especially with color monitors. It can be used for many of the same kinds of applications as in MacDraw, MacPaint, and SuperPaint. Possibilities for doing all kinds of illustrations appear endless. Currently this program is used for designing textile prints in color. Students enjoy creating the color palettes and applying the colors to their designs. However, unless you have a color printer, you cannot print out the designs as created on the screen. We take slides of the color monitor and then have color prints made from the slides.

Macpaint And Superpaint

These bit-oriented programs create images by positioning individual pixel points on the screen. To edit a drawing, the individual points can be deleted or added allowing for greater design clarity and accuracy. MacPaint is the first program students use in the course because it is easy to learn and students with limited exposure to the computer or to computer graphics are quickly motivated to create garment designs. SuperPaint has greater capabilities than MacPaint including more fills patterns and a more accessible drawing window. Both programs are used for wardrobe libraries, garment line presentation, pattern drawing, figure drawing, and garment design. The main disadvantage is that the line clarity in printouts is not as sharp as in the object-oriented programs.

VerseCAD

This excellent all-purpose CAD package has many possibilities for apparel design and production. Although it is typically considered most useful to engineers, architects or interior designers, it can certainly be adapted for apparel purposes. Like most CAD software, it is object-oriented. However, the sophisticated features make it particularly suited to assignments involving pattern grading, marking, pattern alterations, and design. It can also be used to present garment designs and build wardrobe libraries. The potential of VerseCAD for apparel use is so extensive that already plans are being formulated for an advanced CAD class using VerseCAD as the foundation program. The primary disadvantage found so far is the lack of documentation specific to apparel. Although the manual provided is comprehensive, problems related to apparel take a good deal of time to develop since we experiment with new ways to use VerseCAD's many functions. I also found it very beneficial to attend a three-day VerseCAD training session sponsored by Prime Computer
Corporation at their training center in Bedford, Massachusetts.

**Conclusion**

This course has proved to be a very important addition to the Clothing and Textiles curriculum. Although we don’t have the sophisticated systems distributed by companies such as Lectra, Gerber, or Microdynamics, we do have a viable course that exposes students to the concepts and applications of CAD in the garment industry and which has stimulated students to consider careers in which CAD for apparel is a major component.

Future plans include obtaining a plotter, a scanner, additional terminals, and an apparel specific software package, such as ModaCAD or Computer Design. However, for university programs where financial resources are limited, the use of microcomputers and standard graphics software may be the solution to providing clothing and textile students with a reasonable experience related to CAD for apparel. Students who accept positions with companies who have CAD technology will be able to learn the system much more easily. Those who go to companies who do not yet have CAD capabilities will be in a position to assist in decisions related to computerization and be integral in its implementation. The course presented here is only one approach to preparing students for the jobs of the future. However, computerization of the apparel industry is a phenomenon that will affect all kinds and sizes of businesses. The success of Quick Response depends on the industry’s ability to integrate new technology necessary to keep pace with foreign competition. University clothing and textile programs must seriously consider how they will prepare their students for this new technology.

**References**

Fraser, A. (1985, March). Designers, patternmakers, and production managers evaluate CAD/CAM. *Bobbin*, p. 27.


**Software Directory**

Aldus Freehand. Aldus Corporation, available through MacWarehouse (1-800-255-6227), version 2.0, $329.00

MacDraw, Claris Corporation, current version is MacDraw II available through MacWarehouse, $295.00

MacPaint, Claris Corporation, current version is MacPaint II 2.0 available through MacWarehouse, $95.00

Superpaint, Silicon Beach Software, Inc., version 2.0 available through MacWarehouse, $125.00

VersaCAD, VersaCAD Corporation, a company of Prime Computer, Inc., 2124 Main St., Huntington Beach, CA 92648, version 3.0, $2395.00 (educ. discount available)
Entering Apparel Slopers to Scale Using CAD

Gwendolyn Sheldon
California State University, Chico

Purpose

The purpose of this paper is to describe two methods of entering slopers or patterns to scale into a CAD drawing. One method involves the use of a graphics tablet; the other method does not require a graphics tablet. The reason for describing both methods is the budgetary and size restrictions at many universities which limit accessibility to graphics tablets large enough to use with full scale slopers.

Importance of Entering Scaled Slopers

Entering scaled slopers allows a designer to use individualized or established manufacturer slopers with computer-aided design and manufacturing systems. When switching over to computerized systems, the established fit of the line can be maintained by entering the slopers used for the line into the computer, then, making computer-generated patterns from those slopers. Patterns made from the slopers will maintain the same basic fit as the original sloper. Consumers will then find that the line will fit the same (except for design ease) garment to garment and season to season.

Curriculum Context

This assignment is part of a Computer-Aided Design of Apparel course that teaches students to use computers for fashion illustration, drawing, patternmaking, grading, and markermaking. The course is taken by all apparel design majors and some fashion merchandising students at California State University, Chico. Students come into the course with at least a basic design and flat pattern background; prior computer experience is not required. Most of the students have had a Fashion Illustration and Drawing course and most students take the course in their senior year. The assignment on entering slopers to scale is done the third week of a fifteen week semester, while students are still gaining proficiency in the basic drawing functions. The method for entering slopers without a graphics tablet gives students practice using the method of entering points by coordinates and shows them the importance of accuracy.

Equipment

These methods were used on Macintosh Plus, Macintosh SE, and Macintosh II computers with AuraCAD software (formerly known as Micro Graphic Manufacturing Station). This software is very similar in capability to programs such as AutoCAD. The retail price was $900 at the time of purchase; the educational price was $250 per station. The digitizing tablet used is a 12” x 18” Kurta tablet (approximately $800). A half scale sloper is used on the tablet because of its limited size. The slopers were plotted out full scale on a plotter. These techniques can be applied to other computers and CAD software.

Concept of the Graphics Tablet

The graphics tablet enables the designer to input data by digitizing. The graphics tablet can be used with a pen or a cursor. As the cursor (or pen) is moved over the surface of the tablet it sends the computer the precise position of the pointing device (pen or cursor) relative to the surface of the tablet. The computer screen pointer is moved by the computer in proportion to the movement of the pointing device on the tablet. The cursor and pen are different than a mouse in that the mouse can be picked up and put down in another place and the screen pointer will not move until the mouse is slid along a surface. This means that items to be copied to scale can be attached to the tablet and accurately input to a drawing.

Advantage of Digitizing

The graphics tablet allows great precision for inputting graphic data. The cursor is different from the mouse in that it has a window with crosshairs (lines crossing in a + shape) instead of a rolling ball on the bottom. The crosspoint of the hairs enables identification of a precise point on the object underneath the cursor.
Method for Digitizing Slopers

Instructions are for AuraCAD, equivalent AutoCAD instructions are in [brackets].

1. Place the sloper or pattern under the plastic cover of the tablet (or tape the sloper to the tablet). This will anchor it, so it does not move. To make the grainline parallel to the screen grid, lay the Center Front of the sloper parallel to the lower edge of the graphics tablet.

2. Open a new CAD drawing. Set the viewing size large enough to accommodate the size of the sloper.

3. You will need to alternate between using the mouse for changing commands on the computer and the cursor on the tablet for inputting points on the sloper. [For AutoCAD, enter commands through the keyboard.]

4. In tracing the sloper, alternate between using Free Line [Line] to trace lines and Free Point [Point] to input points on curves.

5. Begin at a corner point, such as the center front of the neckline (Point A on Figure 1). Using the mouse, go to the point menu and select Free Point [Point]. Place the cursor over the corner point, lining up the cross-hairs in the window with the center front corner point. (Look into the window from straight above the window, not on an angle, to avoid distortion.) Enter the point by clicking on the enter button on the puck.

6. Trace curves by entering points 1/2 inch apart along the curve using Free Point [Point]. (These points will act as guides when making an arc to match the sloper.)

7. Trace lines by entering the two endpoints of the line using Free Line [Line]. (Access Free Line with the mouse [keyboard]. Input lines with the tablet puck.)

8. Work your way around the sloper using Free Point [Point] to input points along curves (such as the neckline and armsye) and Free Line [Line] to enter lines (such as from Point B to Point C in Figure 1).

9. Go back and make arcs on the curve guidepoints. Use Arc: 2 Existing Points and Radius [Arc with 3 points]. The guidepoints entered previously will let you know how accurate the arc is. Redo until the arc follows the guidepoints on the curve. (Remember that a larger radius will give you a flatter curve if you are using commands involving radius of the arc.) Sometimes 2 arcs are needed, a combination of a flatter and a rounder arc, to replicate a sloper curve.

10. Plot the sloper to check accuracy. Place the original sloper on top of the plotted sloper for comparison; adjust if necessary.

Method for Entering Slopers Without a Digitizing Tablet

This method may be used when a large enough digitizing tablet is not available for entering slopers. It is more tedious than digitizing but can be done accurately. Instructions are for AuraCAD, equivalent AutoCAD instructions are in [brackets]. Hand trace the sloper onto graph paper.

1. Lay the sloper to be entered onto a piece of 1/8" or 1/4" graph paper.

2. Be sure that the center front line of the sloper is lined up on one of the graph paper lines and the center front neckline point is on a graph line crossing.

3. Trace, with a fine point pencil or pen, around the sloper tracing all lines and curves. Measure relative points on the sloper. (If you do not understand the Cartesian coordinate system read Appendix A before proceeding.)

4. Begin at a corner on the center front of the sloper, such as the center front neckline point of the bodice front (Point A in Figure 1).
corner point on the sloper (Point B in Figure 1, the intersection of the neckline and shoulderline). A T-square and the graph paper lines should be used to maintain accuracy. Consider the first point (Point A, the neckline center front) as the intersection of an X and Y axis (point 0,0). Measure the relative position of the second point (Point B, the neckline/shoulder intersection) measuring how far along the X axis (to the left or right) and the Y axis (how far up or down) from the first to second point (from A to B). If the shoulder/neck point is 2.25 inches to the left and up 2 inches from A, then the position of the neck/shoulder point relative to the center front neckline is X = -2.25, Y = 2 (2.25,2). Record the position of the neckline/shoulder point, (-2.25,2), on the graph paper copy.

6. Measure the relative position of the next corner point which, working around the sloper, would be the end of the shoulder (Point C in Figure 1). Point B, the shoulder/neckline point would now be considered (0,0). If Point C, the end of the shoulder, is to the left 4.5" and down 1.4", then the relative position of C would be (-4.5,-1.4). Record the relative position of Point C on the graph paper.

7. Working around the sloper, measure and record the coordinates for the position of each corner point relative to the last corner point. Points along the curves also may be identified as guidelines for creating arcs. Transfer the identified points of the sloper to a CAD drawing.

8. Open a new drawing. Make the viewing size large enough to accommodate the size of the sloper.

9. Make a point on the drawing representing point A (see Figure 1), identified on the graph paper copy of the sloper.

10. Using the Relative Point command [Relative Coordinates] to identify point B (neckline/shoulder), enter the coordinates which were recorded on the graph paper (-2.24,2 in the example in Figure 1).

11. Work around the sloper in the same order as the Cartesian coordinate points were identified on the graph paper, entering the relative position of each point until each corner point and curve guidelines of the sloper are identified on the drawing.

12. Connect the corner points on the drawing to create the lines and arcs where appropriate using line and arc functions. Use Line between 2 existing points [Line] to create lines and Arc:2 Existing Points & Radius [Arc with 3 points] for curves.

13. Plot the sloper; then trace the original sloper on top in a different colored pen for comparison.

14. If differences exist between the original and plotted sloper, make adjustments to the drawing until it is accurate.

Results

Students used both of these methods and were able to create slopers on the computer that replicated slopers used in the clothing lab. The method without the tablet was more time consuming and required more adjustments after the first plotting, but had the advantage of accomplishing full scale slopers.

Appendix A: Cartesian Coordinate System

A Cartesian coordinate system is used for locating points in a drawing. An X and Y axis are indicated. The X axis is horizontal, indicating how far to the left or right of the origin (intersection of the X and Y axes) a point is located. The Y axis is vertical, indicating how far up or down from the origin a point is located. Any point on the drawing can be located by indicating the X and Y coordinates. The coordinates are indicated by listing the X coordinate followed by a comma, then the Y coordinate. The origin (intersection of the X and Y axis) is point (0,0). The figure below shows a Cartesian coordinate system with the examples of coordinates.
Design Evolution Assignment Using CAD

Gwendolyn Sheldon
California State University, Chico

Purpose

The purpose of the design evolution assignment is to have students experience creating designs by an evolutionary process. The students are given a simple garment design which they modify into another design, and modify again until a number of variations or directions are generated from a single concept. This design method is particularly suitable for computer-aided design because designs are continually duplicated (a process done quickly and easily on the computer) before modifying. This design development technique can help students gain confidence in their ability to develop a variety of design concepts.

Objectives

Upon completion of the assignment the student will be able to:

1. evolve a given design into a new design that is appreciably different from the original
2. generate a number of design solutions, evolved from a single given design
3. better conceptualize the development of garment groups related by themes of design silhouettes and details.

Curriculum Context

This assignment is part of a Computer-Aided Design of Apparel course that teaches students to use computers for fashion illustration and drawing, patternmaking, grading, and markermaking. The course is taken by all apparel design majors and some fashion merchandising students at California State University, Chico. Students come into the course with at least a basic design and flat pattern background; prior computer experience is not required. Most of the students have had a Fashion Illustration and Drawing course and most students take the CAD course in their senior year. The design evolution assignment is completed by students in the second half of the course, after they have mastered all the basic drawing functions of a CAD program. One week is allocated to the assignment. The assignment gives the students practice using the CAD drawing functions, builds their self-confidence in developing design ideas, and prepares them for the next assignment on developing a garment group.

Hardware/software

This assignment was done on Macintosh Plus, Macintosh SE, and Macintosh II computers. The software used was AuraCAD (formerly known as Micro Graphic Manufacturing Station). The assignment could be completed using any computer with other CAD programs such as AutoCAD, VersaCAD or others. Printing can be done using dot matrix or laser printers or plotters.

Method Overview

Students begin the assignment with a simple garment design, a plain tank style dress. The design is duplicated; then one modification is made to the duplicate. (Delete and drawing functions are used to change the design.) The modified duplicate is then duplicated and further modified to create harmony within the design. The process continues with each new design being duplicated then modified. Different areas of the garment (such as neckline, waistline, sleeves, etc.) are modified using different shapes, details, seam types, decorative features, and trims. Periodically the designer returns to the original design or one of the earlier modified designs and begins a new direction of design variations. A sample completed assignment, Figure 1, is included at the end of this paper.

Instructions for the Assignment

1. Begin with the tank style dress on a new drawing file. The view size of the drawing should be large enough to duplicate the dress about 20 times. Zoom in to work on the dress.
2. Duplicate the garment.

3. Modify the duplicate in one area such as the neckline. Examples: Change the shape of the neckline, such as changing a scoop neckline to a V-neck or add a placket at the center front neckline (see Figure 1). The delete function is used if a feature of the original neckline needs to be erased. Appropriate drawing functions (lines, arcs, etc.) are then used to create the new design feature.

4. Duplicate the new design.

5. Modify the new design by repetition of the new feature to other parts of the garment, creating harmony within the design. Example: A placket of buttons added to a neckline could be carried through by repeating a placket of buttons at the side seam perpendicular to the hemline.

6. Duplicate the modified design. Then try different forms of repetition of the added design feature in different parts of the garment. Example: Add the placket of buttons as a vertical placket at the end of a long sleeve, then a horizontal row of buttons on a short sleeve cuff, etc.

7. Duplicate and modify the design at another area on the garment. Examples: Add, raise or lower the waistline, add a peplum, change the shape of the neckline, change to a kimono, raglan or set-in sleeve, add a collar (try several different styles of collars), add pockets, add stylines, gathers or pleats, or add decorative trims that you repeat in different areas.

8. Duplicate the design and modify it again.

9. Duplicate the original or one of the earlier modifications and change the design in a new direction. Evolve that design by repetition, changes in a variety of garment areas or by adding new emphasis. Use design resources, such as fashion publications, historical references, clothing seen on people you see in person, on TV or in movies.

10. Group or convert some of the variations into coordinating pieces of a garment group (pieces that could be worn together).

11. Create a minimum of 20 different garments.

12. Print the sequence of evolved garments including all garments in the process. Do not delete designs you do not like; show all garments so the evolutionary process is evident.

Results

This design development technique helped students gain confidence in their ability to develop a variety of design concepts or multiple solutions to a design problem. Students also learn that the final design concept does not have to be in their minds when they begin the design process; rather it can evolve through a process of experimentation. It also teaches them that not every design idea in the process has to be a usable final design; that if you keep generating ideas, enough successful designs will emerge to make the process worthwhile. The concept of developing groups becomes clearer also, as the series of modifications often develops related garments that could become a group within a manufacturer’s line. Because of the frequency of duplicating designs, the students became aware of how much time computer-aided design can save in the design development process.
Figure 1
Design Evolution Example
Using the Macintosh Computer for Textile and Fashion Design

Willard Van De Bogart
Van De Bogart Design Group, Oakland, CA

If the early settlers of New England, origins of many of the leading textile mills, could witness the computer operated mills of today I suspect they would look on in disbelief. The textile mill is becoming completely computer driven, and for many apparel industry managers this has become a reality as well as a necessity in light of the increase in imports.

Gwendolyn J. Sheldon from California State University, Chico for the summer 1988 Clothing and Textiles Research Journal comments:

"employed designers predict that designers entering the industry in five years will need an understanding of the capability of all computerized apparel equipment, and have hands-on experience with apparel equipment and have hands-on experience with design/illustration and patternmaking equipment as well as grading, costing, and color matching equipment."

Alan's study showed that 78% of the respondents felt this strategy would be beneficial.

The Macintosh Environment

The many scenarios on the use of CAD in design for the fashion designer are being considered every day as the technology becomes more user friendly and industry specific. The Macintosh operating environment and its use of icon-driven menus rather than typed in commands has become the most popular graphics computer on the market. It comes as no surprise, therefore, that some software developers would prefer the Macintosh for the apparel and textile designer. Several offerings are now available to the designer which run on the Macintosh, and range from personal pattern printing to a fully integrated CAD/CAM system capable of running the top looms and knitting machines in the world.

Andros Software

If you are interested in starting with a very simple package, Andros Software from Moss Beach, CA has devised a program for use with all Macintosh computers which produces a basic bodice from ten body measurements. There is even a tape measure which comes up on the screen duplicating a tape measure in the studio. Once all the basic body measurements have been placed in the SewSoft(TM) Bodice program it will automatically decide how many pages to print out, and each page will be registered to create a precisely-fitting master pattern (sloper or basic bodice) for a blouse, top, or shirt. The SewSoft Bodice also allows the adjustment to commercial patterns to individual shapes, and can be used to modify styles and copy the design of a ready-made garment. The new SewSoft for precise personal patterns for skirts has been released, and plans for pants for both men and women is soon to be released. The program consists of a self booting 3.5 inch Macintosh disk, and a forty page manual. The company welcomes comments on their software. Andros has sold over 300 packages to
schools and universities, and also caters to the home sewing market and the seamstress. However, when it comes to creating fashion for the marketplace the requirements are quite different.

AVL Looms

AVL Looms from Chico, CA, has the advantage of being a company with three divisions which all share their resources and developments. Its Colorado de Haute Tension division is in Paris known for the development of their software Design & Weave(TM). This software, which runs on a Macintosh 512, 512e or Plus, allows you to design fabric and weave the pattern right on the screen. It is set up in an easy to learn sequence of first determining the number of shafts which will be used to create the weave. Up to 63 can be selected. Next the threads are selected, and a pattern of threads is determined. From here a pegplan can be seen on the screen, and any number of types of weaves can be selected such as twills, herringbones, etc. This package is considered the home version; however, where Andros is tailored more for a home user, AVL Looms has graduated into the major leagues with a selection of packages for the most discerning textile designer. The other partner in AVL's arsenal is AVL Limited UK. This division is responsible for marketing its product in Europe as well as the Eastern block countries; AVL Looms in the United States is responsible for North and South America.

Today AVL boasts the newest Textile Design Station, a powerful set of fabric design programs for the Macintosh II, IIX, II CX, and SE series. The system consists of four modules: doby weaves, prints, jacquards, and knits. Resolution is 1024 x 768 and a German Prodrive 40 meg removable disc cartridge is used to store fabric designs. A new addition to the upgraded Design & Weave software called "Weave Painting" allows the designer to simply "paint" weaves on the screen, and the software does the rest. It has its limitations as it will not do complex jacquards; but it will complete about 30 different weave patterns. There is now a new package called "JacqWeave" which generates accurate simulations of the finished fabric on both the screen and the printer. Once these designs are woven on the screen, AVL can then send this information to industrial weaving machines. Fabric is not the only development AVL has perfected. AVL is equally committed to creating reality with color for printed textiles. "MultiColor II" was developed specifically for the Macintosh II series. "MultiColor II" allows importing via a color scanner and printing out a variety of colorways in minutes. Layouts can be in any style of repeat such as half-drops, quarter drops, or even custom drops. It is also possible to rotate, flip, or turn the design in any way you want. This flexibility once experienced allows a designer to explore patterns that would take many hours if done by hand. All programs with AVL use a common Color File system, which allows users to save their own colors by name. It is also easy to mix and match colors with a new color utility program called "Prism." This software allows the designer to see either 64, 144, or 240 shades of any color. Each set of color "chips" can be mixed with either red, green or blue or the light, saturation, or hue can be varied. The physical differences between emitted light (the monitor) and reflected light (the printed page) have been compensated for by allowing the color file to store both values for each color.

AVL has developed the ability to develop yarns, and then design with them. They start with six basic yarn types...i.e. one, two, or three ply yarns, slub yarns, nubb yarns, and blended yarns.

The textile industry is becoming more sophisticated in its use of these software systems. Although older habits are falling away, there will still be a need for skilled and experienced people.

Pointcarre

From Plelan Le Petit, France, comes a unique and very useful graphics and textile design package called Pointcarre, which has gone from the Apple II G to the Mac II. The best way to describe this package is it is fun and very useful in designing different types of jacquards, knits, and a variety of useful graphics for the textile industry. Pointcarre is a clever, space-rulled paper with a series of graphic and textile tools displayed in a column at the right of the screen, that replaces the current menu. This gives the designer immediate access to the tools which are in sight at all times. Grids can be brought to the screen as well as dots for precise registration of a drawing. The software has many different geometric transformations such as rotations and scrollings. Pointcarre acts like a paint system, but there are nuances which are unique. Two such functions are "auto catch" and "pattern step." "Pattern step" allows the traveling of the mouse to be programmed to the format of the current pattern. This is very important in repetitive functions for printed fabrics as well as for wefting, filling, and Jacquard structuring. The "auto catch" function allows the size of the catch to be
programmed according to the size of the current pattern. It allows the automatic catch of a modified version of a drawing without changing its size. This is a fundamental function for rapid modification of the different draft elements of a cloth. With these two functions the basic unit of a repetitive pattern can be captured and displayed rapidly and without any risk of mistakes.

There is also an information board on the screen which displays such things as the width and height of each pattern area, the state of the window, and its size, grid information, and plotter information. These windows can also be closed on the screen. Drawing is then forbidden outside this window. The remaining portion of the screen is thus protected. Designs of any size can then be exactly positioned, vertically or horizontally, for the printer and the plotter.

This combination of graphics and textile design allows a greater sense of freedom for the designer who can freely draw images, and then be able to reduce the drawings and reposition the drawings in a repetitive fashion to see what a complete print would look like. With the Macintosh known for its graphic capabilities I think the Pointcarre system is a natural for an artistically inclined person wanting this sort of graphic and cloth design capability. Where AVL allows the designer to paint and weave, Pointcarre allows the designer to create any graphic and turn that into a variety of weave structures.

ModaCAD

ModaCAD is the first fully integrated apparel design and manufacturing system. It is used both in industry and in colleges and universities. ModaCAD's integrated modules consist of Monach Knitting System (MKS), Design, Textile Design & Textile Manufacturing, Patternmaking, Grading & Marking, Data Management, and three new modules: ModaImage, ModaForm, and ModaVision.

Monarch Knitting System

The MKS system was developed by Monarch Knitting Machines of New York and aids the knit textile designer in the development of knit jacquard, textures, and automatic striped fabrics. These fabrics can be created at the stitch level, one stitch at a time, or by traditional paint and sketch procedures. Since the MKS system automatically converts the pattern sketch into knitting information, manual preparation of graphs is no longer necessary as is the case with all available computerized knitting systems. The MKS system has a fixed library of 50 knit structures and can build more.

MKS offers five distinct methods of registering colors, including the Pantone Matching System, control of red, green and blue values, and CMYK values which are used in the printing industry. The unique features to Monarch are the color outputs. Color registration charts can be printed through a wide range of supported color printers with resolutions of up to 2000DPI (dots per inch) and film recorders to 8000DPI. With this new addition to the ModaCAD system it is now possible to transport knit design over to the grid on a sketch in the ModaCAD design module to see what a knit would look like.

ModaCAD is unique because for the first time the entire pipeline consisting of front end design, project management, and automated manufacturing can now be done with one software package. ModaCAD is also the first fashion software package to integrate text and graphics together, thereby linking all the steps in the design process.

Design Module

The Design module includes the paint and sketch portions so important for quick illustrations. The paint portion has been customized and the palette has all the traditional icon-based paint box tools, as well as modified tools for fashion design. At the top of the tool palette there are two overlapping icons. By clicking on them they change from normal tools to fabric simulation tools. These tools provide a variety of functions specifically suited for fashion designers. Users can call up pre-defined color palettes such as flesh tones, metallics, pastels or can create their own customized palettes. For example by choosing any two colors in the palette one can automatically create a blend. The colors can also be made warmer or cooler, and lighter or darker. These commands are useful to a designer since many of the techniques that are done by hand are incorporated into the software thus making the selection of colors as intuitive as when it was done manually. ModaCAD also utilizes the color wheel that gives a numerical scale so the user can come back to an exact color combination.

The fabric simulation tools in the Design module includes a selection of tools that aids in garment design. One such tool is the Visual Effects command. With this designers can perform many unique functions such as draping, smoothing, outlining, diffusing, and scaling. MODADRAPE is special to the Design module
which has quick editing that allows a designer to select an area and automatically drape it. Draping allows a designer to drape fabric over a form automatically and simulate how a finished garment will look on a live model, accounting for fabric weight, highlights, shading, and folds.

The Fabric Draping command, located in the fabric simulation mode, has many useful features including swatching, cycle color, extra color, fabric effects, and charcoal. With the fabric effect, for example, one can paint with a swatch rather than a solid color. The Dynamic Effect command also in the fabric simulation mode allows the image to be rotated, slanted, or bent. Within the last feature it is possible to bend the fabric in any direction, achieving realistic results. The Fabric Effects command includes functions such as Sunburst Effect, Venetian Blind, Dither, Fade Out, and Dual Blend.

ModaCAD has a scan module which was specifically designed for ModaCAD by a third-party software developer. Users can choose their style of scanning from normal, sharp, exaggerate, and soften. After a fabric swatch has been scanned-in and put into a file the designer can then create a new file and scan in flats from a story board. By using the Macintosh clipboard it is possible to bring in a fabric swatch and fill the scanned-in flats.

Textile Design and Textile Manufacturing Module

The Textile Design and Textile Manufacturing module features on-screen weaving and textile design preparation. The manufacturing and layout plans are generated automatically. The Textile Design modules including virtually all weaves including dobby and jacquard also has the ability to accept scanned input, perform color reduction, and automatically generate peg and draft plans with an unlimited number of harnesses. Variable thread count densities are also adjusted automatically to assure correct sizing. This module also has yarn management, custom color management, and calibration.

Patternmaking and Grading & Marking Module

The new patternmaking module called PAD SYSTEM(c) is referred to as the intelligent based pattern making system and has the capability to utilize body measurement specifications to automatically generate patterns. These measurements are entered on pre-defined basic block patterns which then enables automatic grading and marking. This capability is a far cry from what Andros Software Sewsoft Bodice package will do; but then the price is different as well as the sophistication and needs of the user.

In ModaCAD all the newly input pattern measurements are put in a single file which is compatible with a variety of plotters. ModaCAD can link the design and sketch function with pattern generation by a customized relational database and a customized drafting package. For example it is possible to translate a sketch into a pattern by comparing a new design with a particular block pattern that is stored in a library of over 2,000 images as well as a complete library of fabrics, a fashion history library, and an extensive library of flat block patterns. With Multi-Finder it is possible to have several windows on the screen showing views of sketches, pattern blocks, and even pictures of stored fashions.

To generate a pattern with ModaCAD you can either digitize it, scan it in, or draw it in. One of the best features is having a library of basic pattern blocks and start drafting off of these. This means as you are creating a particular style you can bring up a block pattern and compare it with a sketch using the multi-windowing function. ModaCAD has a grid on screen of 256 small squares which represents the 256 layers associated with construction points on one layer, dimensions on another, cutting lines, and seam allowances all on separate layers. Each time a layer has been used a portion of the grid turns darker. Another tool pattern designers will find very helpful, is the Spline Curve function. This function automatically smooths curves. If, for example, you wanted to modify an armhole, or drop it a little bit, or scoop it out all you do is clip points about the curve and a smooth curved line will follow the points. Then with the delete function the old armhole is removed. After all the necessary changes have been made it can be saved as a group and then as a symbol to bring the modified pattern into another drawing. During the whole process the system prompts the designer on what to do. This file can then be closed out and saved as another basic block. Neat!

The techniques that can be developed on the ModaCAD system for pattern generation is very comprehensive. Every silhouette that is stored in the image library has a block pattern associated with it. So, when you start sketching and making comparisons to the blocks you can then click over to the pattern generation software and estimate where you have to change the pattern to match the silhouette. When designing for a specific manufacturer, just insert the grade rules they use and design within these specifications. After all the pattern pieces have been fully designed and
graded, ModaCAD’s system will then automatically mark these pattern pieces or shuffle these pattern pieces about so it will maximally utilize the fabric. In this case you merely plug in the value for the width of the goods, and the cut amount you are making in the different sizes. The program will give a value for the utilization of the fabric. The program also keeps the pattern from the grain line of the fabric before cutting.

**Data Management Module**

The Data Management module is ModaCAD’s integrated database which automatically generates spec and cost sheets, keeps track of suppliers, and helps estimate labor costs. The program is designed to interface with a variety of database, order processing, inventory, and scheduling systems. This relational database within ModaCAD can be used in many ways. It is designed to link libraries of images, important costing factors on the cutting floor, and the availability of resources. ModaCAD also refers to this as their “Integrated Project Management Software.” Included are a wide variety of standard templates which aid in the access of suppliers, inventories, and even critical path analysis on the production floor. However, a unique aspect of this database is the image and pattern data management. Included are style cards, which help to bring up resources needed for manufacturing. Once a style card is brought up from the image library, you are prompted for the name of that particular style. If you do not know the name, it’s possible to call it up using a two word description. For example, if the style is red you can mention the fabric or the year the style was done. Once a string of style cards is retrieved from the database, the cards will include the name of the designer, the year it was produced, the season style number, and key words for the color and fabric. If you click on any one of these style details such as fabric, it will list all the fabric used in that style. The style cards are flexible enough so that it is possible to add to them for future reference. A user can put a style on the clip board and transfer it to the Design Module for additional changes, as well as matching it to block patterns also stored in the database. This process works even smoother under Multi-Finder.

**Modalmage(TM), ModaVision(TM), and ModaForm**

Most recently ModaCAD has introduced three other new modules (Modalmage, ModaVision, and ModaForm) that will assist the designer. Modalmage is a rendering system which transforms wire frame models into photorealistic 3D images. This module will actually create shading and surface detail combined with texture mapping for representation of complex 3D images. Of interest is the feature “cloth texture” which is capable of simulating the rendering of fabric wrapped around models and includes such features as stretchability, flexibility and transparency.

ModaVision allows the designer to sculpt or drape fabric and visualization of complex 3D surfaces with full depth of vision. A special feature in this module is ModaScope which is a stereoscopic viewing technology providing visual clues to the actual three dimensional structures of the forms. With this module it is possible for the designer to simulate the correct fit of cloth on a form. Now its possible to create models in virtual space and manage these models with life like cloth draped on their form.

The last of these new modules is ModaForm which is capable of providing a direct link from conceptual design models to flat component patterns. Essentially ModaForm flattens the 3 dimensionally sculpted models produced in ModaVision onto flat pattern pieces. This module is important because it links design and pattern production. The special features of this module is that it interprets darts, pleats, and other elements available in a flat pattern system such as ease and seam allowances. This module will also create special construction marks such as notches and drill holes for accurate positioning. Seam lines can easily be changed and if a change is made in one pattern piece it will automatically alter abutting patterns.

**Other Programs**

The Macintosh, as indicated with these dedicated apparel systems, offers the designer new flexibility and ways in executing their ideas. Many apparel software developers are now making available their software for the Macintosh operating system. Computer Design, Inc. from Grand Rapids, MI, well known for their 2D and 3D software running on the Silicon Graphics series, has now made available their Design Concept 2D/PC(TM) Modules on the Macintosh IIX. The exception is the KnitPlus module which still runs on the SG platform. Microdynamics, Inc. from Dallas, Texas uses Time Arts for their graphics portion of the MicroDesign system and is planning on releasing a Mac version of Lumena according to Susan Nigro. At present the MicroDesign files can be converted to a DOS file format readable by the Macintosh.
Since the Macintosh is so easy to use as a graphics tool it also comes as no surprise that a designer also has a variety of software packages which can aid in idea generation especially for fabric and print designs. One package comes from the ARTfactory in Redlands, CA. ARTfactory offers Hi-Tech backgrounds as well as contemporary and textured backgrounds. Although the images at ARTfactory are designed to simplify the desktop publisher's graphic publishing process, these images add another tool in creating fashionable ideas for the marketplace. Fashion not only is clothes, but also accessories which includes jewelry, belts, hats, shoes, and thousands more; therefore, any clip art software packages that have unique images to offer can be a real inspiration to designers.

As the fashion industry becomes more computer literate you will see more and more developers who will tailor their software for this very colorful and lucrative marketplace. Many developers have ignored this rich environment which is design intensive. For now, Andros, AVL, Colorado de Haute Tension, (AVL, LTD. UK), Pointcarre, and ModaCAD have realized this market, and are the present leaders in the Macintosh environment for apparel, textile, and print designs. The future of fashion, fashion accessories, and all beauty related products will take on a new CAD look as designers learn of the new capabilities and innovations they can achieve with their Macintosh. And as the lady said on the latest T.V. cosmetic commercial ..."how's them apples?" (c)1990 wvdb

(Willard Van De Bogart is the principal in the Van De Bogart Design Group. Product development in apparel, apparel accessories, beauty, and cosmetic products are designed using CAD technologies. For more information contact Willard Van De Bogen, 5939 Telegraph Ave, Suite 209, Oakland, CA 94609, (415) 428-9327 MCI E-Mail, 429-6900 or FashionNet)
Computer-Aided Design Applications to Apparel for Special Needs

Nancy Ann Rudd
The Ohio State University

Because of the relative newness of computer applications in the field of textiles and clothing, faculty members need to gain competence in the use of this technology in order to successfully educate today's students and to engage in curriculum development for tomorrow's students. Furthermore, faculty as well as students could find the technology beneficial in the area of research. Computer Aided Design (CAD) is critical to the area of special needs apparel design and can enhance curriculum in the general area of design, whether for special needs audiences or mass markets. The purpose of this paper is to describe the viability of CAD technology in designing apparel solutions for special needs market segments, and to compare this design technology with that of free-hand illustration and production sketching. A secondary purpose is to show how undergraduate students can feed into on-going research projects and gain a working understanding of the importance of market research in the generation of apparel designs.

Background

The term "special needs" refers to a wide variety of individuals who have unique physical, social, and psychological requirements that necessitate specialized apparel. Among such people are women who have undergone mastectomies to combat breast cancer, chemotherapy patients experiencing hair loss, the elderly, and the disabled. Each of these needs groups can be considered a separate market segment because of the specificity of their needs. The scope of this paper does not permit describing each group individually; it will focus on the first two needs groups mentioned here, each of which has been studied in some detail. Breast cancer affects over 143,000 women each year (Cancer Facts, 1989). Mastectomy, the surgical removal of the breast, is the most commonly recommended treatment. The most recommended post-surgery treatment is chemotherapy, even if there is no evidence of cancer spread. Mastectomy has many negative physiological as well as psychological outcomes which occur in various degrees and lengths of time after surgery. Among the physiological effects are lymphedema (swelling of arm on operative side), tenderness, scarring of chest and/or underarm, limited arm movement, and changes in figure balance and posture.

Each year over 300,000 Americans undergo chemotherapy as a means of eradicating cancer cells or controlling the spread of cancer (Spear, 1986). This figure includes patients with all types of cancer. While chemotherapy regimens generally last from six months to two years, their side effects are temporary yet often extreme. One of the most traumatic and obvious side effects is alopecia (hair loss) which is both drug and dose-dependent. Two of the most notorious chemotherapeutic drugs resulting in hair loss are doxorubicin and cyclophosphamide, each causing 75-100% hair loss (Cline, 1984). Because hair is so important in the presentation of self to others, alopecia may dramatically alter one's self-concept, thereby affecting interaction with others at a very critical time in the patient's recovery. If others react negatively to external cues such as appearance, the patient's support system may be weakened (Mulready & Lamb, 1985). If a patient has lost both a breast and her hair, the blow to the body image can be devastating.

Clothing is a significant aspect of each individual's near environment and thus contributes to physical comfort, social acceptance, and psychological satisfaction. Social interaction is the basis on which individuals form a self-image. Social interaction can be hindered or enhanced by appearance cues. Alopecia, often readily seen by others, and the loss of a breast, not so readily seen by others yet still known by others, can hamper the patient's self-confidence as well as her social interaction with others. Standardized ready-to-wear apparel and headwear often fall short of satisfying the functional and psychosocial needs of these groups; therefore, customized apparel design alternatives are required to provide comfortable clothing that accommodates impairments and enhances self-worth. The bottom line is improving the quality of life for individuals by enhancing self-
image and presentation of self to others. Quality of life is an important consideration in an individual's overall satisfaction with life; it influences how comfortable one is with one's self and one's environment, and it impacts on one's ability to cope with adverse circumstances such as cancer or other physical impairments.

Needs assessment data have been gathered through survey questionnaires and interviews for each of these needs groups. Identifying and quantifying the functional and psychosocial needs of each group has resulted in a fairly complete set of criteria for design prototypes. For example, for post-mastectomy women, garment design needs were identified as ease in movement, easy fit with no binding or tight seams to irritate the operative area which might be tender, concealment of any sunken areas due to tissue or muscle removal (neckline and armhole), accommodation of restricted arm movement and edema, and design elements which focus attention away from breasts (Rudd and Dodson, 1985; Meacham, Kleibacker, Pitts, & Rudd, 1986).

Chemotherapy patients experiencing alopecia have identified headwear needs which include comfort, fit, and attractiveness (Johnson, 1989). Commonly identified problems included wigs that were hot, irritating to the scalp, or not well secured. Also cited were dust ruffle caps worn alone and skull caps worn under wigs that were too tight on sensitive scalps; scarves that were cool or clammy and did not stay secured on heads when hair loss was substantial (Rudd & Johnson, 1989).

**Application of CAD Technology**

After identifying design needs in the research projects, prototype design solutions were generated through the design technique of fashion illustration in which garment designs are rendered in great detail using artistic media. These detailed renderings are accompanied by production sketches which further explain fabrication, inner construction, closures, ease, and any variation in fit from one side to another (Rudd, Pitts, Meacham, & Snezek, 1988). Selected renderings for post-mastectomy women have been translated into prototype designs via flat-pattern or draping techniques and construction in fashion fabric; these designs have been evaluated on volunteers for fit, function, and aesthetic acceptability. Headwear designs for chemotherapy patients are currently in the design generation stage.

Over the past four years students in a fashion design course at The Ohio State University have used the research data for post-mastectomy women to design apparel to meet specific needs. For each design project, students completed a collection of 20 thumbnail (brief) sketches that met the identified needs. Next, they selected the three designs that best met the psychosocial, functional, and aesthetic needs of the special needs group and rendered the designs via free-hand illustration in their choice of artistic media (pencil, charcoal, chalk, ink, watercolor). Production sketches were also included. Projects were evaluated on how well the design solutions satisfied the identified needs, how feasible they were to produce, and how well they were rendered technically.

To be successful in apparel design projects for special needs groups, students follow the design process outlined by Watkins (1988) in this sequence:

- **accept** the problem by choosing one of several special needs groups to design for
- **analyze** the problem by using existing research data and gathering any additional information necessary
- **define** the problem by focusing on a particular type of design solution (i.e., swimwear for post-mastectomy women)
- **ideate** by generating as many feasible designs as possible (use of any media including CAD is a motivator)
- **select** the most feasible designs using peer, faculty, and volunteer feedback
- **implement** ideas via analysis of production details and costs
- **evaluate** the success of the final three designs in group discussions of how well they meet psychosocial, functional, and aesthetic needs.

Because some of the identified needs for each special needs group are so individualized and because standardized apparel production is not the answer in meeting these individualized needs, computer-aided design has been explored over the past two years as a viable alternative in designing apparel solutions. This technology is highly efficient in the last four steps of the design process above, particularly in the ideation and selection
stages. Garment designs can be modified easily on screen, requiring less time to generate many feasible designs and accommodating maximum variation in figure specifications for any one special needs group. For example, many similar yet individualized designs can be drawn for post-mastectomy women who have different functional limitations and figure specifications due to surgery as well as posture. Students are able to illustrate via computer and generate numerous variations (thumbnail sketches) for one particular type of garment such as swimwear or evening wear. Mastery of drawing with a light wand or mouse takes considerable practice and is much different than drawing with conventional artist’s media. Some students prefer this design technology to free-hand illustration, particularly with respect to storing all design ideas in the memory for eventual modification; others opt for the free-hand illustration as a design technology.

The IBM personal computer accommodates different types of software which facilitate apparel design by the illustration technique. What follows is a description of the CAD technology as presently being used at Ohio State to generate apparel designs for special needs audiences and a comparison of the CAD technology with free-hand illustration and production sketching.

**Microsoft Paintbrush**

Initial design generation was accomplished on an IBM-PS 2 (Model 30-286 with 1028 KB) with Microsoft Paintbrush software, a mouse and/or light wand. Using the draw command and selecting one line width from 10 increments, one can draw on a table top or on a rubber mat with the mouse or light wand. Any number of colors for both background and foreground and a total of 16 drawing functions can be selected on screen, including free-hand drawing, arcs, geometric shapes, straight lines, and spray paint. Color can be changed as one draws; pattern can be selected from two pre-designated patterns on screen, drawn free-hand or with the various box/circle functions. The *window* function may be used to enlarge and correct specific portions of the design. Designs may have accompanying production terms and details typed alongside via the type or manuscript function. Designs are saved for later modification and printing via the ink-jet plotter or thermal printer.

The light wand was found to be somewhat similar in function to a pencil and, therefore, transference of skill came quicker using this medium than when using a mouse. However, for both the mouse and light wand, it took several hours of practice to gain beginning proficiency in drawing with the hand on the table and ones eyes focused on the computer screen. It was essential that students already be proficient in free-hand illustration and in addition, that they have a steady hand and a smooth rather than sketchy drawing style for the most professional results. Students learned to draw one basic silhouette and add smaller-scale variations right next to it on one fashion plate. If the concentration was on swimwear styles, for example, several neckline or strap variations for the same suit could be added on-screen simultaneously. Students also enjoyed changing coloring on-screen which enabled them to show several color stories for one line of apparel. It is important to point out, however, that not all colors appearing on screen could be printed due to printer technology, a direct function of printer cost. Exact color matching is possible, but such printers are extremely costly.

**Microdynamics**

The other software that has been explored is the Microdynamics Apparel Design System, Model 50, Version 3.06, which has much more sophisticated drawing capabilities and is also much more costly than Microsoft Paintbrush. Using the pen function, one chooses line size and colors of background and foreground in much the same manner as with the Paintbrush software. Using a light wand on a data tablet, one draws, again choosing from similar drawing functions as with Paintbrush. It is possible to choose from pre-designated patterns, copy in textile prints, or design original textile patterns in any color, scale, and repetition; the mirror function allows the printing of mirror images of any motif. Fabric pattern or print generation is much easier with the Microdynamics system since one can use any of these functions rather than laboriously draw prints to scale with the Paintbrush. Further, the light wand is more precise, which permits drawing with a finer line and greater scale precision, particularly for minute details. Accompanying production details can easily be sketched alongside or typed in using the keyboard. Designs can be stored temporarily for later modification and eventually saved. While 256 colors can be seen on the screen at one time, only 124 can be printed using an ink-jet printer. Thus, it is necessary to *assign* each color on screen to the one closest to it on the master list of colors the printer can produce, a time consuming task for an elaborately colored design.
Conclusions

Both the Microsoft Paintbrush software and the Microdynamics Apparel Design System are viable software alternatives for designing apparel for special needs groups. Students and faculty initially spend much more time designing via CAD than designing via free-hand illustration, primarily due to the start-up time involved in developing the hand/eye coordination necessary with CAD. It is a challenge to most students to look in one direction while drawing in another, unlike free-hand illustration where one looks directly at what is being drawn. The sense of having control varies between the two design technologies, in that the student usually thinks that he or she is in control of the media when free-hand illustrating, yet often feels the medium (computer) is "in control" when using CAD. This feeling may dissipate once CAD mastery is gained.

It is imperative that students understand fashion illustration techniques prior to designing "on-screen"; no amount of effort can compensate for a poorly drawn, ill-proportioned figure. Even to enter a basic fashion figure into the computer's memory which can then be called up as a "croquis" on which to design garments requires skill in drawing body balance, proportions, and musculature in interesting action poses. Students also need a thorough understanding of garment fit, style details, and fabrication to be able to render their designs successfully, whether via CAD or free-hand illustration. Ideally, students have completed a beginning aesthetics course (including color, texture and pattern, styles and apparel production terminology), an apparel fit and construction course, a pattern-making course (either draping or flat-pattern), and at least one course in fashion illustration. In addition, students need to have studied the psychosocial and functional clothing needs of mass markets as well as segments of the special needs market.

In the four years since engaging in this learning strategy, students report being both thoroughly challenged in designing for special needs groups and being satisfied with the results of their projects. The CAD design technology is a viable option to free-hand illustration in the design generation process, and is to become more fully integrated into the design program at The Ohio State University. Computer-Aided Design Technology and Apparel for Special Needs are two senior level courses which are slated for development over the next three years. These are both design practicum courses which will be built upon a foundation of coursework in aesthetics, psychosocial and functional needs, apparel design and illustration, and pattern making. A future phase will include patternmaking with CAD in order to compare CAD techniques with flat-pattern and draping techniques in the production of prototypes garments.

Through these analytical design projects students are exposed to research regarding specific market segments. Students use this research to develop design solutions and can thus see firsthand how research and development together help answer real-life questions and needs. Perhaps this early involvement will prompt students to make significant contributions, once in the work force, toward improving the quality of life for all people. By studying both CAD and free-hand illustration design technology, students will be better prepared to enter the industry and bring design solutions to life.

References


Pattern Alterations with AutoCAD

Nancy H. Steinhaus
Western Michigan University

The apparel industry is computerizing for design, pattern development, marker making, and grading tasks; consequently, many manufacturers prefer entry level employees to have computer experience. One way to assure students of adequate CAD exposure prior to graduation is to offer various experiences in existing classes throughout the student’s academic career. CAD experiences are relevant for the following subject matter areas: apparel design, illustration, analysis, construction, and flat pattern.

Pattern alterations are an appropriate introduction to CAD as part of a basic construction class. The objectives for introducing CAD at this level are to: 1) build a foundation of apparel-related experiences early in the academic career; 2) stimulate excitement for experiences to come in future classes; 3) compare computerized technology with traditional manual methods; and 4) begin to prepare students for entry level employment.

A project was undertaken to develop numerous tutorials to teach students apparel-related computer applications using AutoCAD software. Tutorials focus on specific commands that can be applied to apparel tasks. A simple step by step tutorial involving common alterations to a rectangular pattern piece is offered here. This exercise involves three skirt alterations: lengthening, increasing width, and decreasing width. Two different AutoCAD commands, OFFSET and STRETCH, are used to add length showing that sometimes more than one AutoCAD command can be used to complete a task. Choice of command depends on desired efficiency, user preference, and the nature of the task. The exercise was developed on IBM compatible hardware. A keyboard and either a mouse or puck and tablet are necessary. AutoCAD Release 10 is the software. Schools of Engineering and Architecture utilize this equipment and might share facilities if requested. A disk with two rectangular skirt patterns is needed. The file used here is named "A:2skirtbk" (located on the A drive). Use "B:2skirtbk" if using the B drive.

The user needs to be aware of the following terms before beginning the tutorial on the next page.

**Pointing device or pointer** - a mouse or puck for drawing and selection.

**Underlined words** - to be typed by the user.

**ENTER (all CAPS)** - press the ENTER key on the keyboard.

**Pick** - Move the pointer to the line or command option to be selected and enter the selection by pressing the appropriate button on the mouse or puck.

1. Load AutoCAD. Select 2 "Edit an EXISTING Drawing" from the Main Menu and ENTER.

2. Enter name of drawing: Type A:2SKIRTBK and ENTER.

   Two identical skirt backs will appear on your screen.

3. Lengthen the skirt on the LEFT two inches.
   At Command: Type OFFSET and ENTER.

   Offset distance or Through < >: Type 2 and ENTER.

   Select object to offset: Pick the hemline. See the "O" in Fig. 1.

**Lengthening A Pattern Piece Using Offset and Extend**

![FIGURE 1](image)

Side to Offset: Pick a point below the hemline. See arrow in Fig. 1 above left.

Select Object to offset: Press ENTER.

4. Center back and side seam lines must meet new hem.
   Command: Type EXTEND and ENTER.

   Select boundary edge(s): Pick the OFFSET hemline.

   Select objects: See 1 in Fig. 1. Dotted lines replace originals.
Select objects: 1 selected, 1 found
Select objects: ENTER
Select object to extend: Pick sideseam near hem. See 2 in Fig. 1.
Select object to extend: Pick CB seam near hem. See 3 in Fig. 1.
Select object to extend: ENTER and note extended lines.

5. To complete the task, remove the original hemline.
Command: Type ERASE and ENTER.
Select objects: Pick the original hemline.
Select objects: 1 selected, 1 found.
Select objects: ENTER.

6. At Command: Type REDRAW and ENTER to remove '+' marks.

Lengthening a Pattern Piece Using STRETCH

1. During this exercise work on the pattern on the RIGHT.

   FIGURE 2

   At Command: Type STRETCH and ENTER.
   Select objects to stretch by window.
   Select objects: Type C and ENTER.
   First Corner: Pick the first corner location below and left of skirt hem. See Fig. 2.
   Other Corner: Pick other corner up and right. See Fig. 2. Lines become dotted.
   Select objects: ENTER since selection is completed.

   Move the crosshairs to the top of the screen. A word list will appear.

   Pick TOOLS. A new list will appear.

   Pick ENDpoint. A small box will center on the crosshairs.

   NOTE: ENDpoint "grabs" the precise end of a line to continue a drawing or to locate an exact location to execute a procedure.

   Base point: ENDpoint of... Pick the lower left skirt corner.
   See Fig. 3 below.

   FIGURE 3

   New point: Press the F8 key until <Ortho on> appears on the prompt line. ORTHO moves only vertically and horizontally.

   Pick a new hem location down 2 grid rows. Lines are elongated. Press F8 <Ortho off>.

Increasing and Decreasing Width of a Pattern Piece

1. You will now change the width of the waist and hip area making the waist smaller and the hip larger.

   Continue working on the skirt on the RIGHT.

   At Command: Type OFFSET and ENTER.
   Offset distance or Through < >: Type .5 and ENTER.
   Select object to offset: Pick sideseam (see "O" in Fig. 4 illus. #1).
   Side to Offset: Move to the RIGHT of the sideseam and pick it. See #1 and #2.
   Select object to offset: Pick hip curve (see "O" in Fig. 4 illus. #3).
   Side to Offset: Move to LEFT of the hip curve and pick it. See #3 and #4.
   Select Object to offset: Press ENTER.

2. At Command: Type ZOOM and ENTER.
   All/Center/Dynamic...../Window....
   Type W (for window) and ENTER.
   First Corner: Pick the first window corner as shown in Fig. 5. The top of the vertical sideseam lines must be included.
   Other Corner: Pick the other corner.
3. A close-up of the upper skirt appears. See Fig. 6. Although not apparent, a space occurs between the OFFSET hip curve and waistline at the arrow. Extend the hip curve so that the two lines meet.

4. It is necessary to remove the excess waist length.

Command: Type TRIM and ENTER.

Select cutting edge(s)...Pick OFFSET hip curve.
Select objects: See #2 in Fig. 6.
Select objects: 1 selected, 1 found.
Select objects: ENTER.
Select object to trim: Pick between the 2 hip curves. See #3 in Fig. 6.
Select object to trim: ENTER.

5. At Command: Type ARC and ENTER.
Pick the TOOLS option and ENDpoint.
Center/<Start point>: Pick top end of the new hip curve. Old hip curve must NOT be in the box. See Fig. 7 illus. #1 below.

Center/End/<Second point>: Pick old hip curve about halfway down the curve. See Fig. 7 illus. #2.

Pick TOOLS and ENDpoint.
Endpoint: ENDpoint of... Pick the top of the OFFSET seamline. The old seamline must NOT be in the box. See Fig. 7 illus. #3 above.

6. To complete this task, remove the OFFSET hip curve, the original hip curve, and the original side seamline.

Command: Type ERASE and ENTER.

Select objects: Pick the OFFSET hip curve. See #1 in Fig. 8.
Select objects: Pick original hip curve. See #2 in Fig. 8.
Select objects: Pick original sideseam. See #3 in Fig. 8.
Select objects: 1 selected, 1 found.
Select objects: ENTER. See Fig. 8 for completed hip curve.

7. At Command: Type ZOOM and ENTER.
   All/Center/Dynamic/Extents/Left/Previous, etc.:
   Type P and ENTER.

8. The skirt hemline must be extended to the new sideseam.
   Command: Type EXTEND and ENTER.
   Select boundary edge(s). Pick sideseam close to hem.
   Select objects: 1 selected, 1 found.
   Select objects: ENTER.
   Select object to extend: Pick hemline close to sideseam.
   Select object to extend: ENTER

9. Your skirt back pattern pieces are complete.
   Command: Type END and ENTER. This saves your drawing and returns you to the AutoCAD Main Menu.

10. Exit the AutoCAD Main Menu by typing 0 and ENTER.
AutoCAD in the Curriculum: Pre-Production Design

Diane Knoll
Colorado State University

New advances in technology are changing the way textiles and garments are designed and manufactured all over the world. Using computer technology, companies have the potential of increasing productivity 400% (Kosh, 1988). Computer aided design (CAD) is one of the methods used in the product design phase which speeds up the pre-production process. Apparel companies are negotiating orders based on computer print-out drawings instead of actual sample garments (Van De Bogart, 1988). Because of the lower cost of a drawing compared to a sample garment, retailers have more options in their choice of style lines (Ihow, 1987). This increase of options as a result of technology is a manifestation of Naisbett’s observed trend toward “multiple options” from an “either/or” perspective (Naisbett, 1984).

To stay abreast of these changes in apparel design and production which have been brought about by the use of computer technology, a growing number of college apparel design programs include CAD instruction. In a course designed to teach pre-production design techniques using a CAD system at Colorado State University, it was found that students greatly improved their ability to draw the fashion figure. The software used in this instruction was AutoCAD version 10; the hardware used at each work station was an IBM compatible AT computer with a 40 megabyte hard disk, 80287 math co-processor chip, an EGA monitor, graphics tablet, electronic stylus, and a standard dot-matrix printer. Students printed out all of their assignments during the semester.

The main objective of the course was to learn the CAD drawing and editing commands used in the making of drawings for pre-production design/style boards. Five projects were designed by the instructor to teach the drawing and editing commands; each project assignment was accompanied by a tutorial. The projects gradually increased in complexity and degree of difficulty as the students gained CAD proficiency during the course of the semester. Students were encouraged to bring reference materials (books, fashion magazines, fabric samples) to class for use as sources of inspiration for their design projects.

In the first project the students developed one each of four fabric designs: stripe, plaid, paisley, and figure/ground done in this order. Each design was then rendered with felt-tip pens in four different color versions for each of the fabric design types.

To design a stripe pattern students were encouraged to use the line command; however, several students arranged shapes in a linear pattern which created an interesting variation of the traditional stripe. In creating the plaid fabric design, students used the line command, and were encouraged to vary the interval spaces between the lines in both warp and weft direction to create visual interest. The paisley fabric design required the combined use of the line and arc commands to create one or two paisley shapes. These shapes were then multiple copied, scaled and rotated to create visual interest and the illusion of variety. Many students worked from samples of paisley fabric to replicate interesting paisley shapes.

In the first three fabric designs, the students were given design parameters within which to work (stripe, plaid, paisley). In the fourth fabric design the students were required to create a figure/ground combination, in which the figure could be whatever the student wanted to work with (geometric, floral, ethnic). Examples from the Historic Costume Collection were used by some of the students for sources of inspiration. The concept of scale became an issue in this part of the instruction, in that there needed to be a visible size difference between figure motif and ground pattern in order for the viewer to discern which was which. The concept of shape was also an issue. The students worked with the outer configuration of the figure shape to determine the optimum appearance of variation in design repetition (using rotate and multiple copy). It was apparent to the
instructor that the learning challenge presented to the students was two-fold: learning a software command structure while simultaneously wrestling with design as a problem solving process.

In the second project the students designed a logo which required conceptualizing an idea in graphic terms. To do this they chose a category of clothing, researched a target market, price point, and activities in which the apparel would be worn. Next the students designed a computer generated logo which expressed an identifying theme or concept of a company manufacturing the chosen category of clothing. Students would use the logo on a business card and hangtags or labels for the clothing. To do the logo applications students had to become adept at using the text as well as the drawing/editing commands of the software. Some of the students took the print-outs of the hangtag and business cards to Kinko's, had them copied onto card stock, and selectively applied color to the images using traditional media.

In the third project the students were required to draw three fashion figure croquis: female, male, and child. This instruction combined the methodology used by Tate and Edwards (1987) in their book The Complete Book of Fashion Illustration with tutorials developed by the instructor. Tate uses a lined grid system to provide a framework for locating the various parts of a fashion figure. Using the layer command in AutoCAD it was possible to have this framework present while drawing the figures. Students drew and edited, comparing what was on their computer screen to what they saw in the text, until they were satisfied with the appearance of the fashion figure. The fact that students were able to make many revisions before they had a drawing on paper (hard-copy) appeared to be a factor in the high quality of the drawings. This assignment was thought to be very difficult by the students, but by the time they had completed the figures they were fluent with the drawing and editing commands plus were able to use the layer command. In addition, it appeared to the instructor that the students had improved their understanding of human proportion and scale during this exercise.

In the fourth project the students created a graphic image data base of apparel parts in multiples of five: five collars, bodices, sleeves, skirts, and pants. Each apparel part was drawn over the croquis using the layer command; by using this method the parts are easily interchangeable, and they are automatically drawn to the scale of a fashion figure. Using the apparel parts the students were required to design six complete outfits. Embedded in this exercise is the discovery of the time savings that can come out of an apparel parts data base.
The final project in this course required the students to use all of the skills developed in the previous four assignments. Students do the research to create a logo for a company; design a line of six garments which expresses the company's concept; design the fabrics for the line; and render a minimum of two designs into four color ways using traditional media.

The function this course serves in the curriculum is two-fold: literal pre-production design skills are developed, and transferable skills in computer technology are simultaneously learned. Evaluation of student work is based on original solutions to design problems, and on the quality and clarity of their drawings. These projects make a significant contribution to the students' design portfolios.

References


Overcoming Problems in Apparel Drafting Using PC Pattern

Isabelle M. Lott and George E. Lott
Pattern Works

The introduction of the personal computer into the apparel pattern drafting process has generated a new set of problems for the pattern drafter. The extent to which these problems can be appropriately dealt with at the university level will assist the garment industry in capitalizing on the elements of efficiency and accuracy which are inherent in computer-aided design.

This paper identifies five common problem areas indigenous either to the concept of computer-aided design, or to the nature of a particular piece of CAD software when it is adapted to the garment-design process:

1. What You See is not Always What You Will Get
2. Grading Distortions
3. Slow Processing Speed
4. Repetitive Tasks
5. Measurement

The proposed solutions to these problems are based on the application of PC PATTERN™ in conjunction with AutoCAD® on an IBM-compatible 286 hardware system, and are the result of the application of these pieces of software in a commercial setting. Each of these problems relates to the speed, accuracy and efficiency with which a garment can be drafted.

PROBLEM #1: What You See Is Not Always What You Will Get

The screen of the monitor for a computer system is relatively small in comparison to the size of the completed garment pattern. This means that the size of the pieces on the screen is so small that it is difficult, if not impossible, to detect flaws unless the drafter were to zoom in tightly on each and every area when a potential flaw might occur. Doing so is impractical, not to mention inefficient. Flaws which fall into this category are:

1. Unconnected or Hyperextended Lines: lines which do not connect, and/or lines which extend beyond their intended connecting point.
2. Jagged Curves: kinks, or small imperfections, in curves.
3. Askew Symbols: symbols which are improperly placed on lines.
4. Loss of Linetype Variation: linetype variations which cannot be translated to the final pattern.

Unconnected or Hyperextended Lines

It is very difficult, if not impossible, in most circumstances, to start a second line exactly where a first line ended: the monitor will not provide enough detail, and the human hand cannot be held still enough to permit such precision. However, AutoCAD’s OSNAP (the shortened version of Object Snap) OVERRIDES commands, used in conjunction with the drawing commands, will guarantee the necessary degree of precision. In pattern-drafting, the CENTER, ENDPoint, INTERsect, MIDPoint, NEArest, NODE and PERpendicular commands are used most frequently. The sequence used is (1) pick the appropriate drawing command, followed immediately by (2) the appropriate OSNAP OVERRIDES command, and then (3) draw.

Lines may also be disconnected if the seamline of a garment is a combination of lines and/or arcs, which have not been joined to make a polyline. Each of these individual lines and/or arcs will offset to the outline as separate entities, and the result can be overlaps or gaps. By using the JOIN POLYLINE command, each seamline will be a unit, but the best way to avoid the problem is to use the POLYLINE command when making seamlines which are combinations of lines or lines and arcs.

Jagged Curves

Imperfections in curves occur most often when the curve was drawn, or digitized in, using straight line segments without the FITCURVE command. (See Fig. 1.) Under most circumstances, the PEDIT command can be used to move the polyline vertex which is causing the distortion. However, when possible, the PLINE
command, in conjunction with the ARC portion of the PLINE command, should be used to make the curved parts of the line, as opposed to fitcurving straight line segments. (See Fig. 2.)

Askew Symbols
Symbols will not sit properly on the pattern if they were placed without the use of OSNAP OVERRIDES NEARest to command in conjunction with the placement of the symbol. PC PATTERN's LOCATE SYMBOL command amalgamates several AutoCAD commands, making symbol placement a less complicated exercise.
Symbols can also be skewed during the grading process. Solutions to this problem are set forth below under Problem #2: Grading Distortions.

Loss of Linetype Variation
If a polyline is composed of too many pieces, i.e., it has too many vertices, linetype variation will be imperceptible: dashed lines, dot-dashed lines, etc., will all appear to be continuous lines. This can happen if a curve is created in small increments, or if a polyline is repeatedly fitcurved in an effort to get it right. In order to respond to the user's demand for precision, AutoCAD makes each polyline segment smaller and smaller, until the point is reached where the distance between vertices is too short to allow for linetype variation.
The problem can be solved by redrawing the polyline with a different colored layer. Use the PLINE command, along with ARC, to generate the curved segments, taking care to create as few vertices as possible to shape the line. When the line is completed, erase the bad line, and change the remaining line to the layer upon which the rest of the pattern resides. If the project is finished, and there is no intention of any future editing, the RESTORE POLYLINE LINETYPE command can be used to change the polyline to its designated linetype. This command breaks the line into tiny segments, however, making additional editing and grading impossible.

It is good practice to run a test plot in at least half-scale, in order to identify these problems prior to grading. Corrections will have to be made on only one size at this stage.

PROBLEM #2: Grading Distortions
Grading the pattern may cause a distortion of polylines, as well as some displacement of symbols. Grading does not distort lines and arcs, it simply stretches them, but polylines, especially those with short segments, are distorted when grade lines intersect them. To reduce, if not totally eliminate, this problem, polylines should be drafted in ways which will generate as few vertices as possible, and arcs should be used to create necessary curves. The process appears to be cumbersome at first, but practice permits the creation of the right shape with surprising speed, and it will greatly reduce time spent editing after grading is completed. (See Figs. 3, 4 and 5.)

Grading through diagonal lines and arcs can misappropriate symbols. However, careful planning can eliminate the problem. Symbols should not be placed on diagonal lines, if at all possible. If the pattern demands such placement, the symbols should be placed as far away from the potential grade lines as possible, and grade lines should be drawn through the straightest part of arcs.
One might inquire as to the rationality of placing symbols prior to grading, if there is a possibility of truncating the location of the symbols. In practice, the vast majority of the symbols placed before grading will be transferred to subsequent layers accurately, and experience indicates that it is more efficient to correct a few misplacements than to wait and place many times more symbols than originally necessary.

**PROBLEM #3: Slow Processing Speed**

Regardless of hardware configuration and software, the more complicated a given drawing file, the longer it will take the computer to process the information. With AutoCAD and PC PATTERN, drawings that have several pattern pieces, in five or more sizes, start to slow the performance of a 286-computer, especially during the regeneration process. With drawings of over 300,000 bytes of data, regeneration can take three minutes, or more, as the ZOOM process is activated. While this might appear to be a problem, many technical writers forgive AutoCAD because of the tremendous benefits which result. Given these benefits one must question the purchase of additional software which would claim to eliminate the regeneration process.

The slowing of the processing speed as drawing files increase in size can be reduced by making some adjustments in software, as well as by paying attention to the sequence in which some tasks are performed.

**Software Adjustments**

1. Turn the REGENAUTO command OFF. This option permits an avoidance of regeneration, or permits the option of avoiding regeneration with the zoom commands by choosing a less radical zoom.

2. Use the SAVE VIEW command to set up windows around the drawing. In a typical pattern, each pattern piece would be a separate window, and the assembly of all of the pieces would be a window as well. By using the RESTORE VIEW command, it is possible to zoom to an individual pattern piece, or all of the pieces, while avoiding regeneration most of the time.

3. Set VIEWRES to 1000 for optimal speed. The pieces of a pattern are usually large enough so that this setting will not seriously distort the on-screen appearance. If greater resolution is desired, increase the VIEWRES setting, keeping in mind that processing speed is inversely proportional to resolution.

4. Freeze the FILL layer so that all symbols will be open, rather than filled. This saves regeneration time, obviously, but it will also save time while generating test plots. The FILL layer can be THAWED prior to plotting the final pattern, if necessary.

5. Choose simple font styles for labelling. Triplex and duplex fonts are the most complicated, and, therefore, will have a negative impact on regeneration time. PC PATTERN has preselected three fonts: TXT is the fastest; ROMANS is simple and less computer-generated in appearance; ROMAND is the simplest duplex font to use for emphasis.

**Recommended Task Sequence**

1. The base size (0 layer) of the pattern should be drafted on the seamline, and errors and imperfections should be corrected before
proceeding any further. Problems which are not corrected at this stage will be passed on to the cut line, and on to all additional sizes, creating a magnified editing problem. Use PC PATTERN’s ALIGN TO GRID command to place all pattern pieces precisely on the vertical or horizontal. The SNAP command will insure that adjoining pieces are positioned exactly parallel one to another. This will provide a visual check as well as making design line and symbol placement easier.

2. Seamlines should be offset to the cutlines, and corners should be finished with the FILLET command for lines and arcs, and the SEAM FILLET command for any line to be joined to a polyline. Seamlines should not be extended to the cutlines. (See Fig. 6.) Doing so consumes time and interferes with line measurement checks, discussed in more depth under Problem #5: Measurement.

3. Symbols should be placed on seamlines and cutlines in such a way as to avoid the places where grading lines are apt to be placed. Symbols should be placed on the base layer, prior to grading, so that they will be copied with each successive grade to its own layer. Placing symbols on the base layer eliminates the necessity of placing each set of symbols on each successive grade.

4. Once the base layer has been completed, it should be copied to a layer with the appropriate size designation. For example, the 0-layer might be copied to layer 10, followed by freezing the 0, or base, layer. Proceeding in this fashion will keep the original copy of the pattern in tact, so that it can be recovered should the drafter desire to make after-the-fact changes. It should be noted that even the most accomplished pattern drafter can commit errors while grading, and many times it is easier to start over than to attempt to correct mistakes. The unblemished 0-layer pattern is a welcomed security blanket.

5. Grade the pattern. If seamlines are not required on the final pattern, they should be erased before beginning the grading process. The seams have been saved on the Base Layer, and the drafter can return to this for alterations, if necessary.

6. The sizes which are necessary to make the marker should be copied to the FABRIC layer, and the FABRIC layer should be frozen. If a pattern is particularly complex, causing significant delays, remove the marker pieces to another drawing, using the INSERT or WBLOCK command.

7. The pattern should be labelled, and the grainlines should be inserted, using the TEXT layer. If the hardware is seriously sluggish at this point, all size layers but the smallest and the largest should be turned off before labelling. Text, on its own layer, can be used for any and all sizes.

8. Linetype variations used for size differentiation should be the last step before the plotting, because linetypes other than continuous require significantly more regeneration time. Linetype variations require more plotting time as well, but they are necessary even for the test plot in order to determine if polylines have retained the assigned definition. Prior to the test plot LTSIZE (Linetype scale) should be set to a fraction of .5 or less for optimal results with garment patterns.

9. Thaw the FABRIC layer and freeze all other layers in order to create the marker or layout. The calculation of yardage, as well as the printing of the markers, is more efficient if the work is done in full scale. If a pattern consists of a large number of sizes the limits on-screen will have to be increased.

**PROBLEM #4: Repetitive Tasks**

Task repetition is unproductive, inefficient and boring. On the other hand, each drawing will require repetition of such tasks as labelling, setting up size layers, color layers and linetype layers, and drafting pockets, zippers, plackets, etc.
PC PATTERN has set up a prototype drawing with the several settings adjusted to the needs of garment pattern drafting. These settings can be changed at the outset of a project, and such changes will reduce repetition as the project progresses. For example, if the company involved, either as operator of the system or as client, uses a particular size range, these sizes should be installed on the LAYER menu in the prototype drawing, as well as layer color designation and linetypes for each size. Change the limits for the screen size, if a given pattern is quite small or quite large, in the prototype drawing as well.

If the pattern drafter uses several sets of size ranges for a variety of clients, each should have unique layer setups. To deal with this problem, the drafter should create individual drawings for each size range and assign a separate layer and color to each size. These drawings can be inserted into new drawings, and layers will be automatically established.

A similar process should be used to simplify labelling. A prototype label drawing, containing appropriate fonts, spacing and ancillary information, should be established. (See Fig. 7.) This drawing can then be imported into the current drawing when it is time to label the pattern pieces. Once the drawing is inserted, use the PC PATTERN EDIT TEXT command to change the style number and name to the current drawing, followed by the COPY-MULTIPLE command to put a label on every pattern piece. The label on each pattern piece can then be edited to the requirements of each piece. The label can be scaled down to fit on smaller pieces, but the parameters of the plotter should be kept in mind as this reduction takes place. Fonts should not be scaled to less than 1/10", if the plot is being drawn by a .3mm felt tip pen, or a .5mm drafting pen. Font sizes between 1/4" and 1/2" fit best on pattern pieces, and this size range will plot quicker than larger sizes.

Design enhancements which are regularly used, such as pocket treatments, zipper flys, collars, cuffs, etc., can also be placed on individual drawings and imported into the current drafting project. Treating these design elements in this way will save the time involved with redrafting the elements each time they are required. After importation, the only additional work required will be the editing of a portion to fit the current project.

Finally, the drafter should resist the temptation to make separate facings and lining pieces before the pattern is completed to the stage of adding cutlines and symbols. Once the pattern has been brought to this stage of completion, the pattern can be copied, and the parts unnecessary to the facing or lining can be erased. Simple editing can make facings and linings larger or smaller. All cutlines and symbols will be exact replicas or those common to both pieces, and they will not have to be redrawn on the new piece.

**PROBLEM #5: Measurement**

Computer-aided Design forces the pattern drafter to adjust to a new perception of size, and, in so doing, CAD demands familiarity with new measuring techniques. The traditional ruler and French curve ultimately will have little, or no, use when using a computer to draft a garment pattern. However, PC PATTERN has provided a collection of familiar drafting tools which can be brought up on-screen to assist in the transition process.

The AutoCAD DISTANCE command only measures the distance between two points on a straight line, and the MEASURE command only determines an increment, or series of increments, from the endpoint of a line. The DIMENSIONING commands can also be used to determine the length of a line. The LIST command provides a veritable compendium of information, such as the layer upon which a line is located, the coordinates of all of the vertices, their length and area, as well as the angle and slope of the line.

PC PATTERN provides a series of commands which allow for the types of measurements most required by pattern drafters. By simply touching a line LINE LENGTH will calculate the length of a line or polyline, and SUM LINE LENGTHS calculates the cumulative length of a number of lines, both curved
and straight lines. CHANGE LINE LENGTH adjusts the length of all types of lines. LOCATE SYMBOL places symbols, or breaks a line, at a specified distance, or distances, from the end of a line.

The use of these commands is straightforward and direct. The problems in their use will not arise until the drafter adjusts from working in full scale, as was the case with pencil and paper, to the significantly smaller scales of computerized drafting. In the initial stages of conversion to CAD, the drafter must also be constantly aware of the fact that the computer only does what it is told to do. It will not do what the drafter is thinking.

To short circuit some of these transitional problems there are several drafting techniques which should be employed. Seamlines should not

be extended to cut lines. (See Fig. 8.) If one tries to measure the length of a seamline extended to cutlines, the measured length will be between the cutlines, and the drafter will have to subtract the seam allowances, something which is easy to forget as one is learning CAD.

Dart and tuck lines should be extended to the cutlines, however, for ease of marking, but the seamlines should be erased between these lines so that the dart/tuck depth will not be calculated in the seamline length. Caplines, hiplines, and centerlines should be drawn between seamlines so that they will reflect the dimension of the finished garment, without including the seam allowances. (See Fig. 8.)

As is the case in traditional drafting, it is still more efficient to draft adjoining garment pieces parallel to each other and parallel to the grain, represented by the grid on the computer screen. (See Fig. 9.) However, the process of creating this parallel state is different. Once the pattern has been digitized into, or drafted on, the computer, and the direction of the grain has been established, the pattern pieces can be oriented to the grid and to each other. PC PATTERN's ALIGN TO GRID command rotates each piece to the appropriate vertical alignment. The AutoCAD MOVE command, used in conjunction with SNAP, brings matching corners of one piece into parallel horizontal position next to the adjoining garment piece. Without measuring the drafter can visually determine if adjoining seamlines are of equal length, and symbols can be placed precisely opposite one another to insure a perfect match.

The AutoCAD OFFSET command is a very valuable measurement and drafting tool for apparel design that does not have a manual drafting counterpart. OFFSET allows the drafter to duplicate the precise shape of a seamline at whatever distance away from the seamline the drafter requires. The value of this command for seamlines and hemlines is obvious, but the command also has a role in the design of facings. It can be used to establish a distance from a line so that necklines, yokes, etc., are much easier to design, and OFFSET can be used to draft pieces like waistbands that require line markings at centers and sides. (See Fig. 10.) In the process of creating these markings the length of each pattern piece can be checked.

Summary And Conclusion

The creation of a computer-aided drafting software program for the garment industry, be it in a commercial or educational setting, attempts to
replicate the principles and processes of traditional, manual flat-pattern drafting, in a high-tech environment. Many of the tasks and techniques have computerized equivalents. In some situations, however, portions of the drafting process have had to be rethought so that the computer can process information as efficiently as possible.

1. Polyline vertices are the invisible points along a polyline which define that polyline.

2. PC PATTERN requires the following hardware items to operate:

   1. A 286 or 386 IBM compatible computer.
   2. At least 1 meg of RAM.
   3. A 40MB hard drive.
   4. A math coprocessor.
   5. A VGA or EGA monitor.
   6. A 12"x12" digitizer tablet or mouse.
   7. A 24", 36" or 45" plotter with roll fee. The plotter should be capable of printing a plot longer than 48".

Software requirements, in addition to PC PATTERN, are as follows:

   1. AutoCAD 10.0.
   2. MS-DOS 3.30 or higher.

The following items make for a more efficient system, but are not critical:

   1. A 3'x4' digitizer tablet.
   2. A floppy disk file server.

PC PATTERN is available from Pattern Works, 307 Lakewood, SE, E. Grand Rapids, MI 49506.

For the accomplished pattern drafter, the transition from manual to computerized garment drafting can generate problems which can slow the learning curve and generate needless frustration. This paper has identified five sets of these problems, and has proposed steps which the drafter can take to solve the problems, facilitate learning the software and minimize frustration. Generally speaking planning, and careful thought about what one is trying to accomplish, will minimize most problems which might develop. 2

References

Fane, Bill (1990, May). The learning curve. CADalyst, pp. 77-80.

Customizing AutoCAD for Apparel
With ApparelCAD Software

Phylis Bell Miller
Mississippi State University

More and more apparel manufacturers are taking advantage of computers for sketching, pattern making, grading, and marker making. While only large companies could once afford these systems, AutoCAD® software makes the same advantages available to smaller firms. When used in combination with ApparelCAD™ software, AutoCAD performs many of the same functions as computer systems costing as much as 20 times more.

ApparelCAD, which was developed solely by a design instructor, was also designed as a low-cost alternative for educational institutions. Being sold for less than $500, it is now being used by more than 21 institutions, including universities, junior colleges, design schools, and secondary school systems, as well as by manufacturers, such as L & H Technical Services.

Using ApparelCAD for Fashion Illustration

To streamline fashion illustration, male and female croquis figures of various sizes are stored within the system. They are displayed in icon menus, from which they can be brought to the screen instantly. After sketching a garment on the croquis figure, the designer can delete the parts of the body that would not be visible beneath the clothing. (See Figure 1.) Special ApparelCAD macros that automate breaking, trimming, and erasing simplify the process. The addition of hatch patterns that represent fabrics makes the drawings more realistic.

ApparelCAD gives designers the additional advantage of sketching in full scale. While the croquis figures can be printed or plotted to fit paper of any size, they are actually life-sized. As a result, the designer can use AutoCAD's dimensioning commands to check and record the exact size and location of yokes, pockets, hemlines, and other details. These commands also allow the designer to quickly add notations, measurements, and directional arrows to sketches for spec sheets.

Using full-scale croquis figures also makes it possible to eliminate some pattern-making steps. Appliques are especially easy to create with ApparelCAD. They can be copied directly from the garment illustration, scaled to various sizes, and separated into pattern pieces. A marker can then be made and the pieces cut without drafting a separate pattern. Patterns for pockets, yokes, and other details can be made in the same way.

Apparel industry professionals feel that ApparelCAD has many possibilities as a sketching tool. "The illustrations are so precise that they could be faxed along with the dimensions directly to the manufacturer," says Coty Award-winning designer Jon Haggins. "Garments could be produced directly from the sketches, which would be excellent for anything done from specifications," he comments.

Figure 1
Shirt-Waist Dress Used for Demonstration
Copyright 1990 by Phylis Bell Miller
Simplifying Pattern Making With ApparelCAD

ApparelCAD enables designers to work more efficiently and in a smaller space than the average workroom. It contains basic slopers for Misses' sizes 6 through 16 as well as for other size ranges, releasing valuable workroom space once needed to store slopers and patterns. The slopers can be recalled instantly via screen or tablet menus.

The program reduces start-up and development time by making it possible to eliminate several patternmaking steps. The pattern maker no longer needs to create trial patterns in quarter- or half-scale. He/she makes each pattern full-scale and instructs the computer to plot or print it in the desired size. Because all modifications are made on one pattern, potential errors in transferring information from one pattern to another are eliminated.

ApparelCAD contains several commands that simplify pattern making. Being written with AutoLISP, AutoCAD's special programming language, these routines execute several AutoCAD commands and make calculations instantly. They also eliminate confusion by prompting users for information in terms related to apparel.

The process of shaping and drawing darts requires the use of at least 16 different commands and settings. ApparelCAD's MDART command performs all of the necessary commands and automatically changes the settings. It also saves and restores settings that were in use before the start of the command.

Drawing and spacing overlaps, buttons, and buttonholes require several commands, settings, and calculations. The BUTTON and LBUTTON commands draw buttons of any width according to either their diameter or line size. Other commands, such as TBUTTON and OVERLAP, use the button's diameter or radius to position and draw the topmost button and the overlap.

The buttonhole commands, including LBHOLE, RBHOLE, and VBHOLE, compute the correct length for and draw horizontal and vertical buttonholes. They also mark the button position. The BPLACE command draws and spaces the desired number of buttons and buttonholes. Other ApparelCAD commands add seam allowances, join open corners, and perform similar patternmaking functions. (See Figure 2.)

For ease in labeling and marking the pattern, the program contains menus with preset text styles as well as ready-made labels, such as "Cut 1" and "Lengthwise Grain." The Symbols menu includes notches, drill-hole markings, dots, and other

frequently used items.

Drafting With ApparelCAD

ApparelCAD streamlines drafting by enabling the draftsperson to combine and even eliminate steps. The software manual explains how to simplify the drafting process and contains instructions for drafting specific patterns. (See Figure 3.)

A special menu holds the commands and macros most frequently needed for drafting. They perform such functions as making multiple copies of an object and slashing seams at a midpoint or intersection. Other menu items display icons that insert L-squares, French curves, and other drafting equipment. Although drafting can be performed without these tools, they are included for persons who feel more comfortable using them.
Grading and Making Markers with ApparelCAD

The ApparelCAD manual explains and illustrates how to grade any pattern quickly and easily according to the operator's own set of grade rules. Throughout the process, the pattern remains in one piece. The grading menu contains a special lesson on grading as well as the needed commands and settings. If the grader uses dimensioning to label the pattern before grading it, he/she can check the measurements for accuracy as the work progresses: the measurements are set to change instantly as the seams are lengthened or shortened, providing immediate feedback.

ApparelCAD's ready-made markers and marker menu make it possible to create markers of any width and length. Depending on the size of the plotter, the marker can be plotted full-scale or in miniature, in which form it acts as a guide for layout.

Personalizing the Computer System

Special add-on, custom menus enable even persons with limited experience with AutoCAD and no knowledge of programming to personalize their own systems. They allow the user to add new slopers, symbols, croquis figures, and other items to the menu without having to modify it.

Each menu item is preset to insert a block or drawing with a generic name. When the designer or pattern maker creates a new item, he/she assigns it one of the names on the menu. When that item is picked from the menu, it recalls the block with the same name. To replace an existing block with a new one, the designer simply renames or deletes the old block and assigns its name to the new block.

Getting On-Line Help With Apparel Features

ApparelCAD provides two kinds of on-line help. AutoCAD's help file has been expanded to include information about all of the new commands. In addition, it explains the macros that appear in many of the menus. Instructions on how to use other new features are also included.

Slide lessons are one of ApparelCAD's unique features. Each one explains how to perform a particular technique, such as rotating and shaping darts or grading patterns. When 'Lesson' is selected from the menu, it activates an automatic slide program that contains illustrations and instructions. When the operator divides the screen into two viewports, he/she can view the slide lesson on one side and perform the process on the other.

The ApparelCAD manual contains the information included in both the help screens and the slide lessons. It also provides complete information on installation and the program as well as helpful suggestions and troubleshooting hints. The extensive glossary defines terms found in the AutoCAD commands and manual, including scientific and mathematical terminology.

Making AutoCAD Easier to Use

To make AutoCAD's regular features available at all times, the ApparelCAD menu has been added to the AutoCAD master menu. This is especially important on systems that are shared among two or more departments. In addition, most of AutoCAD's menus have been expanded to include commands and macros that designers and pattern makers use frequently. For example, the MEASURE, DIVIDE, and CHANGE commands have been added to the pull-down and ApparelCAD
tablet menus. Several more options for viewing the drawing are located in the Display pull-down menu.

The tablet menu, which fits on the digitizer surface along with the AutoCAD template, provides instant access to the new screen, pull-down, and icon menus. It also contains macros, some of which split the screen into two viewports, activate the text editor, and display the disk directory. The template’s large cells allow users to make selections quickly. Because the tablet menu is integrated with AutoCAD, it requires no installation; it is ready for use as soon as it is placed on the digitizer.

To increase the operator’s efficiency, ApparelCAD also augments the functions performed by the buttons on the mouse or puck. AutoCAD provides functions, such as turning the grid on and off, for up to 10 buttons. ApparelCAD adds another six functions, including zooming in and out, redrawing the screen, snapping onto endpoints and intersections, and displaying certain menus.

ApparelCAD’s prototype drawing, on which all new drawings are based, is set up especially for apparel and reduces start-up and preparation time. It contains such conveniences as present text styles and layers, the architectural units system, a 24” by 16” work area, and dimension settings appropriate for patterns and fashion illustrations.

Almost everyone forgets the content of a particular drawing at some time. To allow users to quickly determine the content of each drawing, the END command has been redefined to make a slide of the screen. It assigns the slide file the same name and stores it in the same drive and directory as the drawing. By opening only one file, the operator can use the “View Slide” feature to view the contents of several drawings. This feature is a valuable time saver when working with large drawing files, which take considerable time to open. During class sessions, it allows the instructor to review each student’s drawings quickly.

**What Equipment Is Required For ApparelCAD?**

ApparelCAD works along with AutoCAD software of Release 10 or higher. It operates on IBM compatibles but is being modified for AutoCAD on the Macintosh. Any system that can use AutoCAD Release 10 can also support ApparelCAD.

The general requirements for AutoCAD 10 are at least one megabyte of RAM (random-access memory) and a math coprocessor. If possible, more RAM is preferred for faster operation. For adequate disk storage space, a hard disk with a capacity of 20 megabytes or more is suggested. The ApparelCAD files require about 1.5 megabytes of hard-disk storage space. The program is supplied on high- or double-density 3.5” or 5.25” floppy diskettes.

For the greatest ease in working with any CAD software, the larger the monitor and the higher its resolution, the better. A 16” or larger color monitor with resolution of 1024x768 pixels per inch or better is recommended. Having a larger monitor makes it easier to work on small details. The higher the resolution, the smoother and more accurate the appearance of the drawing on the screen. Having a color monitor makes it possible to take advantage of color for coding and for aesthetic reasons; it also makes working with CAD more enjoyable.

When plotting patterns, size is the most important factor. A plotter that uses paper 48” or wider is the best buy. One that uses several paper sizes – from A to E – is suggested. A roll-feed attachment is a helpful addition to the system. It can make plots of any length, making it helpful for plotting markers.

Those who do not have a large enough plotter can use plotting services which are often listed in the back of computer magazines. Hardware or software dealers can usually recommend a plotting service.

To check the work for accuracy before plotting, an ordinary graphics printer is recommended. Using a dot-matrix or laser printer can save time and resources before one plots a full-scale pattern or marker.

To use existing paper patterns, slopers, or drawings with ApparelCAD, an input device such as a digitizer or a scanner is needed. Digitizers also offer the ability to use a tablet menu. AutoCAD and ApparelCAD both have templates that can be attached to the digitizer’s surface. This device gives the operator another means of invoking commands and is especially helpful to non-typists.

A scanner can instantly copy a drawing into AutoCAD, saving the time and effort involved in calibrating the digitizer and inputting each point on a paper drawing. However, it is extremely important to purchase a scanner that allows the user to edit the drawing. Some scanned images cannot be changed in any way once they are in the computer.

Using a mouse or a puck, which comes with a digitizer, is the easiest way to draw, edit, and select items from screen, pull-down, and icon menus. Otherwise, the operator must use the
cursor keys on the keyboard, which is a slow and difficult process.

It is prudent to purchase a mouse or puck with as many buttons as possible. A mouse can have up to three buttons, while a puck may contain as many as 16 buttons. With every additional button, the user gains additional functions that make drawing and editing easier and faster.

Getting More Information

To inquire about the software, updates, and workshops, contact Phyllis Bell Miller, the developer and distributor, at P.O. Box 2883, Mississippi State, Mississippi 39762-2883. (601)323-1411. Please include area code and phone number with written inquiries.
This paper describes Cadterns, a computer assisted system using Lotus 1-2-3 and AutoCAD, for the drafting of adult female sewing patterns needing no or minimal alterations for fit. It has been developed as third-party software for AutoCAD to be used as an educational teaching aid to eliminate the cumbersome mathematics involved in the custom fitting of student slopers, thus freeing the instructor and students to focus on the creative tasks of fashion design and patternmaking.

The first patterns available in this system are basic slopers to be used as tools for manually altering other patterns, or for styling new garments using flat pattern design techniques, either manually or at the computer. Lotus 1-2-3 and AutoCAD are required for drafting the sloper and either AutoCAD or AutoSketch can be used for further styling. Whether used in self-directed or teacher-directed study, these slopers are a valuable tool.

The slopers being described differ from most traditional basic patterns in the following ways:

They are drafted for height as well as circumference variations

Dart points and dart circles are clearly marked at each dart location

Straight grain lines are strategically placed as perpendicular and parallel reference lines

All ease allowances are relative rather than absolute, thus allowing more ease for large figures and less for small

Ease allowances within each sloper can be changed according to fashion or preference and then previewed on the monitor before plotting the final draft.

Using this system, patternmaking is addressed as both a science and an art:

**SCIENCE of patternmaking:**
measurements are used directly to draft the pattern and indirectly to calculate the ease variables included

a Lotus 1-2-3 spreadsheet converts the input measurements into a set of points, lines, and curves in the form of a set of input commands for a CAD system

an AutoCAD computer program takes these input commands and plots the individually drafted slopers on a computer monitor, a computer printer or a drawing plotter.

**ART of patternmaking:**
flat pattern design can be applied to the AutoCAD drawing using AutoCAD editing techniques to develop patterns for other styles

at a less sophisticated level, custom slopers drafted by AutoCAD can be imported into AutoSKETCH (very user friendly) for applying flat pattern design techniques.

Slopers and patterns can be drafted in any scale (depending on the hardware used): half or quarter scale for use in study, documentation and practice, and full scale for use as patterns.

**Pattern Cuts**

The current range of patterns includes four basic slopers: skirt, bodice, sheath, and blouse. Still under development is a sloper for the pant. All of the patterns are available in two types of cut: Standard and SUPERIOR. The third cut, SIGNATURE Cut is expected by July, 1992. This variety in pattern cuts allows for a variety of figure types.

All patterns are individually drafted according to specific circumference and length measurements: Standard Cut patterns have predetermined measurements, much the same as
traditional patterns available through pattern catalogues. The circumference variations used are: bust, waist, and hip. The length variations are: shoulder, back waist length, mid-shoulder to bust point, shoulder to elbow, elbow to wrist, waist to hip, and hip to knee. Further measurements required for the pant sloper will be: crotch depth (rise), crotch length, and knee to floor.

Figures 1 and 2 are the size chart and corresponding measurement chart respectively as applied to Standard Cut sizes.

To choose a Standard size, select a height from the A - E rows, then a circumference from the 1 - 5 columns. For example, a tall and slender person who is 5'9" and generally wears a size 10 would choose D from the height rows and 2 from the circumference columns, thus requiring a Standard size D2 pattern.

Superior Cut slopers are drafted according to individual circumference and length measurements. Further customizing alterations required will be minimal, but may be necessary for asymmetric figures, atypical posture, or major figure irregularities.

The Signature Cut, still under development, will accommodate more severe figure abnormalities or more exacting fit and will require that measurements be taken by a qualified professional. It will have fewer automatic default values to determine the shape of the pattern drawing and will not assume that the figure is symmetrical.

Which cut do your students require? Much depends on the level of study being pursued and the teaching style of the instructor. In general, the more fitted the style, the more customized the sloper must be. Also, as the figure ages, it goes through a variety of changes, some predictable and some not. Generally speaking, the Standard Cut is appropriate for the youthful figure and loosely-fitted styles. The Superior Cut accommodates the fitting needs of most symmetrical figures fitting into a traditional pattern size range of 6 - 24. Finally, the Signature Cut will deal with the particular needs of a specific figure, even if it is asymmetric or of unusual posture.

Drafting the Sloper

Data Input

Information specific to the sloper to be drafted, the cut desired and the figure measurements of the user is required. A Lotus 1-2-3 spreadsheet guides the user through this process by asking questions and y/n (yes/no) acknowledgements of changes, allowing for corrections. If a Standard Cut is selected, most of the input information will simply be the acceptance of default values. At the end of the data input, the user is asked if the default ease allowances are to be altered and, if so, considers them individually. A rough drawing of the pattern then shows on the monitor to allow the user to check for incorrect data entries. Should any major irregularities show on the monitor, the user can review and re-enter data at this point. If it shows the appropriate shapes for the major pattern pieces, the user continues to enter data for another sloper pattern or exits Lotus 1-2-3 and moves to AutoCAD.

Pattern Drawing

When sloper data input is complete, information is imported into the appropriate AutoCAD drawing by entering a SCRIPT command and naming the Lotus 1-2-3 file which holds the pertinent information. The drawing then shows on the screen as it will be drafted by the graphics printer or plotter, including all extra pieces (such as collar and cuff, markings (such as grainlines and dart circles) and facings. To output the drawing to a graphics printer or plotter, the command PLOT or PRPLOT is entered. There follows a series of questions allowing for some options (such as scale) in the hard copy of the pattern drawing. The drawing is then sent to the graphics printer or the plotter.

Figure 3 shows an overlay of 3 Superior Cut skirt sloper patterns for the same figure using different amounts of ease, all with a common center back line. The innermost pattern has 0” of ease, the middle pattern contains the default amount of ease, and the outermost pattern shows ease equal to double the default amount.

To keep the pattern pieces from the clutter of too many words, lines are drawn in specific styles and/or colors to indicate specific usages. (See Figure 4.)

Figure 5 shows a Superior Cut blouse sloper for a fashion doll overlaying a Standard cut size C3 blouse sloper in the same scale, with a common centre back line. This demonstrates the comparison between a custom pattern and a pattern for a Standard size selection.

Pattern Information

The logo with information regarding the pattern, user or size, date, and pattern piece appears on every sloper pattern piece. Measurements used to draft each pattern appear on the pattern front. (See Figure 6.)
<table>
<thead>
<tr>
<th>circumference:</th>
<th>6-8 very small 1</th>
<th>10-12 small 2</th>
<th>14-16 medium 3</th>
<th>18-20 large 4</th>
<th>22-24 very large 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>height:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>149-155cm very short 4'10 1/2&quot;-5'4&quot;</td>
<td>A1</td>
<td>A2</td>
<td>A3</td>
<td>A4</td>
<td>A5</td>
</tr>
<tr>
<td>156-163cm short 5'1 1/2&quot;-5'4&quot;</td>
<td>B1</td>
<td>B2</td>
<td>B3</td>
<td>B4</td>
<td>B5</td>
</tr>
<tr>
<td>164-170cm average 5'4 1/2&quot;-5'7&quot;</td>
<td>C1</td>
<td>C2</td>
<td>C3</td>
<td>C4</td>
<td>C5</td>
</tr>
<tr>
<td>171-178cm tall 5'7 1/2&quot;-5&quot;10&quot;</td>
<td>D1</td>
<td>D2</td>
<td>D3</td>
<td>D4</td>
<td>D5</td>
</tr>
<tr>
<td>179-185cm very tall 5'10 1/2&quot;-6'1&quot;</td>
<td>E1</td>
<td>E2</td>
<td>E3</td>
<td>E4</td>
<td>E5</td>
</tr>
</tbody>
</table>

Figure 1 Standard Cut Size Chart

<table>
<thead>
<tr>
<th>CIRCUMFERENCES</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 bust</td>
<td>29.3</td>
<td>32.6</td>
<td>36.0</td>
<td>40.3</td>
<td>44.6</td>
</tr>
<tr>
<td>2 waist</td>
<td>22.3</td>
<td>25.7</td>
<td>29.0</td>
<td>33.3</td>
<td>37.7</td>
</tr>
<tr>
<td>3 hip</td>
<td>31.3</td>
<td>34.6</td>
<td>38.0</td>
<td>42.3</td>
<td>46.7</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>LENGTHS</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
</tr>
</thead>
<tbody>
<tr>
<td>4 shoulder</td>
<td>4.4</td>
<td>4.7</td>
<td>5.0</td>
<td>5.4</td>
<td>5.7</td>
</tr>
<tr>
<td>5 back waist length</td>
<td>14.9</td>
<td>15.7</td>
<td>16.5</td>
<td>17.3</td>
<td>18.0</td>
</tr>
<tr>
<td>6 shoulder-&gt;bustpoint</td>
<td>8.9</td>
<td>9.5</td>
<td>10.2</td>
<td>11.0</td>
<td>11.8</td>
</tr>
<tr>
<td>7 shoulder-&gt;elbow</td>
<td>13.0</td>
<td>13.8</td>
<td>14.6</td>
<td>15.4</td>
<td>16.1</td>
</tr>
<tr>
<td>8 elbow-&gt;wrist</td>
<td>7.5</td>
<td>7.9</td>
<td>8.3</td>
<td>8.7</td>
<td>9.1</td>
</tr>
<tr>
<td>9 waist-&gt;hip</td>
<td>8.1</td>
<td>8.6</td>
<td>9.0</td>
<td>9.4</td>
<td>9.9</td>
</tr>
<tr>
<td>10 hip-&gt;knee</td>
<td>12.8</td>
<td>13.4</td>
<td>14.0</td>
<td>14.7</td>
<td>15.4</td>
</tr>
</tbody>
</table>

Figure 2 Standard Cut Measurement Chart in Inches
Figure 3  Fashion Doll Skirt Slopers with Variable Ease

Figure 4  Explanation of Line Types

<table>
<thead>
<tr>
<th>.legend.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stitching</td>
</tr>
<tr>
<td>Grainline</td>
</tr>
<tr>
<td>Marking</td>
</tr>
<tr>
<td>Options, changes</td>
</tr>
<tr>
<td>Facing</td>
</tr>
</tbody>
</table>
Flat Pattern Design

Flat pattern design techniques can be manually applied to hard (oak tag) copies of the finished sloper in small practice scale or full pattern scale.

Alternatively, flat pattern design techniques can be applied to the custom sloper directly on the computer. This can be accomplished by editing the AutoCAD drawing with AutoCAD drawing commands, or by importing the AutoCAD drawing into AutoSketch. The AutoSketch editing environment is considerably less intensive, thus more user friendly. Likewise, any software package developed for patternmaking could be used for editing the sloper once the AutoCAD drawing of the sloper has been imported. Editing is greatly facilitated by the use of a pointing device, such as a mouse. The edited pattern can be sent to the plotter or graphics printer when complete.

Teaching Applications

These slopers are intended for instructional use in the classroom or as a tool for a self-initiated independent study of patternmaking using a tutorial. With the first alterations already made by the computer, the patternmaking student is able to progress more rapidly to the task of translating sketches and ideas into patterns, eliminating much of the burden of mathematical calculation and application.
The slopers under discussion become useful teaching and learning tools on several educational levels, from the less complicated entry level to the sophisticated professional training level. At each level, the student is encouraged to start with the skirt, as it is the least complicated of the slopers. Once patternmaking confidence has been gained with the skirt, the techniques learned can be transferred to other slopers and expanded. It should be noted that these patterns include minimal assembly instructions and as such are not intended for independent use by beginner sewers.

Entry level students would benefit from use of the Standard Cut, the most economical and uncomplicated in terms of sophistication of hardware and support software requirements. The Standard Cut sizing provides slopers appropriate for loosely fitted styles which serve well for the study of simple changes, including dart manipulation and conversion and finishing details. The teen years are presumably not the time for the figure study required to make extensive alterations to slopers, as the teenage figure is still in a stage of metamorphosis from child to adult, and is bound to change significantly within the next few years. It is recommended that the skirt and blouse slopers be used at this early learning stage as these slopers allow for immediate application of styling techniques with minimal technical patternmaking expertise.

Intermediate and advanced patternmaking and design studies traditionally use a skirt and bodice sloper, both available in this system. Using SUPERIOR Cut or SIGNATURE Cut slopers allows for effective separation of the studies of fit and of style. The process currently under development is for pattern manipulation, using flat pattern design techniques, to be merged with custom sloper information, resulting in a custom fitting pattern of original design.

Recreational course students are typically more interested in immediate application of patternmaking information than in studying fit or patternmaking as academic subjects. People who love to sew often regret their dependence on traditional patterns but lack the confidence generated by training or experience to eliminate a need for patterns. These students can benefit enormously from using a SUPERIOR Cut or SIGNATURE Cut sloper as a tool for styling garments with flat pattern design techniques, or for altering other patterns to personal measurement specifications. Using a custom sloper, recreational students can indeed enjoy immediate application.

As different levels of teaching and learning require different pattern cuts, different pieces of hardware and software are required. (See Figure 7.)

The sloper patterns are currently available to the home sewer. The publication will be a spiral bound 8 1/2" x 11" booklet of approximately 25 pages containing information about custom slopers plus introductory information on how to use a custom sloper for flat pattern design or pattern alterations. The Introductory Tutorial being prepared for the home sewer will include information from the publication.

The Student Tutorial will be available on floppy disk and in soft cover with plastic spiral binding. It will be useful for independent study or as a supplement to classroom teaching.

All software has been developed as add-ons to AutoCAD or AutoSketch as itemized in Figure 7. Cost of software as listed in Figure 8 will range between approximately $750 and $2000.

In the future, software will become available at non-educational prices to manufacturers for custom work use and to fabric retail outlets for custom pattern retail. This will enable today's student a familiar work environment as tomorrow's professional.

KEY: # = Hardware  o = Software

Superior Cut patterns:
- IBM PC compatible personal computer, min. 512 RAM, 2 floppy disk drives or 1 floppy + 1 hard disk drive, math co-processor recommended
- High resolution monitor
- Mouse recommended for pattern sizing
- Graphics printer for 1.44, 2.3, 3.5cm. disk patterns, or
- Flat plotter with optional color pens, (green, blue, red, yellow, color) for full color
- MS-DOS or PC-DOS 2.0 or higher
- AutoSketch version 2
- CATHERS Standard Cut software

Superior Cut patterns:
- Computer, monitor, mouse, and printer or plotters, as above
- Math co-processor
- Lotus 1-2-3 Release 2.2
- AutoCAD Version 10
- CATHERS Superior Cut software

Signature Cut patterns:
- Computer, monitor, mouse, printer or plotter and math co-processor, as above
- Lotus 1-2-3 and AutoCAD as above
- CATHERS Signature Cx software

Patternmaking Tutorial:
- Computer, monitor, mouse and printer or plotter, as above,
- Math co-processor optional but recommended
- AutoSketch Version 2
- CATHERS Standard Cut, SUPERIOR Cut or SIGNATURE Cut software
- CATHERS Patternmaking Tutorial

Figure 7. Hardware and software requirements.
Lotus 1-2-3 is a registered trademark of Lotus Development Corporation.

AutoCAD and AutoSketch are registered trademarks of Autodesk, Inc.

**Standard Cut, SUPERIOR Cut, and SIGNATURE Cut** are trademarks used by CADTERNS Custom Clothing Inc. CADTERNS is a trademark (registration pending) held by Lauraline M. Grosenick. (Patent pending.)
Computer Applications in a Merchandising Curriculum

Jeanne R. Heitmeyer
The Florida State University

Computer experience is an integral part of the merchandising curriculum in the clothing, textiles and merchandising program at Florida State University. The objectives of integrating computer applications into the student's education are to provide knowledge of hands-on computer skills, computer terminology, evaluation of computer software and hardware, systems analysis, and information management.

Computer experience is gained throughout the curriculum as follows. An introductory computer course, Introduction to Computers in Home Economics (2 semester credits) taught by a merchandising faculty member, includes the latest available software and is a requirement for all students in the college. The text used for this course is Computing by Stern and Stern (1990). Students complete assignments using the following software: Word Perfect 5.0, Lotus 1-2-3, Lotus 1-2-3 Graph, and dBase IV. The course is organized into lecture and lab components.

Students are first introduced to DOS (Disk Operating System) commands. Assignments included are formatting, copying, and deleting files, and other general file management commands. The next step of the course is to introduce word processing. Students complete a Word Perfect 5.0 tutorial included in the text and then compose an essay on their experience and impressions of computers which they enter and print.

Spreadsheets are the next software used. Lotus 1-2-3 and Lotus 1-2-3 Graph tutorials are the learning activities used in lab, with students producing a personalized energy audit spreadsheet at the conclusion of this section. Database management systems, using dBase IV, are then taught with students producing a short database on customer credit limits. Lecture also covers other types of software such as desktop publishing, project management, and integrated packages. During the final two weeks of lab students run eight or more different types of software, including home economics and general programs, which they evaluate for quality and effectiveness. During this time students are exposed to actual software they will encounter when entering their chosen careers.

The final learning activity which synthesizes knowledge gained in the class is a systems analysis. Each student describes a situation in their chosen field that would be more efficient with computer automation. For example, a merchandising major could select inventory control or the six-month merchandising plan to automate via computer. The computer system is planned by the student to meet this need, complete with a detailed list of hardware and software chosen with justifications.

Hardware is discussed in lecture including the three components of the CPU (Central Processing Unit) -- control unit, arithmetic-logic unit, and primary memory. Terms such as RAM (random-access memory), ROM (read-only memory), floppy disk, hard drive, microchip, bit, byte, and ASCII are defined. Input and output devices are listed and defined. Actual hardware parts of the computer are passed around for class study. Data communications and networks are used for examples for class so the student will gain knowledge of digital and analog transmissions, modems, and configurations and types of networks.

Hardware used for this class is determined by the requirements of the software selected. IBM or IBM compatible microcomputers with 640 K RAM with one 5 1/4" or 3 1/2" floppy with hard-disk drive plus IBM or IBM compatible (as Panasonic or Citizen) dot matrix printers meet these requirements. Computers used in this class are IBM PS-2, Model 30's with IBM dot matrix printers.

Merchandising Math Computer Experiences

Computer knowledge is continued in the merchandising program by incorporating computer class assignments as a portion of class content. Merchandising majors enrolled in Merchandising Mathematics complete a detailed CAI (computer assisted instruction) tutorial on average markon programmed by this author. Examples covered include five different types of average markon. Specific problems include

1. figuring the markon on the remaining planned purchases at retail needed to obtain an average markon on total merchandise handled for a particular period, (2) calculating markon needed on
a purchase when retail price of the purchase and cumulative markon for period are planned, (3) figuring markon desired on a purchase when cost value of the purchase and average markon for purchases for that period are already planned, (4) calculating amount of additional purchases that should be made to obtain a planned average markon when retail value and markon of previous purchases are known, and (5) figuring amount of additional purchases that must be made in order to achieve a planned average markon when cost value and markon on past purchases are known (Corbman, 1985).

This CAI program was developed by the instructor because students were experiencing difficulties learning the many different types of average markon problems. The CAI lesson shows an example problem of each of the five types and then gives two practice problems for students to work on each section. A post-test is given at the end of the computer application program. Student post-test scores are totaled for student and instructor information.

Students in the class also complete a computer assignment using a profit/loss statement. Students enter various dollar figures for net sales, cost of goods, and direct and indirect expenses. They see the value of the computer's instant, totally accurate computation which will serve as a valuable tool in their future career as retailers. Students analyze these printouts produced to determine the best projected figures for a retail store.

**Computer Use In Merchandising Buying**

Merchandising students enrolled in Merchandising Buying complete a computer assignment in which they generate and print several merchandising plans. These merchandising plans are examined for store profit, distribution of sales by month, and cost of goods. Students choose the best plan for their projected retail store.

This program was developed by the department and uses a standard Visicalc spreadsheet. A standard spread sheet such as Lotus 1-2-3 may be used for these merchandising math and buying assignments. They will run on a 512K RAM IBM or IBM compatible microcomputer.

Merchandising students gain valuable computer experience through this integrated curriculum. Each student learns basic computer operations, terminology, and software through completion of the introductory computer course. Computer experience is furthered by adding software components as a part of both the merchandising math and merchandising buying classes which are core requirements for all merchandising students. Merchandising graduates will be prepared to generate, understand, and analyze computer printouts, evaluate software suitability, and assess hardware needs. Through this computer knowledge students will be prepared to make a valuable contribution to the field of merchandising.

**Note.** For further information on computer program content or availability of programs in this paper please contact: Jeanne R. Heitmeyer, 301 Sandels Bldg., Florida State University, Tallahassee, FL 32306

**References**


Computer-aided Experimental Learning for Visual Merchandising: Using AutoCAD for Retail Store Planning, Layout, and Design

Carol E. Mehlhoff
University of Nebraska

Introduction

Change is a constant in the retail environment. Bowser (1983) indicated that one of the changes of contemporary design education distinguishing it from that of the past, stems from the belief of Gropius that students thoroughly understand what they discover for themselves. Schroeder and Gentry (1987) discussed the value of computer-aided experiential exercises not only as an enjoyable and realistic stimulus for learning, but also as a laboratory for the application of information taught elsewhere.

Merchandising students may be exposed to computer-aided experiential learning approaches by using spreadsheet software programs for planning departmental open-to-buy figures to develop their business skills. Rarely, however, is the same pedagogical emphasis put on developing the store layout, design, and product placement skills which are so essential to the successful merchandising professional. Many specialty retail firms as well as chain stores send suggested store layouts to each store location for merchandising placement and display areas bi-weekly or monthly. It is critical that students in merchandising have opportunities to develop their analytical skills to place goods in relation to the most productive selling space within a designated store area.

Future scenarios may include holographically designed store environments. The potential for computer-generated holography in design is tremendous (McLain-Kark & Rawls, 1988). If future computer-aided design systems could generate a three-dimensional hologram of a store or interior space, the merchandise manager could experiment with different schemes for the placement of goods and various merchandising arrangements while "walking through" the simulated environments. Visual merchandising displays could be planned and generated on the computer. The planned display could be viewed in a three dimensional holograph and changes or corrections made prior to installation. Merchandising students with a background in store layout and design will be better prepared for such future developments in computer-aided design, as well as developing analytical skills through the use of currently available systems.

This paper discusses a computer-assisted approach to help students develop retail management and product placement skills needed in the merchandising profession. The experiential learning project was designed for the computer so that students could develop either a department within a store, or a small specialty store of their choice. Objectives included:

1) developing student skills using computer-aided design and drafting for store environments

2) developing team-building skills and

3) preparing students to assume the responsibilities of management positions as they explore multiple solutions in the analysis and placement of merchandise and display areas for optimum sales.

Background of the Project and Student Survey

The computer-aided experiential exercises were developed for students enrolled in Visual Merchandising. The class is taught at the undergraduate level at the University of Nebraska, and is required of all merchandising majors. In addition, interior design students elect the class.

A survey was conducted early in the semester to assess computer skills of students in the class. The students showed a wide variation in computer experience. Of students enrolled for the fall semester, approximately 21 percent had no computer experience. Experience ranged from one computer class in basic programming in high
school to a limited number of students who had one CADD workshop, used spreadsheet programs, or used some form of wordprocessing.

An additional problem in the development of the project was the labor intensive aspects of teaching Computer-Aided Design and Drafting (CADD) to students. Students need 250 to 300 hours of work on the computer to develop CADD proficiency. Much of this training is through one-on-one instruction or small group demonstration. Consequently instructor’s time limitations often mandate that only senior level or graduate students are provided with CADD training.

To solve the problem of the labor intensive demands of CADD, five of the most computer-proficient students were selected for advanced CADD training by the class instructor. These student leaders were then each responsible for teaching three to five of their fellow students in a team-oriented approach. A sign up sheet was rotated through the class so that students could elect to work with a student leader of their choice. The instructor was available for consultation, but was relieved of spending major time blocks needed to develop student CADD proficiency.

Hardware and Software Requirements

For the store layout project the students used AutoCAD on personal computers. The personal computer hardware requirements for this set up are: at least 1024K internal memory (or one meg of RAM), a color monitor, EGA video display, a hard disk drive, and a mouse in addition to the keyboard. IBM machines are set as the standard for this college. In the computer lab, IBM-AT systems with 80286 processors are used. There are tablet systems that greatly increase drawing speed, but also may considerably increase cost. A plotter provides a scale drawing, but a dot matrix printer may also be used.

There are many different companies producing CADD software. This department utilized AutoCAD because it is widely used in the architecture and design fields, and it seems that it will be the software students are most likely to encounter in their professional lives. Software installation involves loading AutoCAD onto the hard disk drive and configuring the personal computer’s hardware for the specific mouse, display, and printer to be used. Our computer lab began with seven computers, three of which were equipped with AutoCAD. Presently, there are twelve computers, five of which will run AutoCAD. Release 10 on AutoCAD is the present version being used in the lab. The Release 10 upgrade features user-friendly features, such as pull-down menus, and advanced 3-D capabilities. A math co-processor chip is required to run Release 10.

The Store Design Computer Project

The store layout and design project used CADD software to develop student analytical and artistic design capabilities. A handout was developed to provide students with specific criteria to be included in each component of the project. The project was introduced just before Thanksgiving and completed in Mid-December. In future semesters six to eight weeks will be allotted to give the students more time for development of certain components of the project.

The project was organized in two stages. During the first stage the students used the DRAW menu to develop a library of store fixtures. For the second component, the students used the EDIT menu to place fixtures within given parameters. The walls and support columns had to remain in fixed positions. Students then placed aisles, fixtures, visual merchandising displays, and merchandise within the space based on prior information presented in lecture. AutoCAD software provides a large selection of commands that users manipulate to create and modify drawing elements. Drawing dimensions are set with LIMITS. The Grid spacing is used to find exact space sizes (GRID) and the ZOOM command is used to focus or “window” an area to complete fine details. These features helped eliminate student concerns about using a T-square, triangle, or architectural scale to draft the floor plan.

Students were allowed the freedom to create their own view of the type of retail firm using the space. Some students chose to design the space as a specialty store. Other students chose to use the space as a department within a larger store. Students could place as much or as little fixtures within the space as each student designer believed was necessary. They also had wide latitude in the placement of display space. Therefore, they could explore and create numerous alternative arrangements, analyze the positive and negative aspects, and then select the final drawing which most appropriately fitted the store type that they had envisioned.

Stage I

For the first stage of the project, students used the DRAW commands to develop a library of store fixtures. DRAW commands include CIRCLE,
LINE, and FILLET among others. Using a team-oriented approach each student leader helped team members to develop fixtures to be used in the store or department plan view. Fixtures included round racks, T-stands, four-way racks, gondolas, cubes, and rectangular racks to provide a basic library of fixtures. The students completed Stage One and turned in their diskettes to the instructors for evaluation. The fixture drawings were evaluated for attention to detail and for accuracy of size dimensions.

The best examples of each fixture type were then "blocked" so the fixture could be moved as a unit. Next the selected fixtures were transferred to the hard drive of each computer so the same fixture library was available to all students for Stage Two.

Stage II

For Stage Two the students used Edit commands such as MOVE, COPY, MIRROR, STRETCH, and ERASE to complete their versions of the store layout plans. With the fixtures in the store "library," students could duplicate fixtures, move them, reallocate space based on seasonality of items, and plan their key items or classifications into the most productive space.

In addition, the students continued to develop the skills and knowledge acquired in Stage One to build in dressing rooms, cash wrap counters, and display areas. The display areas included both mannequin displays and European display techniques (Pegler, 1982). The projects showed a diversity of approaches used to creatively solve problems.

The students could use placement of fixtures to develop subordinate aisles. Traffic patterns were indicated with arrows on the plan. Students allocated space based on a classification merchandising system defined in the handout provided each student at the beginning of the project.

Each student's final store layout in plan view was printed to scale (1/4 inch = 1 foot) using a plotter and plotter pen on vellum paper. Each student or student team then designed a board for presenting their project. The board incorporated the floor plan, key for fixtures, one point of purchase fixture design, and a title block.

Flexibility and Limitations

The AutoCAD software used in the project allows for increased levels of complexity. Students can begin a project at a fairly basic level and still develop very complex floor plans, based on their prior experience and present motivation. Time is always a limiting factor. Another aspect for future projects might be to require a component to encourage continuing development of written as well as visual and analytical skills.

Conclusions

The retail store design computer project was developed for both merchandising and interior design students. With students from each major field, the interaction created a synergistic effect and growth that was marvelous. The students have different perspectives and that made the outcomes even more exciting.

The computer project stimulated student interaction and team effort as well as developing analytical and critical thinking skills. The five student leaders generated enthusiasm in their fellow students. Student comments overheard in the hallways included "It's neat" and "I'm excited," as well as "I wish I had a system like it at home." Students on various occasions stopped the instructor after class to give feedback on the project as a positive learning experience.

The development of student leadership skills during the educational experience is one of the goals of any educational institution. The technique of training student leaders incorporated a somewhat unique leadership module within the more comprehensive experiential learning experience. The five students selected for advanced training showed increased enthusiasm and self-confidence as they were able to help their team members. The leadership training enhanced student interpersonal communication skills and helped student leaders demonstrate problem-solving in training their team. The team leaders developed motivational strategies for their team members. They adopted appropriate time management strategies by teaching their team in small group sessions. Additionally, the team leaders benefitted as their own learning was reinforced by the process of teaching the system to their fellow students.

The experiential learning setting helped students enjoy the learning process. The computer-aided experiential learning project for store layout and design allowed students the freedom to explore additional learning experiences as they gained proficiency on the computer.

Note: The author acknowledges the technical assistance of Sue Mauldin and the assistance of Tana Stufflebean in the development of this project.
References


AutoCAD Streamlines Store Layout and Merchandising

Phyllis Bell Miller
Mississippi State University

In the fast-paced business of retailing, store layout is dynamic. Retailers change displays and juggle merchandise daily to entice customers and spark their interest. As well as being useful for architecture and interior design, AutoCAD can play an important role in store layout and merchandise presentation. It can be customized to animate planning functions that ordinarily take place on spreadsheets. The results can lead to better space utilization and greater profits. The addition of step-by-step tutorials, sample drawings, and work sheets makes AutoCAD easier to use and a streamlined tool for teaching merchandise display.

Using AutoCAD as a Store Planning Tool

Because of its dynamic nature, AutoCAD can simplify the daily planning problems that retailers encounter. As new merchandise arrives, managers must rearrange displays, fixtures, and existing goods to accommodate it. Working with floor plans in AutoCAD allows retailers to experiment with the placement of departments and merchandise. The addition of custom menus simplifies the process and makes it unnecessary to be an AutoCAD expert.

Since retailers use profit figures to determine the number of square feet to allow per department and product, it is important to know the amount of floor space that is available or in use for a particular purpose at all times. The entire floor plan can be covered with a grid composed of four-foot squares, which is the size that store planners frequently use. Being composed of polyline cubes instead of lines, each square of the grid operates independently. As the planner decides where to place departments and goods, he/she can instantly vary the color and line type of that portion of the grid. As sales figure change, the grid can be quickly modified to reflect new strategies.

Outfitting the Store With Custom Fixtures

A library of store fixtures aids in more detailed planning. Being accessible through a series of icon and screen menus, it includes T-stands, waterfall racks, tri-level round racks, modular glass cubes, wrap desks, register stands, and sale tables. Folding screens, pedestals, cubes, and mannequins are among the display fixtures. All items are full-scale and are labeled with their type, size, and normal capacity. Specifications for the fixtures came from the catalog of Murdock-Mendelssohn, a major retail-fixture distributor in Nashville, Tennessee.

To make placement easier and to avoid the need for calculations, two clearance zones surround each fixture. These zones indicate the amount of floor space normally required between fixtures for people to move comfortably and to allow merchandise to be brought into the department. Information about zone widths came from stores throughout the country. The near zone indicates the space needed between fixtures on minor aisles within the department; it also designates how far fixtures should be placed from major store passageways. The far zone provides the necessary clearance for major aisles within the department. Each zone is stored on a different layer. Macros allow planners to freeze and thaw zones instantly once they position the fixtures.

To give a more realistic idea of how the store will look with the merchandise in place, many fixtures hold clothes and other items. These are stored on different layers so that they can be frozen and thawed as needed, which shortens regeneration time during planning. The walls also contain fixtures and displays that can be turned on and off.

Although the fixtures can be used in two-dimensional, plan views, they are all three-dimensional, enabling planners to view the drawing from any angle. AutoCAD also makes it easy to convert the entire floor plan to 3D, giving a realistic view of the store as possible. Rather than sending a list of supplies and a hand-rendered sketch to branch stores, planners can now supply detailed sketches that are more accurate and require less time to produce.

Attaching attributes to the fixtures further enhances the communication between planners and managers. Once the floor plan is complete, information from the drawing, such as fixture type, location, and capacity, can be transported to a
database or spreadsheet program for analysis. This provides a list of the exact type and number of fixtures needed to produce the accompanying floor plan. It can also indicate the amount of merchandise the desired fixtures will accommodate.

Teaching Store Layout With AutoCAD

The addition of tutorials, sample drawings, and custom menus makes AutoCAD an excellent tool for teaching store layout and merchandise presentation. A series of short lessons, which are accompanied by AutoCAD slide scripts, teaches students how to use sales figures to determine the amount of floor space to allow per product and department. They then carry out their strategy using three-dimensional fixtures and floor plans. These lessons and exercises, which will soon be marketed, are designed for people with little or no knowledge of AutoCAD. All features operate through AutoLISP routines and menu items, allowing students to use even 3D easily.

Setting up individual departments is the focus of one unit. Using the formulae in the menu, a step-by-step tutorial, and the accompanying work sheets, students analyze sales figures to determine the square footage to allow for each department. They then lay out the store in the sample drawing, applying their knowledge of the arrangement of departments in relation to each other and to store entrances. See Figure 1.

![Department Store Floor Layout Exercise](image)

Figure 1. Department Store Floor Layout Exercise

Lessons on department design explain how to arrange different kinds of merchandise within the department. Again using work sheets and menus, students quickly determine the amount of space to allow for the four categories of merchandise found in every department — fashion items, trial or test merchandise, staple goods, and clearance items. Accompanying drawings also contain gridded floor plans that change as the planner positions the merchandise.

A unit on fixture placement introduces students to the different kinds of fixtures, explaining their purpose, position, and spacing within the department. They learn how to arrange fixtures in relation to each other and to use the clearance zones surrounding each fixture. An awareness of the accessibility needs of wheelchair users and other handicappers is also stressed. See Figure 2. Advanced lessons employ a spreadsheet program to determine the type and number of fixtures needed to accommodate the desired merchandise and floor plan. As students progress, they can use the fixtures, menus, and formulae to develop their own floor plans.

Because the stores and fixtures are three-dimensional, students can view their drawings in 3D, getting realistic feedback on their efforts. See Figure 3. A series of 3D views built into the menu lets them see the drawing from several angles without having to study AutoCAD's 3D features. If available, AutoShade, AutoSolid, or other solid modeling or rendering software greatly enhances the drawings.

Having a customized version of AutoCAD that requires minimal knowledge of the program enables planners and educators to take advantage of CAD. In addition, those who did not grow up with computers often have difficulty finding the time to reeducate themselves. Applications that stress ease of use and require minimal start-up time allow many new audiences to reap the benefits of CAD.

Note: For information about the ideas and products discussed in the article, contact Phyllis Bell Miller at P.O. Drawer HE, Mississippi State, MS 39762-5765. (601)325-2950 or 323-1411.

This is a reprint from Cadence March 1990. See article for photos of computer slides illustrating steps.
Figure 2. Plan View of Store Layout Showing Narrow and Wide Aisle Spacing Zones

Figure 3.
Introduction

Traditionally applied mathematics courses, and in our case merchandising math, have relied on problems presented in a text or workbook, homework assignments, and a teacher's manual. Teaching in this manner may not permit maximum flexibility in accommodating fast and slow learners and requires extensive hours of grading on the part of the instructor.

A strong foundation in basic merchandising mathematics is essential if additional study is to take place in this subject matter area. For example, how can we study ways to improve gross margin or profit ability if students do not understand how those factors are derived?

To address these problems 25 software programs were written to assist with learning merchandising mathematics. The programs, written for the IBM or compatibles, can be used in the classroom for demonstration purposes or in a lab or home setting for individual drill and practice. The Merchmath.ezy package is presented in such a way that the work can be self-paced and the programs could be used as a mechanism for having student test out of remedial coursework before moving on to advanced courses.

The programs can run on the most basic of systems; however, computer graphics and enhancements are understandably more exciting with 386 machines.

Background and Development Work

The principal author has taught merchandising math for over fifteen years. These programs were an outgrowth of a search for more effective ways of teaching low-level computations, a more efficient use of technology in evaluating student performance, and the ability to meet individual student needs.

After implementing the computerized math labs in conjunction with traditional lecture classes, the class curve suddenly shifted from an average grade of "C" to an average grade of "B". Not only have grades been higher, but the morale and enthusiasm of the students have made this effort worthwhile.

The amount of time spent in developing quizzes and exams and in grading has also been reduced dramatically. Rather than grading 15-20 homework problems per student, per week, the homework and the quizzes are computer generated and computer graded.

The first version of these programs was written in the mid-70s at the University of Nebraska and run on mainframes. The current programs were rewritten for microcomputers, have been used at Colorado State University for three years, and were beta site tested at the University of Minnesota.

Description of Programs

Each of the twenty-five programs has a comparable format. This consistency makes the programs very user-friendly. All problems generated by the system have several variables and components which are randomly selected within predetermined parameters. For example, the product, company name, quantity, cost, and other variables are randomly generated for each problem. Therefore, problems will be consistent in structure but different in content for each student. In addition, problems within each section of the program are generated in a random order. The randomization of component parts, as well as problems, eliminates the possibility of students copying the answers to homework assignments.

The student can take a computer generated and graded exam and given two opportunities to find the solution to a problem. After the second time the correct formula is presented. Each time the student completes a lab session, the computer calculates the number of problems attempted and answered correctly on the first and second attempts along with the time spent in completing the exercise. The students can obtain a print-out of their problems and this evaluation.
student's name or identification code which is entered at the beginning of the session will also be printed on the evaluation form. This printout assures authenticity of the student's work.

The primary software programs included in this series are:

<table>
<thead>
<tr>
<th>individual markups</th>
<th>cumulative markup</th>
</tr>
</thead>
<tbody>
<tr>
<td>average markup</td>
<td>initial markup</td>
</tr>
<tr>
<td>maintained markup</td>
<td>gross margin</td>
</tr>
<tr>
<td>employee/customer discounts</td>
<td>markdowns</td>
</tr>
<tr>
<td>receipt of goods dating</td>
<td>cash discounts</td>
</tr>
<tr>
<td>extra dating</td>
<td>end of month dating</td>
</tr>
<tr>
<td>quantity discounts</td>
<td>anticipation</td>
</tr>
<tr>
<td>loading the invoice</td>
<td>trade discounts</td>
</tr>
<tr>
<td>stock turnover</td>
<td>stock shortage</td>
</tr>
<tr>
<td>planning sales</td>
<td>stock-to-sales ratio</td>
</tr>
<tr>
<td>planning markups and markdowns</td>
<td>planning stock</td>
</tr>
<tr>
<td>profit and loss statement</td>
<td>planning purchases</td>
</tr>
<tr>
<td></td>
<td>planning open-to-buy</td>
</tr>
</tbody>
</table>

Each of these primary programs has a series of subprograms which fully explore use of the concept. For example, subprograms under markdowns include the following:

1. dollar markdown
2. retail markdown percentage
3. complement of the retail markdown percentage
4. gross dollar markdown
5. gross markdown percentage
6. dollar markdown cancellations
7. net dollar markdown
8. net markdown percentage

Documentation

The documentation is thorough and consists of 185 pages. Each subprogram is accompanied by an explanation of:

1. the concept
2. the mathematical formula
3. how and why the mathematic concept is used
4. a sample problem and solution

Use in the Computer Lab

In the computer lab, students engage in self-paced, branched tutorials which permit them to move at their own pace through problem solving sessions. From a main menu and submenus, the student selects areas in which to drill and practice. Students can select a specific type of problem to work on, or they can move through the exercise session using the branching approach. Branching will take the student through a series of problems, increasing in the level of difficulty, until the student has successfully mastered the problem solving process. Thus learners learner can work at their own pace.

If the student is not able to solve a problem the correct solution will be computer generated and he/she can type 'I' to see the correct formula. After each problem, the student has the option of continuing or quitting. If the student elects to quit, the performance report is generated on the computer monitor and can be printed for the student's or the instructor's records.

Long Distance and Off-Campus Learning

The authors see a need for offering more off-campus and long distance instruction in the area of merchandising mathematics. This need has been demonstrated by the growing numbers of non-traditional students who require more flexibility in course scheduling and instruction at remote sites. Rural development research also indicates that small business owners are interested in learning more about improving business performance. This audience, however, requires easily accessible, convenient, and timely coursework.

The authors' future plans, therefore, include the offering of such a correspondence course which would include communication with participating students using a computer modem. The mastery of basic merchandising mathematics will also provide a sound foundation upon which additional coursework and outreach programs can be built.

How to Order

In an effort to make these software programs available to all interested faculty and students, the authors have put together a package which is both professional in appearance and is economically priced. All software and the 185 page documentation can be ordered through:

KINKO'S - Campus West
1113 W. Elizabeth
Fort Collins, CO 80525
303/482-3688

The package offer is available for $37.50 plus postage and handling. Request the MERCHMATH.EZY package and specify 5 1/4* or 3
1/2" diskettes. The software and documentation have been copyrighted. Offered at this reasonable price, we hope that you will honor our personal time involvement and development costs. Each student should purchase a complete package including documentation and software.

Reduced prices can be negotiated based on quantity ordered and postage and handling costs will also diminish as quantities increase.

If you have further questions please direct them to:

Antigone Kotsiopoulos, Ph.D.
Merchandising Program Coordinator
Colorado State University
DMCS - Merchandising
322 Gifford
Fort Collins, CO. 80523
303-491-5260
MacFashion:  
A Computer Tutorial on Twentieth Century Fashion

Catherine A. Cerny and Linda Welters  
University of Rhode Island

"MacFashion" is a computer tutorial used on the Macintosh computer that accompanies a course in twentieth century American dress at the University of Rhode Island. The lower division course, Development of Contemporary Fashion, covers two major topics: the socio-historical factors that have shaped the American apparel industry, and the stylistic changes in fashion between 1900 and 1989. MacFashion is designed to assist the student in mastering the latter topic and complements course lectures and text, O'Donnol's (1982) American Costume 1915-1970. The interactive tutorial requires students to identify representative silhouettes as they respond to questions about specific aesthetic and social trends in men's and women's fashion. Students work at their own pace to gain appropriate study skills and achieve a comprehensive understanding of the subject.

Realizing that a tutorial provides an opportunity to augment course lectures, we elaborate on topics covered in class. MacFashion consists of six diskettes organized first by gender and then by decade. Each diskette focuses on fashion developments within three decades:

<table>
<thead>
<tr>
<th>Women's Fashion 1900-20</th>
<th>Men's Fashion 1900-29</th>
</tr>
</thead>
<tbody>
<tr>
<td>Women's Fashion 1930-59</td>
<td>Men's Fashion 1930-59</td>
</tr>
<tr>
<td>Women's Fashion 1960-89</td>
<td>Men's Fashion 1960-89</td>
</tr>
</tbody>
</table>

Each decade is a separate unit. For each decade, students begin by selecting one of five fashion illustrations. Students are asked to respond to three multiple choice questions for each illustration.

MacFashion was designed with the use of ThunderScan scanning system and Course Builder software. The application runs on Mac Plus, Mac SE, and Mac II computers. ThunderScan, produced by Thunderware, Inc., is a software system with an image scanning attachment which fits on the ImageWriter printer. Images are scanned line by line and digitized in the printer; it can be saved in MacPaint, MacDraw, or a word processing document. Images can be edited either in Thunderscan or Paint programs. Course Builder, produced by TeleRobotics International, Inc., is a visual authoring system for creating interactive educational software. Designed for the average computer user, it requires no knowledge of programming syntax. Rather, it relies on visual programming techniques, similar to flow diagrams and storyboards. Built-in icons are displayed as menu options and activated by the mouse as the author formats the courseware. These icons subsume programming functions and allow the author to replicate a sequence of instructions, questions, problems, and/or explanations.

This paper will outline the design of MacFashion and its application in the fashion history course.

Program Design

To adapt Course Builder to any curriculum, the author must conceptualize the instructional objectives and visualize the means of obtaining them. Success depends on being able to operationalize the learning process for students in a manner compatible with Course Builder capabilities.

Initial Planning

In teaching, both of us found that students, although adept at memorization, had difficulty in recognizing the nature of style change over a ten year period and differentiating the fashion look of one decade from that of another. Class lectures and textbook readings failed to give the student sufficient practice in deducing the social context of a fashion look from its characteristic features. Structured around graphic illustrations, MacFashion would assist the student in refining the visual literacy skills necessary in mastery of the subject, as well as contribute to success in fashion careers.

In designing the format of MacFashion, we focused on fashion themes including:

dominant style trends at the beginning, middle, or end of a decade (e.g., the "barrel" look of the early 1920s)
changing standards of etiquette (e.g., introduction of the tuxedo for formal wear)
clothing styles that had a limited audience but reflected emerging social or aesthetic trends (e.g., the 1960s "mod" look)
functional styles of athletic or occupational dress that modified the nature of mass fashion (e.g., the 1970s "dress for success" look) and
innovative styles that changed the concept and scale of ready-to-wear apparel (e.g., Poiret's lampshade tunic of the early 1910s).

With these themes in mind, we identified characteristic silhouettes upon which we would structure questions and explanations. References, drawn from class slides, costume history textbooks and references, and period fashion magazines helped in authenticating garment details, accessories, hairstyles, and body poses.

Integration of Graphics with ThunderScan
MacFashion uses graphic images of fashions. Initially, graphic images are used as references to help the student select decade and silhouette. First, s/he selects the decade by clicking on a radio button with the aid of representative fashion images (See Fig 1). Having selected the decade, the screen changes. The student then selects one of five silhouettes by clicking the mouse on one of the images (See Fig 2). Finally, a single silhouette with the first question appears on the screen (See Fig 3).

Figure 1. Select Decade to Study

Figure 2. Select Silhouette from 1920s

ThunderScan was an inexpensive alternative for integrating these images into the MacFashion document. Flatbed scanners would have been a faster, but more expensive option. Initially, we planned on using images photocopied from books and magazines; we decided against this for two reasons. First, photocopying might lead to copyright infringement. Second, the reproduction quality of a photocopied image with ThunderScan was poor. We decided to use silhouettes drawn by one of the authors, Linda Welters. This lent an overall unity of style to the images.

Figure 3. Answer Question about Cardigan Suit

Line drawings in felt tip pen were made from pencil sketches. Detail was minimal but indicated fabric pattern, garment line, and clothing accessories. Pencil shading created black/white contrast. Simplicity was necessary because distortions occurred when images were reduced in scale from their original size to one that fit within the computer screen. Shaded areas became darker, close lines lost detail, and facial features sometimes assumed odd expressions.
Images were edited in Thunderscan, and saved in MacPaint. MacFashion images were reduced and transferred using Edit functions. Further editing was sometimes necessary. Where images were used in groupings, images were reduced and arranged in MacPaint before transferring to MacFashion.

Application of Course Builder

Course Builder authoring software describes the development process as a journey of the mind. In turn, it is the author's responsibility to prepare a map that directs the student's itinerary. The Course Builder manual shows how this can be done. Course mapping, drawn on the Course Map Window, consists of States and Routes. States indicate and abbreviate specific programming functions, including the location of commentary and the structure of questions. The relevant State is selected from the menu choices. Routes, visually represented as arrows, determine the flow of information from one State to the next. Both States and Routes contain options that allow the instructor to tailor the program to suit instructional needs. Possible interactive formats include animation, calculation, essay, graphing, music sampler, and simulation.

Forethought in planning MacFashion led to a program map based on the hierarchical arrangement of three decade diskette (level 1), decade (level 2), silhouette (level 3a), and question (level 3b). This three-dimensional map replicates the path taken by students as they choose the decade and silhouette for which they will answer questions (See Figures 4 and 5).

Likewise, the hierarchical approach facilitates the authoring of the tutorial. The question template (level 3b) consists of two dialog States: "question 1(a)," which records the multiple choice question, the three possible answers, and the correct response(s) and bridge, which links "question 1(a)" with "question 112(a)." In addition, there is an image State (e.g., "cardigan suit"), which contains the silhouette, and three text States (e.g., "Patou/Pointe/Chanel"), which elaborate on the response. The arrows direct the flow as the student responds: An incorrect response requires the student to answer the question a second time, whereas a correct response allows the student to proceed to the next question.

Once the program format on one level is completed it is easily replicated: the question template becomes three questions and constitutes the silhouette template; the silhouette template becomes five silhouettes and constitutes the decade template; and the decade template becomes the three decade diskette. The format of levels 1, 2, and 3b contain similar image and dialog States specifically designed to direct flow as the student chooses first decade, then silhouette. Bridges lead the student from one hierarchical level to the next as a consequence of this choice.

The feedback State documents student progress. Customized reports can range from the very general (i.e., course time and course percent correct) to the very specific information (i.e., every input made by the student). Since we see MacFashion as a tutorial we wanted to minimize the stress of grading, yet give students feedback on their progress. On exiting the tutorial, students gain feedback on time, percent correct, percent score, and total correct. Printed copies of the reports inform us of their mastery of the material.

Evaluation of Programming Tools

Although ThunderScan and Course Builder have been advertised as appropriate for the average micro computer user, certain problems were encountered. These problems initially centered on learning the capabilities of the scanning tool, the logic of the programming systems, and memory requirements of Course Builder. ThunderScan can be an effective tool in
scanning graphic images, but the scanning procedure is a finicky operation. We found that doing one simple step out of sequence would cause failure in scanning. Also, high humidity created problems. Only with considerable practice were we able to perfect the technique.

The Course Builder manual is a directory of options and a dictionary of how options function. Introductory software leads the author through the design of simple instructional format. Examples show alternative program formats, but these are very basic program sequences. Course Builder fails to elaborate the program logic of all the potential options and to indicate the ramifications of designing a more complex program format. Unfortunately, the author must rely on trial and error to customize educational software. Although we looked at other authoring software, we still recommend Course Builder to potential courseware authors because of its flexibility.

A third area of difficulty resulted from the memory limitations of the hard disk and the diskette. Although a Course Builder application could be run on one megabyte of RAM, two megabytes were required to design even the simplest exercise. In addition, we found that the memory of the computer and diskette were strained by the extensive use of images along with text. This affected the time necessary to save a document on the computer. As images and text were inserted into the program format, the time required to save data increased and eventually required up to ten minutes to save a three-decade document. Finally, memory requirements affected the format of the tutorial. The six-diskette format of MacFashion is due to the fact that only three decades fit on one diskette.

In each case, it took considerable time to work out these problems before we could proceed in developing the MacFashion tutorial. As a consequence, what we planned to complete in one month during the summer, took another nine months during the academic year.

**Student Use and Evaluation**

The tutorial was first used in the 1989/90 academic year. The diskettes were available for review in the Macintosh computer lab located adjacent to the classroom. Students checked out a diskette and worked at the tutorial at their own pace. They spent from 10 to 60 minutes at each diskette; the average time spent was 30 minutes.
Reactions from students helped to identify problems missed in proof-reading the software. In addition, some students had difficulty starting the computer tutorial or getting printouts of the feedback. These problems were overcome by clarifying the instructional handout and by training the student assistants that managed the lab.

The students found the tutorials helpful in preparing for the exams. Twenty-two of the twenty-seven students in one course responded to questions on the overall quality of the tutorial and its helpfulness in preparing for the exams. Average rating for quality was 8.5 and for helpfulness, 8.2 on a 10 point scale. Overall, the students noted its strength as a "visual review": "It gives visual aid in remembering certain styles and explains the styles to you." Seen as one means to study for the exams, students printed copies of the silhouettes and made notes from the text commentary. Finally, students suggested extending the idea to other topics in the course, as well as to other courses in the Department.

Conclusions

Aside from providing students with knowledge of Euro-American clothing traditions and an understanding of the sociocultural dynamics of fashion, costume history courses challenge students to be more visually aware of the significance of dress of the present. As future merchandisers and designers, their success will depend on how skillfully they interpret contemporary trends. Visual images and their significance are integral parts of the lectures and readings of a costume history curriculum; yet many undergraduate students do not know how to integrate visual and textual information in an effective manner. Computer tutorials like MacFashion give the student practice in developing visual literacy skills.

References/Software


Thunderware, Inc. (1984-87). ThunderScan for Macintosh. 21 Orinda Way, Orinda, CA 94563

Funding was provided by a grant from the Rhode Island Board of Governors Incentive Fund for Excellence.
Fashion Documentation and Analysis by Computer

Judy Zaccagnini Flynn
Framingham State College

People observing what individuals wear has been a pastime for those studying dress and adornment. The fashion aspect of viewing people was used for documenting and analyzing fashion for this experience. Past researchers, Veblen (1899), Simmel (1904), and Lowe and Lowe (1985), refer to the acceptance of an article of dress by the majority of a group as the "Fashion Process." Previous studies have used fashion plates from magazines based on Kroeber’s (1940) work. The next step desired was to be able to track not only high fashion as seen in periodicals, but also everyday wear worn by people in natural settings.

The results of natural setting observations were viewed as helping to understand past everyday dress and predicting fashion trends of the future. By selecting specific target groups, fashion trends of that group were able to be studied. Previous examples have been done with ethnic groups (Flynn, 1979). Trend analysis has been viewed as visual and impression formation oriented. A method of documentation of fashion through written logs, literature search, and photographs of college students was developed by Flynn (1982). Detailed instructions on how to take pictures, record a log, and analyze photographs were given. A database of the analysis of photographs taken was developed from 1979 to the present. One of the uses of the database has been to analyze the subject’s appearance in relation to fashion theory and trend analysis.

Purpose

The purpose of this project was to engage students in a research exercise to understand fashion theory and trend analysis using the computer. The computer was viewed as a research tool for sorting and collecting large quantities of data, analyzing the data, and describing it graphically. This paper focuses on the computer applications.

The computer facilities available have been varied and constantly changing. The project is a cooperative effort among the computer center's user consultant, students, and faculty at Framingham State College.

Computer Requirements

The college system has been unique in that it joins 10 colleges and 3 universities in 1 computer network system. The mainframe and SPSSX software used was 25 miles from campus; thus, students were given an explanation of the Regents Computer Network (RCN). The mainframe used was a CYBER 180/830A with dual CPU with 32 MB combined memory-8MB (60 bit) words memory. The operating system was Network Operating System (NOS). A ethernet network with fiber optics backbone using TCP/IP protocol linked the computing resources of the campus and the Massachusetts Higher Educational Communications Network.

The software was varied in the project. The first software used was SPSSX which is accessed from the RCN and was used for statistical analysis. The students had access to 40 terminals and two printers in a campus-supported computer laboratory. The laboratory was situated in the Home Economics and Science Building. The second software used was optional. Graphic packages including SPSSPC and Lotus were available in two labs. One lab was the Home Economics PC lab with 8 Apple IIIC; 3 Macintosh; 3 IBM XT; and 1 IBM AT. The second lab was a campus computer lab in the Home Economics and Science Building, with 24 PC IBM AT compatibles. The data were resident at the RCN mainframe because the required software to download to campus PC's was unavailable.

Students

The students were undergraduate sophomores with no or one course in computer science or computer applications. The computer user consultant on campus offers two one-hour sessions on the use of NOS and the Full Screen Editor (FSE). Student attendance was optional but encouraged. One hour of class time was used to explain the RCN system, and one hour was spent in the computer laboratory. The emphasis was on the learning of research methods and computer
applications. The students were called "student researchers."

A student researcher was assigned fifteen numbers and provided directions to photograph students on the Framingham State College campus in a natural setting (Flynn, 1982, 1990). Photographs were taken, decoded, and data were entered into a database. Each student photographed 15 students on campus. Decoding the photographs was done manually by each student using two theoretical frameworks, Hillstead (1980) and Flynn (1982, 1990). The variables by which each photograph is evaluated have increased each year as fashions change (See Table 1). Sixty-five variables were analyzed in 1989. An IBM 80 column assembler form was used to code each picture first. Attempts to code directly at the terminal have failed due to the number of variables, terminal, and student time restraints.

Data are entered by creating an "empty" file labeled the first four letters of the student researchers last name i.e., Abbot becomes ABB0. The data are entered using the full screen editor (FSE).

Table 1. Example of one Variable: Jersey Top (JERSEYT)

<table>
<thead>
<tr>
<th>Code</th>
<th>Variable Label</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>'COWL'</td>
</tr>
<tr>
<td>2</td>
<td>'TURTLE NECK'</td>
</tr>
<tr>
<td>3</td>
<td>'T-SHIRT'</td>
</tr>
<tr>
<td>4</td>
<td>'POLO SHIRT'</td>
</tr>
<tr>
<td>5</td>
<td>'RUGBY SHIRT'</td>
</tr>
<tr>
<td>8</td>
<td>'UNABLE TO DETERMINE'</td>
</tr>
<tr>
<td>9</td>
<td>'DOES NOT APPLY'</td>
</tr>
</tbody>
</table>

**Explanation:** JERSEYT is the abbreviation used due to length of variable names restraint. The ' ' symbol tells SPSSX to print out each term as a variable label. The / at the end of the listing tells SPSSX to go to the next variable. The sixty-five variables analyzed are referred to in SPSSX as "Data List FILE." Putting data into the "empty" file allows for easy corrections. When corrections are made the file is printed for the student researcher to submit to the professor. Students are graded on accuracy as their 15 pictures were joined with all pictures of their year.

Professor

The professor reviewed the printed data and used the student researcher's four letter last name code to join all cases in the class and created a "class data base." (See Table 2.)

The database was kept separate by year for ease of identifying each class and to allow for the data to be used for more than one project. Each year the data are stored on tape for retrieval. The data are placed on two separate accounts: first, the faculty account to prohibit student access and possible harm to the data;

Table 2. Commands to Create Class Database

<table>
<thead>
<tr>
<th>Command</th>
<th>Purpose of Command</th>
</tr>
</thead>
<tbody>
<tr>
<td>Log on</td>
<td>To begin program, directions vary with campus</td>
</tr>
<tr>
<td>New, class89</td>
<td>Create new file</td>
</tr>
<tr>
<td>Ready</td>
<td></td>
</tr>
<tr>
<td>GET, ABLE, ABB0, CAMB</td>
<td>Student files are found using their name codes</td>
</tr>
<tr>
<td>GET, COTT, DEEL, SEFT</td>
<td></td>
</tr>
<tr>
<td>Ready</td>
<td></td>
</tr>
<tr>
<td>xEdit</td>
<td>Edit file to join cases</td>
</tr>
<tr>
<td>xEdit 3.10</td>
<td></td>
</tr>
<tr>
<td>Empty file/creation mode</td>
<td></td>
</tr>
<tr>
<td>??</td>
<td></td>
</tr>
<tr>
<td>Input</td>
<td></td>
</tr>
<tr>
<td>? spacebar</td>
<td></td>
</tr>
<tr>
<td>?</td>
<td></td>
</tr>
<tr>
<td>Edit</td>
<td></td>
</tr>
<tr>
<td>??read ABLE, ABB0, CAMB</td>
<td>Reads student data files, and makes one file of the class</td>
</tr>
<tr>
<td>??read COTT, DEEL, SEFT</td>
<td></td>
</tr>
<tr>
<td>?? Q, RL</td>
<td>Quit program</td>
</tr>
<tr>
<td>Class89 is replaced</td>
<td>Job is done</td>
</tr>
<tr>
<td>Class89 is a local file</td>
<td></td>
</tr>
<tr>
<td>Ready</td>
<td></td>
</tr>
</tbody>
</table>

second, in a public account with a protection code where students can access the data, but not tamper with it. The entire class database was printed out and taped to the wall in the hall outside the classroom door. The students were to check their individual data to guarantee their 15 piece data was part of the class data base. Students were then shown the data from previous classes, 1979 to the present. Limitations were set: the
The database had to contain the variable for at least three years and the students decided if their variable applied to females, males, or the entire class. A SPSSX software package was used for statistical analysis of the sixty-five variables. The program was written with the aid of the regents and the campus user consultant (See Table 3). Three separate programs were used with the "select" command for male, female and class. The SPSSX program was attached to each year's data and the resulting analysis was stored on the faculty's and a public account.

Table 3. Key Commands of SPSSX Program

<table>
<thead>
<tr>
<th>Command</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>SET BLANKS=0</td>
<td>Year, Campus, GenClass, Skirts, Pants, Sweater, Bodystyle, Dress, Open, Collars, Sleeves, Hair, Stocking, Shoes, PantsLA (0.99)</td>
</tr>
<tr>
<td>MISSING VALUES</td>
<td>Sem to weight, Use to Silgen, Layered, Bloch, Jersey, Topsame, Jumper, Length, Should, Slelen, Coatjac, Sweatcar, Hat to Purse, Umbrella, Boots to Neckstye, Pantfull to Scale (0.9)</td>
</tr>
<tr>
<td>FREQUENCIES</td>
<td>Variables= Year to Scale / Missing = Include / Histogram / Format = Index / Statistics = Mean Median Mode Skewness Range Minimum Maximum</td>
</tr>
</tbody>
</table>

Students then created a file for their individual variable from 1979 to the present. The directions were divided into three parts: command, year's data, and account number. Thus, the command read: get, class79/Un=C905036. The student used the FSE for each class data. Editor commands of the FSE were used to locate their variable. The text of the variable analyzed was highlighted, labeled by year and saved. This was repeated for each year and the created file for each student's variable was printed (See Table 4).

Table 4. Student's Variable Printout: Skirts 1985

<table>
<thead>
<tr>
<th>Variable Label</th>
<th>Value</th>
<th>Frequency</th>
<th>Valid Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>STRAIGHT</td>
<td>1</td>
<td>24</td>
<td>4.6</td>
</tr>
<tr>
<td>A-LINE WITH WB</td>
<td>2</td>
<td>12</td>
<td>1.6</td>
</tr>
<tr>
<td>GATHERED</td>
<td>3</td>
<td>14</td>
<td>1.9</td>
</tr>
<tr>
<td>GORED</td>
<td>4</td>
<td>1</td>
<td>.1</td>
</tr>
<tr>
<td>FLARED</td>
<td>5</td>
<td>7</td>
<td>.9</td>
</tr>
<tr>
<td>PLEATED</td>
<td>7</td>
<td>1</td>
<td>.1</td>
</tr>
<tr>
<td>DOES NOT APPLY</td>
<td>9</td>
<td>673</td>
<td>90.4</td>
</tr>
</tbody>
</table>

The printout was brought to class. The main terms were explained and methods for graphically showing the results were demonstrated. Tordella's (1988) recommendations on creating graphics were used as a guide. Students had the option as to which method they used to complete the graphics: hand, Panasonic Graphmaker, or PC packages. Options were necessary because of the shortage of equipment and the mix and variety of software packages available on campus. The most commonly used packages have been SPSSPC and Lotus (See Figures 1 and 2). Eight hours of class lecture/discussion focused on fashion theory/trend analysis including: 1) terminology, 2) cyclical theory-obsolescence, 3) fashion marketing cycle-T1 to T4, and 4) recurring fashions.

Student Paper

The student's paper focused on analyzing what was shown on the graph in relation to fashion theory. Using the plotted graph the students described how their variable fit into cyclical theory. A series of questions were given to guide the student's paper:

- What stage of the fashion cycle is (are) the variable(s) in?
- Are you seeing a fad, fashion, or a classic?
- How does the variable relate to the fashion marketing cycle?
- What do you predict will happen to the fashion variable viewed?

Student's answers incorporated data from the graphs, readings, and class lecture notes. The computer printout of the individual data and plotted graphs were appendices of the paper. Students evaluated the project by open response at the end of the project.

Conclusions

Four hundred thirty-two student researchers have actively participated in the study from 1979 to 1989. They have taken 15 pictures each, which has established a database of 6,464 photographic cases from 1979 to 1989. (See Table 5.)
Figure 1. Graphic Done by Sally Thieme: Bar Chart

Figure 2. Graphic Done by Sally Thieme: Plotted Graph
Table 5. Database

<table>
<thead>
<tr>
<th>Year</th>
<th># Student Researchers</th>
<th># of Photographs Analyzed*</th>
</tr>
</thead>
<tbody>
<tr>
<td>1979</td>
<td>22</td>
<td>327</td>
</tr>
<tr>
<td>1980</td>
<td>21</td>
<td>299</td>
</tr>
<tr>
<td>1981</td>
<td>37</td>
<td>569</td>
</tr>
<tr>
<td>1982</td>
<td>40</td>
<td>599</td>
</tr>
<tr>
<td>1983</td>
<td>41</td>
<td>615</td>
</tr>
<tr>
<td>1984</td>
<td>46</td>
<td>688</td>
</tr>
<tr>
<td>1985</td>
<td>50</td>
<td>744</td>
</tr>
<tr>
<td>1986</td>
<td>40</td>
<td>596</td>
</tr>
<tr>
<td>1987</td>
<td>40</td>
<td>600</td>
</tr>
<tr>
<td>1988</td>
<td>47</td>
<td>710</td>
</tr>
<tr>
<td>1989</td>
<td>48</td>
<td>717</td>
</tr>
</tbody>
</table>

11 years 432 students 6464 photographs

* 16 pictures were eliminated.

Evaluation

Student researchers have reported that they have become more observant to details and fashion trends. Application of fashion trend analysis has been viewed as important to the fashion buyer, clothing designer, and clothing and textile specialist. The fashion buyer can know what is currently worn by a target group. The clothing designer receives ideas for design inspiration, visualizes how accessories coordinate an outfit, and identifies fashion trends. The clothing and textile specialist can relate cyclical fashion theory to determine what merchandise is designed, bought, sold, and at what price.

Student researchers had experience with both the mainframe and PC. The computer was viewed as a vital tool in compiling and analyzing data. They saw how both could be used in a research project. Students were to interpret results using graphics. The computer work enabled them to see applications to clothing and textiles. Student papers have shown an understanding of the research process and the ability to interpret graphic results in relation to fashion theory and trend analysis.

Further Study

The campus is currently developing standards for uniform PC hardware and software. Thus, in 1991 software graphics will be possible on larger numbers of PC's available for student use. Work is currently in progress to allow the data to be downloaded from the mainframe to the PCs.

Visual scanning of the students' photographs is not possible at present. Each student gives one photograph of his/her choice to the professor. Scanning would provide long term storage of the visual data.

The establishment of other campuses doing a similar project would broaden the study. After three years, trends would be able to be analyzed. Sharing of the database has possibilities for class projects needing a longitudinal database. The resulting database has further options for research, historical documentation, variable analysis, and fashion trends.

References


Electronic Information Transfer to Improve Curriculum Productivity and Use

Jan Scholl
Pennsylvania State University

As we approach the next century, educators envision that computers will play a major role in the delivery of curriculum (Madian, 1990). Speed of development and the ability to continually update educational materials will continue to be critical, particularly in the textiles and clothing field where fashion changes and innovations are continuous.

At all levels education has taken a new focus. Empowered to make decisions by thinking critically and creatively, students now explore possible answers to challenging questions as well as memorize simple facts and sequences. Whether a somatograph is plotted for pattern making or a simple drill and practice program is “booted up,” computers offer students necessary hands-on manipulation for discovery learning.

With the new emphasis on “process” education, one cannot help but question whether blackboards, text-books, and curriculum guides are really needed anymore. By some estimates, however, fewer than 15% of teachers use computers in their teaching (McCarthy, 1988).

While it may be true that teachers want fewer cumbersome curriculum guides, evidence suggests “they’re sick and tired of hearing about ‘newer’, ‘faster’, ‘more powerful’, technological innovations that do nothing to increase ease of use” (McCarthy, 1988, p. 44). Now more than ever, teachers are questioning the role of educational technology by trying to discover the type of information best presented through that medium (White, 1989).

Applying technology to specific educational problems and enhancing the best of our traditional methods would seem to be a better approach than wheeling in any number of educational audio-visuals and waiting for the “magic” to happen. Moreover, designing materials for the users rather than requiring them to adapt to the curriculum would seem a worthwhile goal as well. Clearly, making decisions about technology will be a challenge educators will encounter in the coming years.

This paper is an effort to show how a computer on-line electronic mail and full text system can speed the development and adoption of curriculum and assist educators to select and manage the use of clothing and textiles information. This computer system was used to develop an overall plan for Cooperative Extension programs and curricula for youth. A similar system could be developed by educators at other levels.

Designing materials that will be used widely and readily requires a substantial amount of input from a variety of educators. Developers need to canvass opinions and incorporate ideas that will help students learn.

Clear and speedy communications between the developer(s) and reviewers is essential to retain accurate and up-to-date information throughout the lengthy development process. Once the curriculum is developed, supporting materials and alternate activities encourage continued use. Fortunately, computers and companion software are marvelous tools for filing, retrieving, arranging, and rearranging information for this purpose.

In 1986, Penn State University’s College of Agriculture initiated a computer based on-line information service designed to link university faculty (who continually conduct research and disseminate information) to extension offices throughout the state. An electronic mail system (PENmail) and an extensive database of document files (PENpages) and a bulletin board to locate document files were developed. Later a counterpart to PENpages, called PENN*Link, was established to connect university and governmental agencies to school districts. A telecommunications network of leased telephone lines connects the various locations and the information stored in a DEC VAX computer on Penn State’s University Park campus (Shaffer, 1990).

To access the information, the user needs a personal computer, VT100 - compatible software, and a modem. Access is free to extension offices in Pennsylvania. For others, the only charge is the cost of a long distance phone call.

Though this computer system is innovative and rapidly becoming a model of electronic communication in educational circles, most Pennsylvania Cooperative Extension specialists access it just for day-to-day communications (PENmail) and to develop and file fact sheets and
newsletters (PENpages). This system has much broader applications for C/T curricula.

As at many universities, Penn State has reduced its support of clothing and textiles programs, not only in extension, but within resident instruction as well. Currently, a contract is in place between Penn State Extension and the International Fabricare Institute (Silver Spring, MD) to provide educational materials, answers to consumer questions, and provide an annual professional improvement video conference. Correspondence and planning with the International Fabricare Institute are conducted by PENmail. A summary of this information is documented on PENpages to inform extension agents of trends by giving an overall picture of consumer concerns. Other extension resources are allocated to develop curricula for youth, discussed below.

Curriculum Development

The ability to send copy and to quickly retrieve the needed information can reduce the time it takes to develop educational materials from three to six months. Curriculum, in the form of student and teacher materials, can be placed on PENpages for review by many people at the same time. With information sent electronically, there is no need to duplicate pages, stuff envelopes, or secure postage. Reviews and revisions transfer between sender and receiver within minutes.

Once received by PENmail or taken off the PENpage system, the information may be printed to share with others or reviewed at a more convenient location. The document may also be kept on the PENpage system so it can be located when necessary. Curriculum suggestions return to the specialist via PENmail.

Curriculum Support Materials

Newsletters

Newsletters provide a means of communicating about the curriculum and informing users of upcoming programs, new ideas, and available resources. They are often used in informal educational settings, but can be useful in classroom instruction as well. Newsletters are often read more completely than other educational materials because, by their nature, they contain current information, in short, easy-to-read blocks.

An on-line newsletter has many advantages. Less time is spent on assembly. Various sections of the newsletter can be "filed" away as events happen and updated just before it is sent, giving readers the advantage of knowing what is current. The cost of sending the information is minimal as well.

Another advantage is the variety of ways the newsletter may be delivered. Sent PENmail, the copy arrives "automatically" on the reader's desk because a secretary takes the mail off the system daily. If placed on the PENpages bulletin board, the reader can locate it by menu to prevent loss in the office paper shuffle. Some developers put their newsletter on the PENpages and notify the receiver's secretary, via PENmail, to print the information. This way, another publicly visible person becomes more aware of the curriculum and supporting materials.

Several topic headings or "departments" in an on-line newsletter, such as a table of contents, curriculum update, resource section, and access numbers to other related PENpages documents, can be useful to the reader who skims through for pertinent facts.

An on-line newsletter may also include a bibliography to provide users with knowledge of related materials in the popular press and research arena. Making single printed copies of the cited articles available to those unable to locate them is a useful service. The curriculum developer also gains an awareness of the needs and interests of the educators and insight on who is reading and when they are reading the information.

If the readers recognize the developer's effort in locating resources to improve the curriculum, a certain credibility is established between the educators and the developer. The developer can also provide recognition and facilitate the exchange of ideas to increase the "vitality" of the curriculum.

Fact Sheets

Supporting curriculum documents, such as fact sheets may be written and placed on the PENpages bulletin board. Examples of documents related to clothing and textiles are:

- Stain removal recommendations
- International Fabricare Consumer Question and Answers
- Subject matter fact sheets on new techniques and trends
- Key ideas developed by master teachers and volunteers
- Annotated bibliographies and resource lists (some gleaned quarterly from newsletters)
Science experiments (and other activities to support the curriculum)
New commercial patterns (appropriate for curriculum)
In-service outlines and lesson plans
Curriculum committee minutes
Curriculum concepts and scope and sequence
Fashion revue narrations (We have a program that will also print them on index cards.)
Pretests and posttests; quizzes
Survey and program evaluation results.

This information is useful to educators and students who access the on-line documents just as they would books or articles in a library. The potential exists for students in other parts of the country to input information, ideas, and data and make it accessible to other students (Solomon, 1989).

Basically, the on-line system is an organized filing system. This system makes it easy for the user to keep, review, and respond to materials. Documents that change or are updated regularly are viewed through a series of menus and a weekly listing of changes.

PENmail speeds the exchange of questions and answers about curriculum and announcements of new material. It is also a quick way to survey users on questions related to the curriculum development process.

Integrated Curriculum and Support Materials in the Curriculum Design Process

Steps in the curriculum design process are really no different from the steps taken by a designer, sculptor, or scientist. First, those developing the materials must question: what is needed and why, who will be involved, and are there materials that may be purchased or utilized. In order to successfully deal with these questions, an understanding of the background, needs, and related literature is required.

Next, those involved brainstorm ideas and give suggestions. Plans are formulated. Materials are written, reviewed, and pilot tested. Content and directions are scrutinized; leading to more feedback, dialogue, and questioning. Finally the materials are revised, retested, and published. Supporting materials are developed.

More activity and communication is required than can be sent by the PEN system. The following outlines all parts of the curriculum process and the integration of electronic and face-to-face communication.

A. Questions and/or needs are expressed by one or more educators (Sent by PENmail, talked about at a conference or within a committee).

B. Information is sought to address needs.
   a. PenMail discussions and PENpage sharing of ideas
   b. Research library or other PENpage documents
   c. Secure materials used by others
   d. Consult experts
   e. Review needs assessment data. Survey by PENmail.

C. Curriculum questions and needs discussed by committee. (Face to face contact works best here.) Place minutes on PENpages.

D. Develop outlines and concept grids. PENmail to committee.
   a. Review by educators; comments return via PENmail
   b. Revise and place on PENpages as a supporting document.

E. Develop materials on PENpages.
   a. Review by educators; comments returned via PENmail
   b. Revise and provide entire list of comments back to educators on PENpages
   c. Test directions, developmental skills, etc. in lab.

F. Resubmit materials on PENpages.
   a. Review by educators; comments return via PENmail
   b. Review by editors; comments return via PENmail or by face-to-face discussion
   c. Revise.

G. Put materials in final format.
   a. Work with artist and publisher
   b. Review by educators. Send surface mail.
   c. Pilot test. Send materials surface mail.
   d. Meet with committee face-to-face to approve publication and develop marketing strategy.

H. Print materials.
I. Send out marketing pieces via PENmail and announce in newsletter.

J. Develop other support materials.

K. Conduct in-service trainings. Provide PENpage outline of in-service content to those unable to attend meetings.

L. Answer curriculum questions via PENmail and by phone.

M. Revise all materials periodically using the PEN system.

N. File curriculum and program evaluations.

Curriculum developers find that the development process varies depending on resources, interest, and other factors. This outline is a way of showing how the PENsystem can be used for a hypothetical situation.

**Does The PEN System Really Work**

**For Curriculum Development?**

A one year study was made of the development of a skill-level clothing curriculum using this electronic communication system. The primary objectives were to:

1) increase the communication and adoption of the new curriculum

2) increase the usability of the textiles and clothing information

3) trouble-shoot potential problems and suitability of the curriculum before it is sent or printed in a standard format and

4) increase the productivity of the curriculum development process (before technical and fashion information changes or is outdated).

Compared with similar curriculum development efforts, the use of the electronic information transfer systems increased both the quantity of materials being developed and the acceptability of the materials in the state. Because of the speed of information transfer, concerns about teaching strategies can be shared more quickly, tested, and research-based information incorporated in the final product.

The use of the electronic system in conjunction with a small curriculum committee was evaluated as being far superior to the use of the curriculum committee alone. In addition, it was found that the Extension specialist spent less time developing materials and answered fewer telephone calls.

PENpages has allowed new cooperation between organizations across the state. Because the extension materials were so easy to modify, these documents were also transferred to PENN*Link so that teachers could access them as well. Newsletters and bibliographies were especially popular with these educators.

Limitations of on-line systems for curriculum development purposes were also found. First, it was inappropriate to place lengthy documents (more than 15-20 pages) on one PENpage file. (PENmail allows only 5 pages of text to be sent.) However, the information could be placed within several PENpage files.

Second, very little is written about how to write for the on-line system (Garner, 1990; Rawles, 1990) and readability may be a problem. On-line systems also lack the ability to include graphics and formatting is restricted to capitalization and the use of a space bar. These disadvantages are likely to remain for some time because graphics restrict the ability to send and receive information quickly.

The lack of graphics and formatting may be an advantage, however, if the document will be published. The editor and designer can easily make the unformatted draft meet their specifications. Study is continuing to further expand the use of electronic transfer in other curriculum applications.

Electronic media may never completely replace print. Messages may never replace meetings. And, communications transfer may never replace the U.S. mail. The PEN system, however, provides useful tools to those who want to develop curriculum materials quickly and with the maximum involvement of educators.

**References**


APPENDIX

Software Directory
(approximate prices)

For the IBM

AutoCAD
retail: $2500; ed: $1500

AutoSketch
$40-$90
Autodesk
2320 Marinship Way
Sausalito, CA 94965
415/332-2344

ApparelCAD
$500
Phyllis Miller
P.O. Box 2883
Mississippi State, MS 39762 601/323-1411

BetaCAD
Bernard Reuschhoff
Britta Stolffus
BetaCom
P.O. Box 284
Manhattan, KS 66502

Cadterns
$750-$2000
Lauraline Grosenick
1984-148A Street
White Rock, B.C.
Canada V4A 6R6
606/536-5199

Clocare
Linda Heaton
300 Erikson Hall
University of Kentucky
Lexington, KY 40546
606/257-7775

dBase
Ashton-Tate
Irvine, CA
800/437-4329

Gerber Garment Technology
P.O. Box 769
Tolland, CT 06084

Lectra Systems
844 Linvingston Court
Marietta, GA 30067
404/422-8050

Lotus 1-2-3
Lotus Development Corp.
55 Cambridge Pkwy.
Cambridge, MA 02142
616/577-8500

Merchandise Modules
Jeanne Heitmeyer
301 Sandles Bldg.
Florida State University
Tallahassee, FL 32306

Merchmath.ezy
Kinkos
113 W. Elizabeth
Fort Collins, CO 80525
503/482-3688

Microdynamics
$25,000 first station
(includes hardware)
Darla Box
10461 Brockwood Road
Dallas, TX 75238
214/343-1170

Microsoft Paintbrush
ed: $125 (comes with
Windows or mouse)
Microsoft Inc.
16011 N.E. 36th Way
Box 97017
Redmond, WA 98073-9717

ModaCAD (see Macintosh)
IBM (con't)

PC Paintbrush
retail: $99 retail
ed: 25% discount thru ZSoft
(with additional drivers,
same as Microsoft Paintbrush)
Zsoft
450 Franklin Rd., Suite 100 Marietta, GA 30067
404/428-0008

Pattern Maker
$75
Jim Pickrell
Dept of Fine Arts, UCLA
available through Whiskware
800/543-3201

PC Pattern
retail: $2000; ed: $1200
Isabelle Lott
307 Lakewood, SE
East Grand Rapids, MI 49506
616/949-3429

WordPerfect
WordPerfect Corporation
1555 N. Technology Way
Grem, Utah 84057
801/225-5000

For the Macintosh

Aldus Freehand, 2.0
$329
Aldus Corporation
available through MacWarehouse 800/255-6227

Andros SoftWear
$49.50, bodice; $79.50, skirt
P.O. Box 782
Moss Beach, CA 94038
415/340-1040

Arfactory
Craig Landay
714/793-7346

AuraCAD (MGM Station)
retail: $900; ed: $250
Micro CAD/CAM Systems
5900 Sepulveda Blvd
Van Nuys, CA 91411

AutoCAD (see IBM)

AVL Looms
retail: $10,000 per module
601 Orange St.
Chico, CA 95928
916/893-4915

Computer Design, Inc.
retail: $25,000-$35,000
5270 Northland Drive
Grand Rapids, MI 49505
616/361-1139

Course Builder
TeleRobotics International, Inc.
7325 Oakridge Hwy, Suite 104
Knoxville, TN 37921

dBase (see IBM)

Lotus 1-2-3 (see IBM)

MacDraw II
$295
Claris Corporation
available through MacWarehouse
800/255-6227

MacFashion
$38.00
Intellimation (Division of Apple)
P.O. Box 1922
Santa Barbara, CA 93115
805/685-2100
Macintosh (con't)

MacPaint II 2.0
$95
Claris Corporation
available through MacWarehouse
800/255-6227

ModaCAD
retail: $10,000/module
ed: $5000/module, approx.
Linda Friedman
1954 Cotner Ave.
Los Angeles, CA 90025
213/312-6632

Pointcarre
$7,000-$20,000
286 4th Ave.
Lasalle, Quebec, H8P2J6
Canada
514/365-4798

Sculpt 3D
Byte by Byte
Arboretum Plaza II
Capital of Texas H. North
Suite 150
Austin, TX 78759
512/343-4357

Superpaint 2.0
$125
Silicon Beach Software, Inc.
available through MacWarehouse
800/255-6227

Stitchstack
Karen LaBat
Minneapolis College of Art & Design
2501 Stevens Ave. So.
Minneapolis, Minnesota 55404

ThunderScan
Thuderware, Inc.
21 Orinda Way
Orinda, CA 94563
415/254-6581

VersaCAD 3.0
retail: $2395
ed discount available
VersaCAD Corp.
2124 Main St.
Huntington Beach, CA 92648

WordPerfect (See IBM)

Other

PEN Mall
Pennsylvania State University

Statistical Package for the Social Sciences:
SPSS by Nie, Hadiai-Hull, Jenkins, Steinbrenner,
and Brent
McGraw Hill, New York

Other Sources:
Proceedings On the cutting edge: Computer
Applications in clothing design for people with
special needs. Veterans Administration
Rehabilitation Research and Development Center,
Palo Alto, and West Valley College, Saratoga, CA
Computer Related Presentations--ACPTC Meetings 1985-1989

1985
Development of a computerized device for body measuring
   Eleanor Woodson

Computerized pattern drafting for the asymmetrical or unusually-sized figure
   Nancy Steinhaus and Laura Young

The Adaptation of microcomputers to apparel production for students and small industries
   Phyllis Bell Miller and Jacquelyn DeJonge

Problem-solving computer programs: Analyzing manufacturing and merchandising costs
   Grovalynn Sisler, Jane Swinney, Linda Good, and Carolyn Hoener

Computerized internship management
   Laura Jolly

Computer applications for merchandise budgeting
   Judith Everett

1986
The role of the computer in the future apparel industry
   Mary Carter

Computerized individual pant fit
   Eleanor Woodson

1987
Apparel costing: Computer application of Lotus 1-2-3
   Sandy Ford, Grace Kunz, and Ruth Glock

Designing a database management system
   Patricia Huddleston

Computer skills in retail education
   Margaret Huber and Susan Davis

Development of videotex programs for an apparel quality course
   Anita Racine

Computerized databases in historic textiles: Constructing a model for coverlet research
   Anne Branningan-Kelley

Computer-aided instruction in clothing and textiles
   Lavonne Matern

1988
Wholesale suppliers data base
   Lois Gotwals and Clayton Molinari

Apparel-related tutorials designed to teach AutoCAD
   Nancy Steinhaus

Microcomputer applications in teaching advanced textiles-textile performance
   Maureen Grasso and Jane Craig

Customized standard software to meet the needs of educational institutions and the apparel industry
   Phyllis Bell Miller

Computerizing coverlet design motifs: A pilot study
   Clarita Anderson and Jean Parsons

Linking design and merchandising program areas through computer-aided graphics design of private labels
   M. Jo Kallal and Rosetta LaFleur

Modernizing apparel design courses by developing and integrating computer-aided design by microcomputer
   Phyllis Bell Miller and Anita Racine

Teaching computer-aided apparel design
   Gwendolyn Sheldon and Cynthia Regan

1989
Bodice Editor - computer-aided design program using flat pattern techniques
   Phyllis Brackelsberg

Using paint systems to teach computer-aided textile design and fashion design
   Janice Rosenthal

Customizing CAD software and creating a tutorial for merchandising presentation and store layout
   Phyllis Bell Miller and Nina Dilbeck

Customized patterns: A marketing approach (CAD)
   Lark Caldwell and Jane Workman
Body measurement techniques for custom clothing design: Implications for computer applications
Beverly Ledwith

Incorporating computer applications into merchandising curriculum
Cynthia Regan

Macfabrics and Macfashions: Computer applications for the Apple Macintosh
Linda Welters, Catherine Cerny and Karen Kyllo

Integrating CAD graphics training with creative design topics
M. Jo Kallal

A Lotus macro for teaching about off-shore sourcing alternatives
Jane Craig and Maureen Grasso

Industrial sewing machine guide for apparel design students (Stitchstack using Hypercard)
Karen LaBat

Computer Related Articles: Clothing and Textiles Research Journal

1987
The use of a microcomputer to teach color concepts: Effectiveness and relationship between attitudes and learning styles
Janet L. Offerjost and Lucille M. Terry

1988
The impact of technology on apparel designer training
Gwendolyn Sheldon

1989
Computer technology use by Louisiana apparel manufacturers
Bonnie D. Belleau and Jacqueline T. Didier

1990
CAD/CAM in the textile and apparel industry
Billie J. Collier and John R. Collier