METRIC

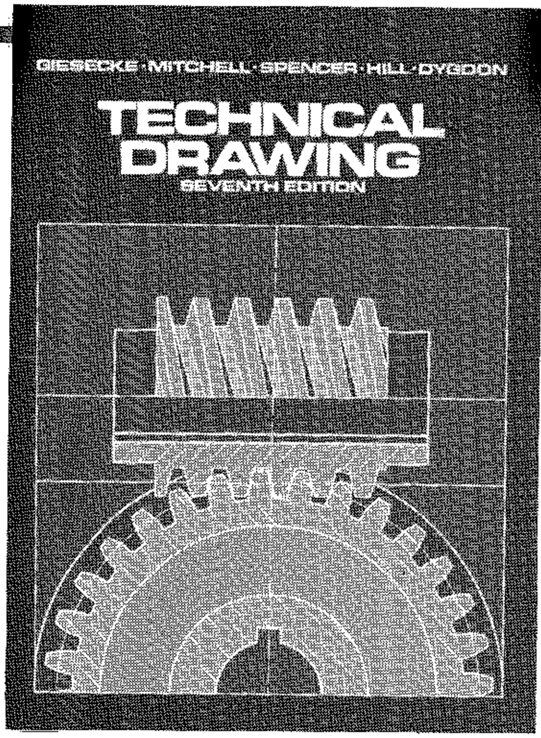
ENGINEERING DESIGN GRAPHICS JOURNAL

SPRING 1980 VOLUME 44 NUMBER 2

ASEE ANNUAL MEETING
UNIVERSITY OF MASSACHUSETTS

JUNE 22-26, 1980

MACMILLAN



47 years and 1½ million students later...

Technical Drawing

Seventh Edition

By the late Frederick E. Giesecke, the late Alva Mitchell, the late Henry Cecil Spencer, Ivan Leroy Hill, Illinois Institute of Technology, and John Thomas Dygdon, Illinois Institute of Technology.

1980, 896 pp. (approx.)

The Seventh Edition of **Technical Drawing** is now available for your engineering courses in graphics and design. Like its predecessors, the **Seventh Edition** offers the clearest and most up-to-date presentation of technical drawing yet to be published.

Students are first introduced to graphical language and design concepts, instrumental drawing, lettering, geometric constructions, freehand sketching and shape description, and multiview projection. All areas of engineering drawings follow, making **Technical Drawing** a complete teaching unit. An abundance of meticulous illustrations—over 1200—logically depict the material. Many of these illustrations are in step-by-step format to guide students in the development of design.

ENGINEERING DESIGN GRAPHICS JOURNAL

CALENDAR

ASEE ANNUAL CONFERENCES

1980 - University of Massachusetts
Amherst. June 23 - 26

1981 - University of Southern California
Los Angeles. June 22 - 25

1982 - Texas A & M University
College Station. June 21 - 24

EDGD MIDYEAR CONFERENCES

1980 - V.P.I. & S.U.,
Williamsburg, VA. Nov. 23-25

1981 -

ENGINEERING DESIGN GRAPHICS JOURNAL is published - one volume per year, three numbers per volume, in Winter, Spring, and Fall - by the Engineering Design Graphics Division of the American Society for Engineering Education, for teachers and industrial practicioners of Engineering Graphics, Computer Graphics, and Design Graphics, and Creative Design.

YEARLY SUBCRIPTION RATES:

U.S., Mexico, Canada	
ASEE-EDG members	$1.50
ASEE but not EDG members	3.00
Non-members	5.00
Foreign subscribers	$10.00

SINGLE COPY RATES:

U.S., Mexico, Canada	
ASEE-EDG members	$1.00
ASEE but not EDG members	1.50
Non-members	2.00
Foreign subscribers	$ 3.50

Back issues are available at single copy rates (prepaid) and are limited in general to numbers published within the past six years.
Subscription expiration date (last issue) is printed in upper right corner of mailing label, W79 for Winter 1979, S80 for Spring 1980, etc.

ENGINEERING DESIGN GRAPHICS JOURNAL OBJECTIVES:

The objectives of the JOURNAL are:
1. To publish articles of interest to teachers and practitioners of Engineering Graphics, Computer Graphics and subjects allied to fundamentals of engineering.
2. To stimulate the preparation of articles and papers on topics of interest to its membership.
3. To encourage teachers of Graphics to innovate on, experiment with, and test apprpriate techniques and topics to further improve quality of and modernize instruction and courses.
4. To encourage research, development, and refinement of theory and applications of engineering graphics for understanding and practice.

DEADLINES FOR AUTHORS AND ADVERTISERS

The following deadlines for the submission of articles, announcements, or advertising for the three issues of the JOURNAL are:

Fall	September 15
Winter	December 1
Spring	February 15

STYLE GUIDE FOR JOURNAL AUTHORS

The Editor welcomes articles submitted for publication in the JOURNAL. The following is an author style guide for the benefit of anyone wishing to contribute material to the ENGINEERING DESIGN GRAPHICS JOURNAL. In order to save time, expedite the mechanics of publication, and avoid confusion, please adhere to these guidelines.

1. All copy is to be typed, double-spaced, on one side only, on white paper, using a black ribbon.

2. All pages of the manuscript are to be consecutively numbered.

3. Two copies of each manuscript are required.

4. Refer to all graphs, diagrams, photographs, or illustrations in your text as Figure 1, Figure 2, etc. Be sure to identify all material accordingly, either on the front or back of each.
Illustrations cannot be redrawn; they are reproduced directly from submitted material and will be reduced to fit the columnar page.

Accordingly, be sure all lines are sharply drawn, all notations are legible, reproduction black is used throughout, and that everything is clean and unfolded. Do not submit illustrations larger than 198 x 280 mm. If necessary, make 198 x 280 or smaller photocopies for submission.

5. Submit a recent photograph (head to chest) showing your natural pose. Make sure your name and address is on the reverse side. Photographs, along with other submitted material cannot be returned, unless postage is prepaid.

6. Please make all changes in your manuscript prior to submitting it. Check carefully spelling, structure, and clarify to avoid ambiguity and maximize continuity of thought. Proofreading will be done by the editorial staff. Galley proofs cannot be submitted to authors for review.

7. Enclose all material unfolded in a large size envelope. Use heavy cardboard to prevent bending.

8. All articles shall be written using Metric-SI units. Common measurements are permissible only at the discretion of the editorial staff.

9. Send all material, in one mailing to:

Mary A. Jasper, Editor
P.O. Drawer HT
Miss. State University
Miss. State, MS 39762

REVIEW OF ARTICLES

All articles submitted will be reviewed by several authorities in the field associated with the content of each paper before acceptance. Current newsworty items will not be reviewed in this manner, but will be accepted at the discretion of the editors.

NOTE: The editor, although responsible for copy as it is published, begs forgiveness for all typographical mistakes, mis-spelled words and any goofs in general. Typing is done mostly by non-professional word processors who either are still in high school or are not trained in professional word processing. Thank you for your patience.

THE AMERICAN SOCIETY FOR ENGINEERING EDUCATION

Engineering Design Graphics Journal

SPRING 1980 VOLUME 44 NUMBER 2

ELECTION RESULTS

The Engineering Design Graphics Division, on March 15, 1980, elected the following persons to office.

Vice-Chairman (1980-1981), Jack C. Brown; Director: Programs (1980-1983), Roland K. Jenison; Director Liaison Committees (1981-1983), Merwin L. Weed; Circulation Manager-Treasurer for the Engineering Design Graphics Journal (1980-1983), John Demel.

In June, the newly elected officers will take office along with the incoming chairman, Paul DeJong. The Division extends its best wishes to our able chairman and his competent officers and looks for a productive term of office.

To those who will complete their term of office this year - our thanks and appreciation for a job well done.

The Division also recognizes those who were willing to run for office but were not elected. These persons have contributed their many talents and abilities to the Division in the past. We know their continuing service will enable our group to better serve Engineering Education in the future.

LEON M. BILLOW
Chairman, EDGD

INDEX TO ADVERTISERS

TABLE OF CONTENTS PAGE

TABLE OF CONTENTS

1980 ASEE ANNUAL CONFERENCE

JUNE 22 - 26, 1980

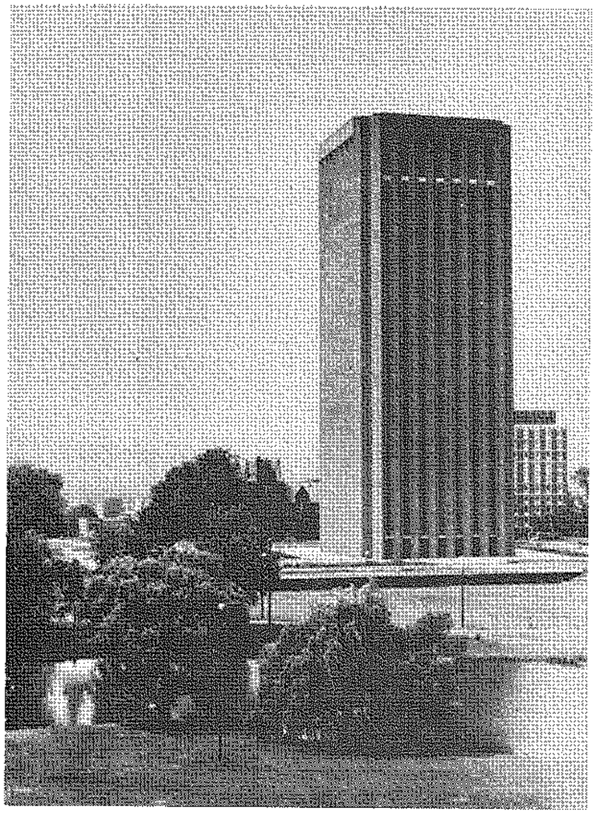


FIGURE 1. The Campus Center and the Duck Pond.

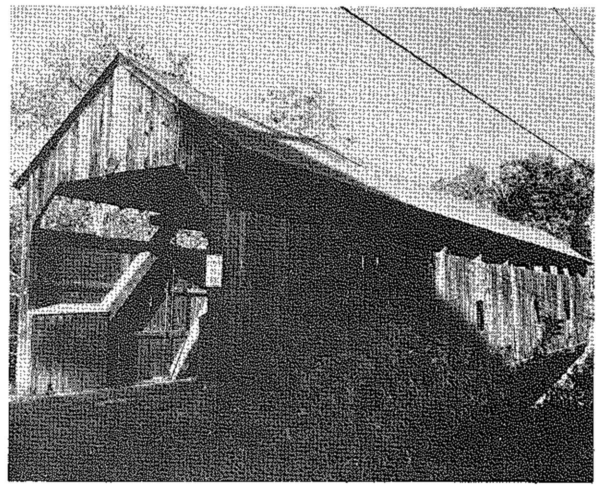


FIGURE 2. A Roofed, Enclosed Structure spanning some fluid mass -- typical of the area.

The University of Massachusetts is THE STATE UNIVERSITY in a "State of Universities and Colleges". A blend of the very,very old and the ultra-new, UMASS nestles in the center of one of the most historic areas of the nation.

Besides the highly interesting and informative program for the EDG Division at this Annual Meeting,(which is given on page 46 of this issue of the Journal), it is probable that most of us who attend the conference will just get "lost" in either history, technology of alternate energy methods, or the setting and scenery, which must be spectacular, judging from the photographs which you see on these two pages.

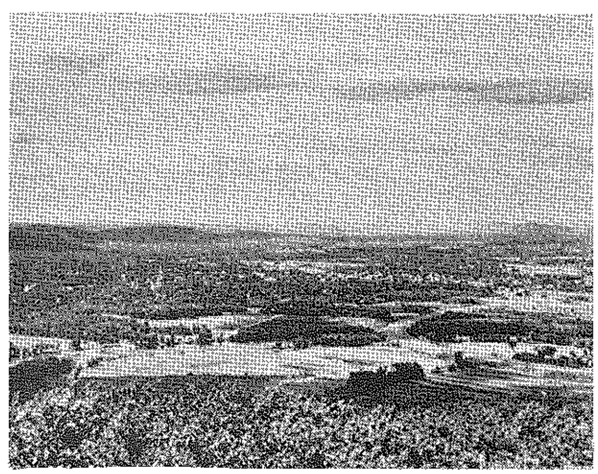
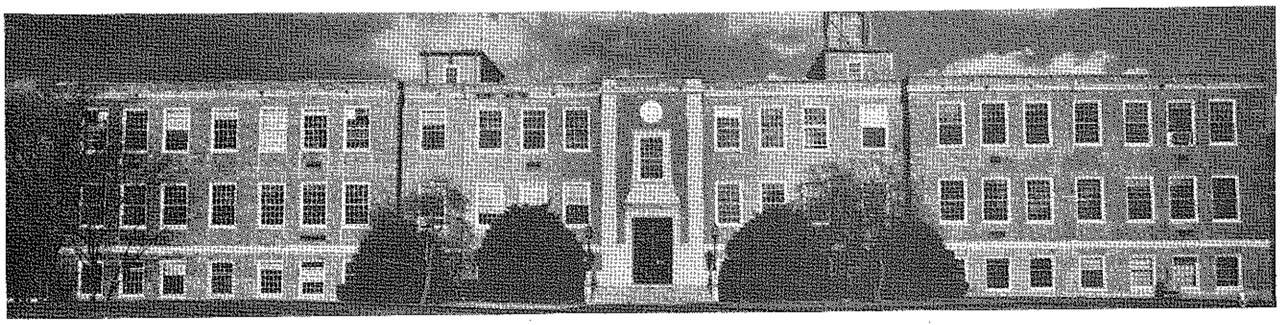


FIGURE 3. Aerial View of the Amherst Region.

UNIVERSITY OF MASSACHUSETTS

AMHERST, MASSACHUSETTS

FIGURE 4. Marston Hall - The center of Engineering Activity.



Don't forget the "Interactive Computer Graphics workshop", also described on page 46 and in Bob LaRue's guest editorial on page 6. Make your plans to invest in this endeavor with a few extra days of your summer. Whether you're an old hand at interactive computer graphics or just getting started, you'll find a lot there for you and your institution.

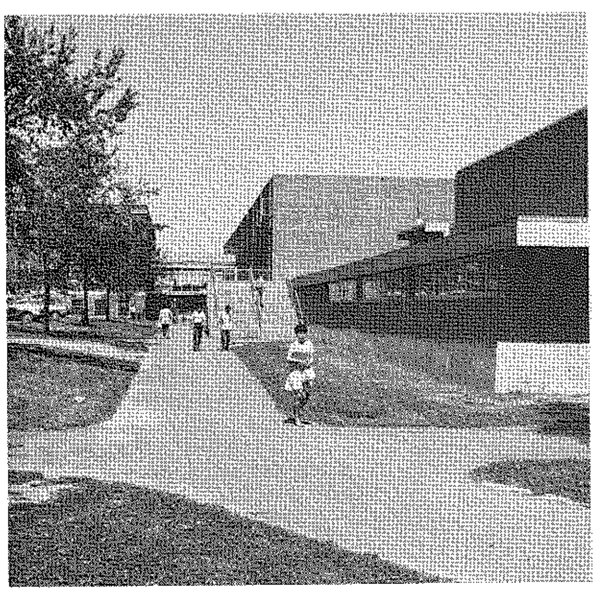


FIGURE 5. Engineering East - Part of the new Engineering Complex.

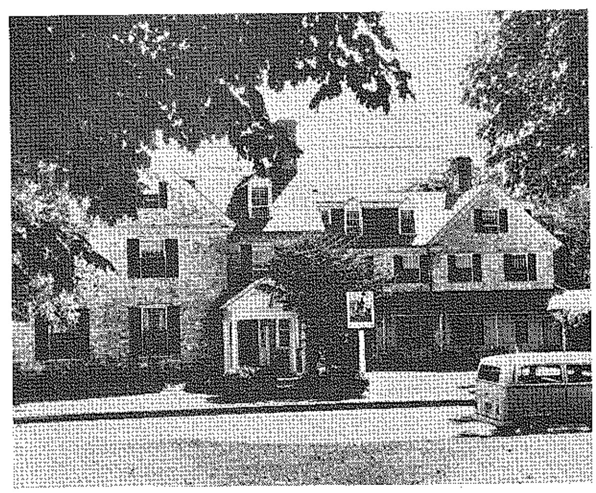


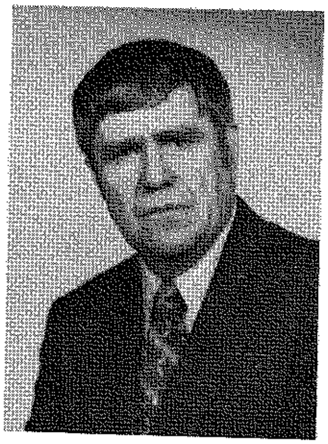
FIGURE 6. The Lord Jefferery Inn

So plan to attend the 1980 Annual Meeting of the ASEE, plan to bring your family, and most of all, plan to be thoroughly entertained and enlightened -- all at the same time.

--Ed.

GUEST EDITORIAL

INTERACTIVE COMPUTER GRAPHICS WORKSHOP



Robert D. LaRue
Ohio State University
Columbus, Ohio

When a member of EDGD who has been poo-pooing computer graphics for years writes an article describing how this magnificent tool can be used, it may be a sign that computer graphics has come of age. The Divisions's first exposure to computer graphics was in the early 1960s and included Boeing's presentation at the Wichita Midyear meeting as well as dynamic discussions by Steve Coons of the research being carried on a MIT. Steve also arranged for us to hear Ivan Sutherland (at that time a graduate student) describe SKETCHPAD at the Air Force Academy Annual Conference. Sutherland is now one of the leaders of a firm producing some of the most versatile computer graphics hardware available.

Since then, idustrial usage of computer graphics has increased greatly. Many companies are now involved in computer aided design utilizing interactive computer graphics. Engineering graduates with a background in computer graphics are in demand.

Paralleling the increasing industrial use of computer graphics was a similar trend toward including use of some form of computer graphics in engineering curricula. Some of the first books for courses in computer graphics (primarily for CalComp digital plotters) came from Northeastern (Franklyn Brown) and Nebraska (Tom Smith). Jack Brown (Alabama) completed his PhD at Texas A & M. His dissertation was an excellent two-volume production on computer graphics. Computer graphics in one form or another is being taught by Division members in schools such as Illinois (both Urbana and Chicago Cirle campuses), Clemson, North Carolina State, Michigan State, Louisiana State, Mississippi State, Texas A & M, Ohio State and others.

A Computer Graphics committee was established in the Division and has been quite active. Evidences of this activity are papers presented at both Midyear and Annual Conferences and others which have been published in the Journal. In addition, two summer schools or workshops have been sponsored by the committee. The first was given at the Texas Tech Annual Conference in 1972. The second was a part of the International Conference on Descriptive Geometry in conjunction with the University of British Columbia Annual Conference in 1978.

The third computer graphics workshop will be presented at the University of Massachusetts following the Annual Conference in June, 1980. This time was selected for the convenience of the host institution. Director of the workshop is Bob LaRue (Ohio State) who will be assisted by Associate Directors Klaus Kroner (U Mass), Jim Burnett (Michigan State) and John Demel (Texas A & M). Additional staff with computer graphics experience will be available to help participants in various aspects of the workshop.

The primary objective of the workshop is to provide participants with experience and information which will aid them in introducing computer graphics into various engineering or engineering technology curricula at their institutions. Previous programming experience is desirable, but not necessary. The workshop will be structured to enable participants to obtain maximum benefit even with little or no background in computer programming or computer graphics. Hands-on experience with interactive computer graphics systems will included as a part of the workshop. Small systems, intelligent terminals and hardcopy devices are some of the hardware that will be available for examination and use. A field trip to an industrial computer graphics user is planned. Advanced sessions dealing with Computer Aided Design and Computer Aided Manufacturing (CAD/CAM) will be presented.

The keynote speaker will be Dr. Michael Wozny, Director of the Interactive Computer Graphics Center at Rensselaer Polytechnic Institute. This installation (including 35 interactive refresh type terminals) is one of the largest and best in an engineering school.

—Continued on Page 8

CHAIRMAN'S PAGE

LEON M. BILLOW
U.S. NAVAL ACADEMY

Since my tenure of office as Chairman of the Engineering Design Graphics Division will be completed in June this will be my last message in that capacity. The fact that I have held this office gives me a feeling of great satisfaction and pride; a satisfaction that arises from a rewarding experience and a feeling of pride that comes from working with the many fine people who make up this organization.

It is for this reason that I wish to deviate from the usual tenor of the Chairman's Message and use this column to express not only the thanks of the Chairman but the appreciation of the Division to those people who have helped make the past year a successful one for the Engineering Design Graphics Division. One great danger in attempting a message such as this is the omission or misspelling of someone's name. If this happens your forgiveness is requested.

Many thanks are due the following: Past Chairman, Clyde H. Kearns; Chaplain, Clarence E. Hall; Vice-Chairman, Paul S. DeJong; Secretary-Treasurer, Charles W. Keith; Nominating and Distinguished Service Award Committee, Robert D. LaRue; Policy Committee, William B. Rogers; and Resolutions Committee, Klaus Kroner.

Director of Liaison, Jack C. Brown and his committee chairpersons: Membership Activities, Mary C. Copeland, Educational Relations, Margaret Eller; Industrial Relations, William F. Elwood; International Relations, Clarence E. Hall.

Technical and Professional Director, Larry D. Goss and his committee chairpersons; Computer Graphics, Francis A Mosillo; Freshman Engineering, L. L. Northrup; Human Factors, F. J. Jankowski; Metrication, E. J. Mochel, Teaching Techniques, Mary F. Blade.

Director Zones Activities, George E. Pankratz and his committee chairmen: Zone I, R. S. Lang; Zone II, F. A. Mosillo; Zone III, I. G. Skubic, Zone IV, R. W. Reynolds.

Director Programs, Arvid R. Eide; 1980 Mid-year Conference Program Chairman, P. W. Miller; 1980 Annual Conference Program Chairman, Arvin E. Eide.

The Engineering Design Graphics Division publishes three outstanding issues of the Engineering Design Graphics Journal each year. The Publication Board consists of the Editor, Mary A. Jasper; Associate Editor, Frank M. Croft, Jr.; Associate Editor, Edward W. Knoblock; Circulation Manager, Garland K. Hilliard, Jr.; Advertising Manager, Menno DiLiberto; Puzzle Corner Editor, Robert R. Kelso.

Ed Knoblock is in charge of the Creative Engineering Design Display which will be a part of the Annual ASEE Conference at the University of Massachusetts this June. Working with him are Jay Abramowitz, Jon Jensen, and Borah Kreimer. Be sure to visit the display area.

In November, the Division held an outstanding mid-year meeting in San Francisco hosted by Cogswell College, its president, Dalhart Ecklund and its dean, Ron Paré. Ron did a tremendous job and undoubtedly spent many hours making sure that everyone who attended enjoyed themselves and derived many benefits from the conference. Ron was assisted in the registration and details of the meeting by his secretary, Mary Holmes. Many thanks to them both.

Special thanks go to those listed on the program as speakers and moderators:

Continued

Dalhart Ecklund, Ronald Paré, William F. Elwood, Carlton W. Staples, Mary Copeland, Merwin L. Weed, Warren White, John T. Demel, Larry D. Goss, John M. Duff, William C. Stenzel, Barbara Ramey, Paul DeJong, C. Gordon Sanders, Arvid R. Eide, Peter W. Miller, Frank Marvin and Clyde Westfall.

This year the Executive Board supported the chairman in his proposal to present certificates of appreciation from the Division to all those who spoke or gave papers on our programs at the mid-year and annual conferences. Special thanks go to Claude Westfall who designed the certificates and lettered the individual's name on each. These presentations were initiated at the San Francisco Mid-Year Conference with very good results. The chairman hopes this will be a continuing practice.

The chairman has also established a "Committee of authority" or referral board to provide expertise in answering difficult questions in engineering graphics. This committee consists of Eugene Paré, Washington State Univ.; Robert Loving, Illinois Institute of Technology; William Rogers, Virginia Polytechnic Institute and State Univ.; Robert Hammond, North Carolina State Univ. Their names and addresses were published in the last issue of the Journal. If you run into a tough question that you can't answer write to them and take advantage of their knowledge.

For many years Frank Oppenheimer has been a friend and advisor to everyone in the Division. The Oppenheimer Award is given by Frank to the best speaker at our mid-year conferences. By the way, Arvid Eide received this award at the San Francisco Conference. Our best to Frank and our thanks for all he has done for the Division.

Our congratulations to the following who were elected to office on 15 March 1980: Vice Chairman: Jack Brown, Univ. of Alabama; Director Programs: Roland Jenison, Iowa State Univ.; Director Liaison Committees: Merwin Weed, Pennsylvania State Univ./McKeesport; Circulation Manager-Treasurer of the Engineering Design Graphics Journal: John Demel, Texas A&M Univ. Our best to these new officers. We know they will do an outstanding job.

We are looking forward to a great convention at the University of Massachusetts in June. Klaus Kroner, a professor there is acting as liaison for the Division. He has obtained a great area for our design display and promises us outstanding luncheons and banquets. All this coupled with the fine programs arranged by Arvid Eide promises us a rewarding and enjoyable convention. Hope to see you all there.

Klaus has been a busy man lately. In addition to his work for ASEE, he had charge, in January, of a successful computer workshop which was held at the college. Our Division co-sponsored this worthwhile project.

Many members of the Division will, we hope, stay for the Engineering Design Graphics Division computer workshop which will be held at the University of Massachusetts following the ASEE Convention. Bob LaRue and John Demel have worked long and hard to make this event a success. We wish them well in this venture.

As you can see by the length of this column we have many people involved in the activities of our Division. I say "our" Division because it is operated by the members. Again I wish to express my appreciation and my thanks to all. Keep up the good work.

Lee

Continued from Page 6

A weekend in the middle of the workshop may not, at first glance, appear attractive. However, although there will be nor formal sessions on Sunday, computing facilities and staff will be available for those who feel that they need additional experience. Others may wish to relax a bit and explore some of historical Massachusetts.

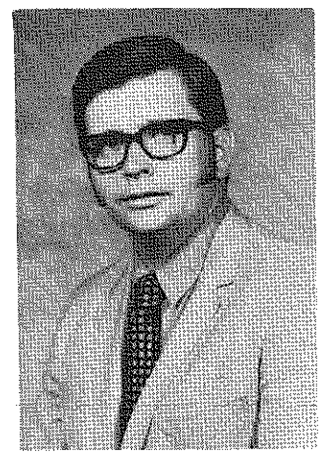
The registration fee (which does NOT include housing or meals - except one banquet) will be $225 for ASEE members. Contrast this with a fee of $450 which is being charged by commercial workshop presentors for a two-day, NO computer experience workshop (no housing or meals either). Housing and meals will be available to participants in the University Campus Center. Pre-registration must be completed by 1 June, 1980. The workshop is limited to 25 participants.

For additional information write

Mark Spengler, Director
University Conference Services
Campus Center
University of Massachusetts
Amherst, MA 01003

from the midyear conference. . .

CONJUGATE DIAMETER BLOCK SHADING FOR TECHNICAL ILLUSTRATION



Larry D. Goss
Indiana State University @ Evansville
Evansville, Indiana

Pictorial drawing, "Technical Illustration" is a mainstay of catalog and replacement part identification. Exploded parts catalogs are published by almost all manufacturers for each of their product lines. These catalogs have been historically printed by offset methods in an 8.5 by 11 inch format. They still are available that way, but in addition, companies with large distributorships such as implement and automotive manufacturers have found that the bulk and expense of printed catalogs is becoming prohibitive. They are finding that paper catalogs are not durable, are subject to frequent catastrophic loss of information from accidental grease smudges, are extremely expensive to print and distribute, and can become useless or at least extremely cumbersome to use because of haphazard control on updating and revision procedures in the field. The standard format for parts catalogs is rapidly changing from the printed page, to the 100 by 150 mm microfiche.[1] By contrast to a printed catalog, microfiche costs only a fraction to reproduce, is extremely compact, can be mailed for less than 10¢, and the pages never get torn or out of order.

What does all this have to do with shading? The extensive reduction ratios to which original artwork is subjected in putting it on microfiche of one catalog format which is available has caused problems for the manufacturer. The reduction ratio from original artwork can range up to 1:140. This is much greater than that which has been used on aperture cards, which can rage up to 1:33 and is also a much larger reduction than the standard library microfiche, which is more or less standardized at 1:16. ISO standards indicate a reduction ratio of 1:12 to 1:25.5 as being acceptable.[2] Obviously, the photo emulsion grain size does strange things to the linework, lettering, and shading on a catalog illustration at these great reductions; so precautions have to be taken in generating the original art to guarantee that the information is not lost in the reduction and blowback processes. One drafting equipment manufacturer advises generating original artwork so that the film line is at least 15 micrometers wide. This would mean making all linework on "E" format or A0 drawings at least 2 millimeters wide if it is to be reduced to catalog microfiche format. In actual practice, line weights on film of 5 to 7 micrometers will remain legible provided that too many generations or intermediate steps do not become inserted between the original art and the mass produced microfiche. Unfortunately a "first generation" microfiche is impossible to produce. The current process requires the following steps as a minimum: film negative, offset plate, offset print, microfilm negative, microfiche positive, mass produced microfiche.[3]

A certain amount of degradation is going to occur in such a lengthy process. The degradation is severe enough that no freehand lettering can be tolerated and most shading techniques block in completely or are severely degraded.

Recognizing that normal shading techniques are completely lost on microfiche has forced a decision -- either abolish shading altogether, or develop a technique which can survive the extreme reductions. The subject of this article is one technique which works with microfiche.

Each catalog illustration is full. Clients don't want to pay for blank space, because blank space usually means extra pages. It has been a major hurdle for me to convince some clients that splitting major assemblies into subgroups on individual pages can be advantageous. Some, such as figure 1, just cannot be logically split and so the end result has lots of little parts (including safety wire) that become very hard to show properly.

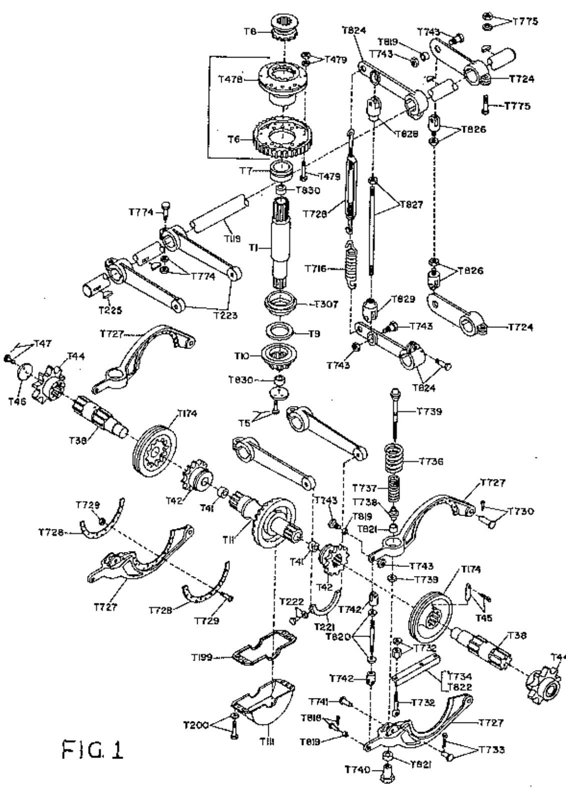


FIG. 1

When that occurs, I try to convince the client that we must have some artistic license to change the proportions of the objects so that they won't be lost on the microfiche. That ususally is not too hard to do and an illustration of distorted scale is the result. Notice if you will, that there is not a single fastener in Figure 1 that will fit the hole next to which it is placed. This kind of distortion becomes standard procedure when you are designing an illustration on microfiche. Figure 1 is obviously unshaded. The remainder of the figures show examples of the shading technique I call "conjugate diameter block shading".[4]

Very simply what I have done is to block out all detail "beyond" the conjugate axis on all rounded shapes and the surface in shadow on fasteners.

There are several advantages to this shading method. Among them are: it is very fast, and therefore an inexpensive technique; it always looks the same regardless of the reduction ratio from the original artwork; it helps in shape discription; it will withstand reduction to microfiche and blowback; and natural changes that occur in the position of the conjugate axes for various drawing angles can be used as visual clues to surface changes that are not otherwise readily apparant.

Figure 2 is an example of the technique in practice. The drawing is isometric and light has been assumed to be coming over the viewer's right shoulder. Note the sawtooth edge to the shading that is applied on internal and external threads. This extra effort provides a sense of realism that is helpful in interpreting the drawing.

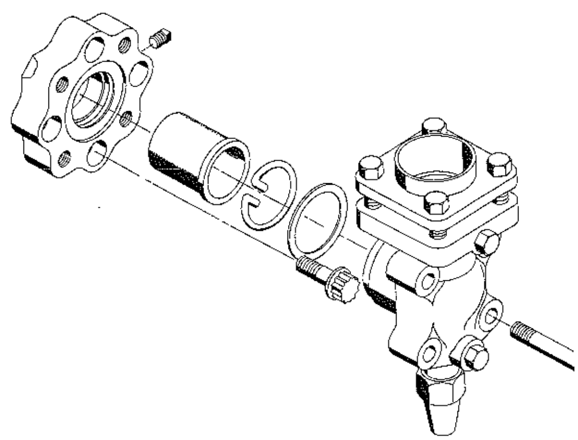


FIG. 2

Figure 3 illustrates the help this technique can be in shape interpretation. The piston and rings can become confusing without the shading being applied, but the addition of it leaves no doubt that there are three grooves for rings and that the detail inside the wrist pin hole is indeed

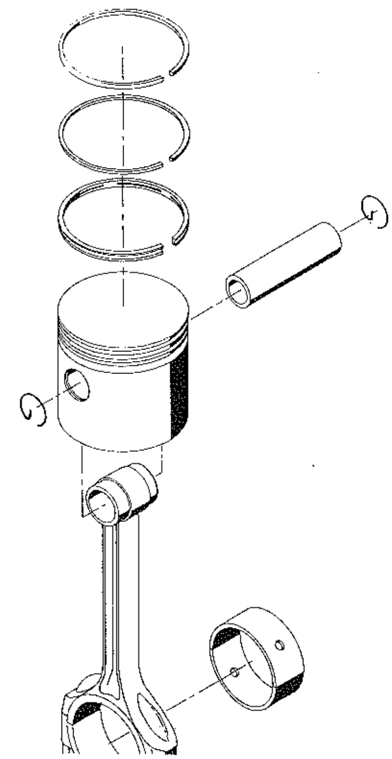


FIG. 3

a groove for the snap ring. A dramatic difference between shaded and unshaded drawings can be seen in Figure 4. Note in particular that the conical interior of part number 23 is completely undectable in the unshaded drawing.

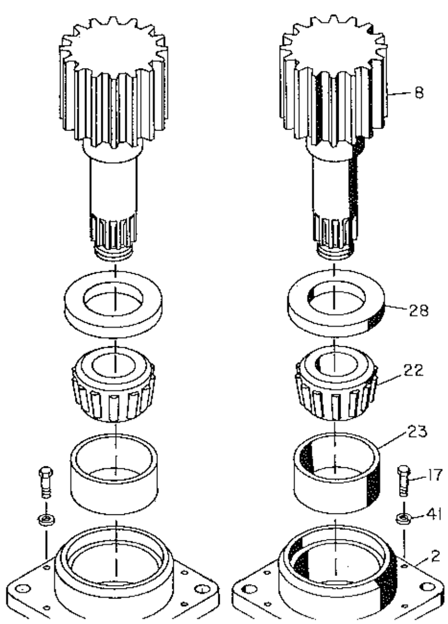


FIG. 4

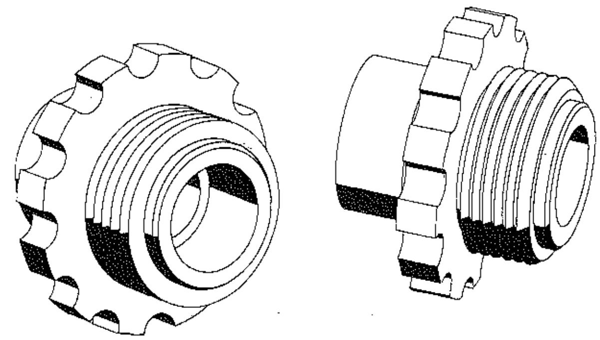


FIG. 5

The shading technique works in all axonometric and perspective drawing systems with equally beneficial results. Figure 5 is an illustration of a part in two different trimetric views. The conjugate diameters are obviously in different locations in these two illustrations and this changes the character of the shading. Plotting the location of the conjugate diameters is a reasonably simple construction which requires only that the illustrator draw two intersecting lines, through the center of the ellipse representing the cylindrical form which is to be shaded, which are parallel to the axonometric or perspective axes of the surface in which the end of the cylinder lies. (See Figure 6.) These two lines will be perceived as being mutually perpendicular to the axis of the cylinder itself. In actual practice only one of the two diameters is needed depending on the orientation of the cylinder and the assumed direction for the source of light.

The proof of my assertion that this shading technique is compatible with microfiche documentation and reproduction must be left unresolved unless you try it yourself or are viewing this article in microfiche format. My own personal experiences have shown that this technique is far more desireable than any other stipple, smudge, line, or applique shading technique for this application.

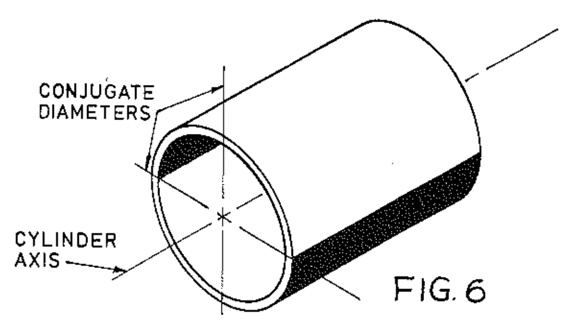


FIG. 6

FOOTNOTES

[1]This is nominal size. Actual standard size is A6 (105 x 148 mm). (ISO 2707-1976 (E) Sect. 3.1).

[2]ISO 2707-1976 (E) Sect. 4.

[3]The number and nature of steps in this process may vary from company to company.

[4]For a discussion of conjugate diameters or conjugate axes see French & Vierck Engineering Drawing and Graphic Technology, McGraw-Hill 3.48.

FROM THE COMMITTEES ......

PLATE GRADING BY SETS

Merwin L. Weed
Univ. of Pennsylvania
Mckeesport Campus

Chairman, Teaching Techniques Committee

In recent years, many graphics instructors have experienced larger class sections on top of a larger number of sections. Upon searching for a means by which to more efficiently deal with the literal stacks of drawing plates, a partial solution has emerged -- the grading of graphics plates by sets rather than by individual grades for each plate. A "set" is here defined as a group of 2, 3, 4, 5 . . . similar or dissimilar (by topic) graphics plates.

The plates are assigned one by one as material is covered, but the students are told to retain the completed plates until the assigned due date. On the due date, the set is stapled together in some assigned order, convenient for grading, and submitted to the instructor for evaluation.

The ground rules for the course must be understood on the first day of class: (1) No set will be graded if not complete. (2) All sets must be submitted for grading in order to pass the course; e.g., as a requirement of the course, all plates must be completed. (3) a penalty is imposed for late plates.

With any grading system there are advantages and idsadvantages. The following is a listing of a few of each uncovered to date.

Advantages:

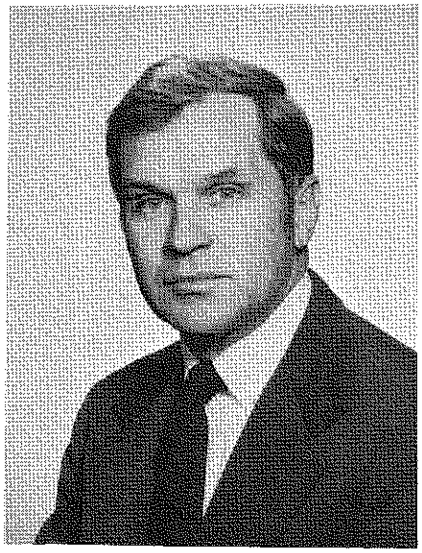
1. Less grades to average at the end of the course
2. Some reprieve between grading sessions.
3. Not all plates of a set need to be graded to the same depth. A sketched plate leading up to an instrument drawing may receive token grading, whereas the instrument drawing may be graded in depth -- thus, an overall timesaving.
4. Fewer episodes of collecting and handing back -- therefore, less confusion.
5. A reduction of time needed for entering grades.

Disadvantages

1. Grading by sets slows the feedback time to the student; therefore the student may commit the same error on several plates before his error is pointed out to him on a graded plate.
2. A grading session tends to be longer for set grading; however, total time is shorter.
3. Keeping track of the quantity and quality of errors as the set is graded is more difficult with a set than for a single sheet.
4. There is a tendency to grade in depth only a few plates in a set, thus overlooking errors that should be brought to the student's attention.

After trying this teaching technique for several terms and for several types of graphics courses, it is believed to be a significant timesaver. The majority of the disadvantages state above can be abated by self-discipline, practice, and by good timing of due dates.

from the midyear conference. . .



Professor Carlton W. Staples
Worcester Polytechnic Institute
Worcester, MA 01609

DO GRAPHICS MODULES WORK?

I BACKGROUND

The WPI Educational Plan

It is important that you know a little about the academic background which provided the incentive for writing and testing modular graphics at WPI.

As you perhaps know, WPI drastically revised its educational system about (eight) years ago. The present system incorporates competency based graduation requirements and emphasizes learning how to learn in project and course work.

The graduation requirements are four in number and include a comprehensive project in the major area (MQP), a project relating society and technology interactive (IQP), a humanities sufficiency which includes a group of integrated courses followed by a comprehensive research paper in a humanities area and finally, a competency examination which is a multi-day consulting type problem followed by an oral examination.

There are no required courses but all students work closely with an advisor in developing a personalized combination of courses and projects. Students must satisfactorily complete a minimum number of courses, equivalent to at least 3 years of study before being eligible to take the competency examination.

Because of the labor intensiveness of student project work, which is usually handled with 2 or 3 students in a project group, it has become necessary to increase the number of students in most courses. In addition, it has become necessary to incorporate self learning aids wherever possible. This has been done in various ways which include utilization of individually paced instruction (IPI). The standard procedure in using IPI, or PSI as it is commonly known, is to provide a study guide for a segment of the course, provide some opportunity to ask questions; examine on that segment when the individual is ready; and then move on to the next module. A considerable number of courses at WPI are offered in both IPI and standard course format.

Graphics History at WPI

For many years graphics, graphical design, engineering drawing, and descriptive geometry, in various forms, were required of all students at WPI. Along with many other engineering schools WPI changed these courses to elective courses some time ago. Enrollments dropped, of course, and about 25% of the engineering students continued to take graphics.

When the WPI Plan was started in 1970 and no specific courses were "required," graphical design joined all the other courses as an available course. Enrollment in this basic course has continued to increase every year since that time from about 100 students in 1970 to 250 students this year. Class size has been held to about 40 because of facility availability and there is almost always a waiting list to get into the basic graphics course.

Why Graphics Modules

Many of the reasons for writing graphics modules are suggested by the historical description above.

Probably the most important incentive was the necessity for reducing the labor intensiveness of the usual lecture, practice, grade, and correct routine of the standard graphics course. With this format students are locked into a time schedule and the instructor is heavily involved in all phases of the course. It is generally effective, but time consuming.

The next important reason was to try to present an aid that would allow us to teach more students in a given germ. Facilities were limited but if the student could be guided by means of a study guide he could use the facilities throughout the day or even work in his own room. In addition, if the student could evaluate some portion of his own work, additional faculty time could be saved.

Another reason was the indication that organization of study units in concise packages, with clear objectives indicated, had been found to be a help in many courses at WPI.

The final reason was that there was a concerted effort on campus to encourage the student in learning how to self teach. One of the major objectives of the WPI Plan is to build confidence in the student that he can master material on his own so that lifelong learning will be encouraged.

II MODULE WRITING

Module Contents

The graphics course material was subdivided into seven areas of study, or modules. (Seven was a logical number for us at WPI since we are on seven week terms.) Each module of study would include a study guide, pertinent textbook material, supplementary instructional material, and models and displays when available.

The study guide itself was carefully written to include an interest-rousing introduction, a clear list of the module objectives, a list of references, and a step-by-step order of study. It is important that this step-by-step writing, which leads the student through the material, be informal and encouraging in tone. It should utilize the text material whenever possible with indications of the most important concepts.

Module Writing Philosophy

The philosophy and contents of study guides has changed somewhat during two years of experience.

The first modules were written with a strong emphasis on textbook references. Few supplementary comments, such as those teachers include in their lectures, were included. The idea was that self learning from an accepted reference would be an important confidence-builder.

Because of the importance of reduction in faculty labor intensiveness it soon became apparent that several areas could be clarified with lecture type descriptive material. The new module revisions then grew in size.

Another time and money saving concept was to include problem sheets with the study guide. Most of the problems suggested were included in the study guide and in so doing the student was saved the cost of a workbook. The module writer (teacher) could also partially complete some problems, in order to save the student's time, if part of the problem was essentially "horsework."

III MODULE UTILIZATION

It wasn't intended that the modular material which was written for graphics should necessarily be used in the standard individually paced instruction manner. As a matter of fact, it was realized that graphics is different from many of the theoretical courses. First, the skill required for reasonably acceptable sketching and drawing requires practice and often, helpful practical suggestions. The incentive for completing a drawing in good form requires some sort of mid-stream checkoff or else students might skip over what they considered unimportant "horsework." We tested three different formats of utilization:

- Conventional classroom course with modules as a supplementary aid.
- Self paced modular course with little mid-stream checking and a final competency evaluation.
- Scheduled modules with weekly checkoffs and evaluations.

Conventional Classroom Course

In this format the well established method of presentation was continued. This included 3 lectures a week and a laboratory-practice session. Worksheets were turned in on schedule, graded, and returned for correction. Weekly evaluations and a final examination were continued as in conventional courses.

The instructor who taught this way indicated that he found the modules a good way to direct the students to specific goals. It was a big help to have the material well organized and have the study guides spell out exactly what the student should learn. The students get a feeling of organization and security in being able to see exactly what is expected of them. They also could see very clearly what topics were important and what references were necessary to specifically learn various topics. The "hand holding" techniques of lecturing on material as it was presented and supervising drawing in the graphics laboratory was used in this format.

Self-Paced Course Leading to End of Course Competency

In this format the student is given a great deal of individual responsibility. The end of course competency evaluation and set of graded working drawings are intended as prime motivators in keeping the student moving and conscientious about learning the material.

A lecture period and a question and answer period were offered each week and problem solutions were made available to the student. Individual responsibility required the student to complete and check his own drawings. Upon completion of a unit all sheets were put in a classroom individual file and the student signed the outside of the file indicating completion and correction. Instructors gave the sheets cursory inspection and the sheets were returned to the student's notebook.

The last module on working drawings led up to a set of working drawings of a reasonably complex assembly; such as, a jaw vise. These drawings were checked carefully for detail and correct mating dimensions. A final 3-hour examination was also given at the end of the course to check competency in many different topics. This is the same examination that was administered to the students who studied via the conventional classroom technique. Results are compared later in this paper.

Scheduled Modules

In this section the students used the modules extensively and contact via 2 lecture periods was included. There was more pressure to stay on schedule with lectures and questions on the current module only. In addition, a weekly graded evaluation was required on the scheduled module. Students were able to check thier own problem solutions and were given individual responsibility to ask questions and make corrections as necessary.

IV RESULTS--COMPARATIVE EVALUATIONS

This section will generalize the results of evaluations which were administered to each of the three sections described previously. It will also subjectively evaluate the student's ability to handle comprehensive problems in a competent manner.

Since different instructors were involved, the results may be biased by the enthusiasm and effort of the instructor. It was found that if the instructor was involved in planning and/or writing the modules he would be more likely to make the modules work well in his class. This conclusion was also reached almost unanimously in development of modules in 7 other engineering areas in conjunction with the XPRT[1] project carried out by six colleges under N.S.F. sponsorship in 1977 and 1978. WPI participated in this project.

Comparative Scoring

Scores for 2 sections (35-40 students per section) are listed below.

	Self-Paced Final Evaluation	Conventional Classroom
Geometric Construction	4.1	9.8
Pictorial	3.3	4.6
Sketching	5.1	9.2
Multiview	24.2	25.8
Screw Threads--Fasteners	6.2	14.2
Sectioning	8.2	7.07
Auxiliary Views	4.2	4.3
Dimensioning	17.4	16.1
TOTAL	72.7	100
Actual	56	77

The conventional classroom section scored considerably better in most topics. This is particularly true in geometric construction, sketching and screw thread representation which are topics that usually require considerable drill and practice. Apparently the primary motivation of the final evaluation wasn't sufficient to make the self-paced section practice enough.

It is interesting to note that in dimensioning and multiview drawing the scoring is exceedingly close. These topics require study to understand them and reasoning, rather than memory, to score well.

It would be most interesting to check retention after a year, but time has not yet permitted that evaluation.

The same type of comparative scores are not available for comparison of the weekly evaluation--middle of the road--format but scores for carefully monitored sections are generally significantly better than those of the sections with more freedom.

Comparison of practical working drawing projects, which were required of all sections near the end of the course, indicated that performance in other than fine details was about the same. Checking and returning of drawings throughout the course emphasized several finer points of drawing that carried over to the final project. The thought, planning, and mating dimension details of the assemblies, along with multiview procedures, was about comparable in all sections.

(1) Experiential Partnership for the Reorientation of Teaching - NSF, Drexel Univ.

V CONCLUSIONS

From the limited testing plus discussions with various instructors and students involved in the module testing, several conclusions have been tentatively reached.

1. It appears that organization of material into study modules is helpful to students and instructors in any format used.

2. Reliance on the modular material to keep the student motivated and working hard, particularly in routine areas, doesn't seem to be very effective.

3. Modules that are generated, or at least contributed to, by the instructor using them are most likely to succeed.

4. An informal, helpful style of writing the study guide seems to be best received by the students.

5. Choice of a text that handles the subject matter of the course well is a good idea so that only a small amount of supplementary material needs to be added to the study guides.

6. Although the self testing style utilized in format 2 has proven effective in other courses, it doesn't seem to be good in a course which requires quite a lot of practice and performance.

7. Modularized material, along with unit by unit testing and minimal sheet check-off, seems to be effective and also fairly economical in regard to faculty time involvement.

8. With the modules, unit by unit testing, and minimal sheet check off 50 students can be handled by an instructor and 1 student assistant.

9. Graphics modules do work and are helpful to both students and instructors. The best utilization of modules seems to be in a modified conventional system rather than a self motivational of P.S.I. format.

FROM THE COMMITTEES

METRIC IN DESCRIPTIVE GEOMETRY

Merwin L. Weed
University of Pennsylvania
McKeesport, PA

Teaching Techniques Committee

All over the nation, the pressure towards metric is being felt. There is resistance to its coming from all directions -- from industry, from the housewife, from the storekeeper, and even from the academic community. Perhaps the resistance stems from a fear of the "unknown".

It is herein proposed to break down this fear by making the "unknown" a "known". A small step in this direction might be to go total metric in descriptive geometry. Why in descriptive geometry and not in a basic course in drawing? There is not a think wrong with going metric in a basic course of drawing; however, it would constitute a bigger step. In a basic course, topics such as screw threads, limit dimensions, positional tolerances, etc. are difficult topics in themselves to teach a beginning student. In descriptive geometry, however, the student is no longer a newcomer to the field of graphics and perhaps can now better take that first small step into metrics.

Descriptive geometry is basically a study in finding true measurements, both linear and angular. Since angular measurement does not change in metric, only linear measurements need to be reckoned with. There is ample opportunity in a descriptive geometry course for the students to read and measure in SI units and to exercise the use of the metric scale, thus giving them a sense of confidence to think and use metric.

The fear of the "unknown" mentioned above may be felt by both the instructor and the student -- for the instructor, because he never taught in metric, and for the student because he has never had to apply metric. But, by introducing metric in descriptive geometry, the first small step into SI units can be taken, together without too much strain and confusion.

DEVELOPING THE COMPLEAT ENGINEER

Dr. Lee Harrisberger
Mechanical Engrg Department
University of Alabama
Tuscaloosa, AL

Prologue

I foresee that one of the new frontiers in engineering education is the development of personal skills and attributes for the successful practice of engineering. There is a broad spectrum of career-coping skills that every engineer uses in the conduct of his engineering. It is commonly assumed in the design of the typical engineering curricula that all of the skills surrounding the practice of engineering are to be learned on the job. It is also generally assumed that the responsibility of the engineering curricula is to develop a sound knowledge base or technical competence. Very little responsibility is given to the development of the mature, professional attributes that are valued in the successful professional engineer. The disciplines of psychology, behavioral science, management and communication have a wealth of training techniques and research experiences that offer a huge resource. Some of these training techniques have relevance and applicability to engineering education and are both implementable and effective. This paper is a discussion of the learning activity that can be included in an engineering curricula to further the development of the compleat engineer.

Why Should We Do It?

For the same reason that we went to the moon! If we know how, let's do it! And, we do indeed know how. In searching through the literature, I was amazed to learn of the number of training techniques, learning activities, and research-authenticated basic knowledge that is available to all who are interested in developing operational skills. I have come to the conclusion (and it has been well documented) that the engineering educational process has been eminently successful in developing engineering graduates who have the technical competence to cope with the current demands of engineering practice. As a matter of fact, there is considerable evidence from the reports of our graduates that they are indeed overtrained for most of the technical demands made of them. We have even received criticism that our undergraduate curriculum is more oriented toward developing competencies to cope with the rigors of advanced graduate study than to prepare our graduates for the pragmatic realities of engineering practice in industry.

Engineering is a highly introverted (thing-oriented) activity. We put such a heavy concentration on engineering science, engineering methodology, and the rigors of analysis that there is little room or inclination to be concerned about the personal and psychological development of the engineering student to prepare him/her to cope with real-world interactions.

It is my contention that it is far more important for us to be responsible for developing the personal skills and attributes that will sustain active, professional growth over a 40-year professional lifetime in engineering. The argument is that the methodology of engineering is necessary but not nearly sufficient. It is of no value if the engineer is incapable of exploiting engineering knowledge so that it will be useful and valuable to his company.

What Needs Doing?

I have had an opportunity to develop a two-semester sequence of mechanical engineering design courses at the senior year. I chose to orient these courses toward the development of the skills and attributes that are prerequisite to functioning as a valued employee in engineering. These two design courses have an overall instructional goal of developing an awareness of, and sensitivity for, the necessity and value of a variety of career-coping skills associated with the practice of engineering. To achieve this goal, I converged on five major areas of concentration:

Design/Problem-Solving Skills

a. Creativity (demand ideation)
b. Information-retrieval
c. Problem-solving skills

Teammanship Skills

a. Leadership
b. Group effectiveness skills
c. Project organization and planning
d. Project management

Communication Skills

a. Technical-presentation skills
b. Preparation of visual aids
c. Nonverbal communication skills
d. Persuasion and salesmanship
e. Report-writing

Professionalism

a. Value engineering
b. Style and aesthetics
c. Liability and responsibility
d. Patents and entrepreneurship

Personal Development

a. Developing listening skills
b. Personal growth
c. Conflict management style
d. Personnel evaluation skills
e. Peronsal management skills
f. Personality development

In pursuing this agenda of practical, relavant competencies, a wealth of useful information was discovered that can be employed in designing effective learning activities.

Design/Problem-Solving Skills

One of the most effective ways to teach problem-solving skills in engineering education is to provide a realistic environment as a practical internship. However, for students who have had little if any team activity, Charlie Wale's Guided Design Activity is an excellent introduction to engineering problem-solving. I use a four-week abridged version of Guided Design, assigning each four-to five-person student teams a copy of an authentic letter obtained from the Peace Corps and written by a field volunteer, requesting a technical solution to a local problem in one of the lesser-developed countries. The teams are required to follow an explicit set of guided design procedural steps.

Another effective means of providing problem-solving experience is a Competitive Design Project. In this experience, all members of the class are grouped into three-or four-person teams and assigned the same problem obtained from a local industrial client. The teams compete for the most acceptable solution by making written and verbal presentations to a jury of professional engineers selected by the client.

One of the most popular and widely used experiential design programs is what I call a Design Clinic, a three-credit-hour course scheduled for two three-hour laboratory periods per week. The objectives are to provide a real-life engineering consulting experience that emphasizes information-retrieval skills, information-dissemination skills, and creative problem-solving skills in a realistic industrial environment.

Engineering problem situations are solicited from a variety of industries throughout the state. Each of the participating companies proposes one or more problem situations that are currently in need of solution. The three-or four-person consulting teams devote the entire semester to developing a solution to the problem situation proposed by the industrial "client". The students have freedom to form teams based on individual interest in working with colleagues on a particular company's problems. Each team selects a leader, maintains a carefully written engineer's log, is issued a telephone credit card (to maintain an accountability of long-distance phone calls) and is required to keep an accurate accounting of all direct expenses incurred (which are charged to the client company). Each team is required to make a minimum of two site visits: one early in the term to meet the project monitor and gather pertinent initial data; and the second, when the teams present their proposed solution to the members of the client company.

The teams are monitored weekly by the instructor. They are required to present a written progress-report letter to the client at mid-term. At the end of the term, each team must present a well-written design report and an on-site verbal presentation (using 35 mm slides).

During the problem-solving process, there are two very important skills which must be reinforced: the creative process of developing ideas and information-retrieval. I have come to believe that our engineering students have a genetic inhibition for engaging in either activity. Incidently, all of my students have been psychologically typed (using the Myers-Briggs Type Indicator). I have observed that the students classified as Sensing Types find the process of idea-getting and "brainstorming" to be a real pain while, on the other hand, those classified as Intuitive Types are not only enthusiastic about the creative proccess but are good at it. Because so many of our engineering students are Sensing Types, it is doubly important that creative problem-solving exercises be included in their training to increase their awareness and sensitivity about the creative process.

Each of the students takes the University of Michigan Remote Association Test (regarded as one of the best) and a modified version of the Graphical Sketch Test. A two-week ideation project is also included, requiring the students (in small teams) to use brainstorming techniques to generate a host of alternative solutions for a product innovation. The teams must then select the best ideas from their list and each team member must use the morphological chart technique to prepare a perspectus of the idea, that is, a "grub-stake" proposal to be submitted to a "banker" or the company management in order to encourage funding for the development of the idea.

Searching the literature and data-gathering is a necessary part of the problem-solving process, especially in client-oriented projects that involve technology beyond the students' experience. To encourage their development and orientation towards information-gathering, each of the student teams is required to conduct an extensive literature search. We have a contract with the Systems Development Corporation Computerized Bibliographic Service. Each team is required to conduct a search using the service and the OATS Tear Sheet Service associated with it. In addition, I require that each team select a technical consultant (either among the faculty or from a specialist in industry) with whom they must consult in order to obtain specialized guidance. All of the teams are encouraged to use the long-distance phone calls to consult with authors of papers, technical specialists in industry, vendors, etc., to obtain up-to-date state-of-the art information. All of these activites have had an impact on the student's attitude toward information-retreival and the outcome of his project.

Teammanship Skills

In the fields of behavioral science and management science, there is a wealth of information to support the development of team skills. Over the years as I have watched student-teams engage in project activity, I have noticed that they are grossly naive in the areas of leadership and group effectiveness. They apparently know very little about the psychology of working together in small groups as either a "chief" or an "Indian".

Two activities used to dramatize their inability and to create a high sense of "need-to-know" are the ORGS management game and the Group Effectiveness Test. The ORGS game is an intnesive three-hour laboratory activity in which the five-person student teams form small companies. They are engaged in manufacturing Tinker Toys Products to be sold on the open market to a "buyer". This intensely competitive game is not only exciting, interesting and fun but it also serves to amplify the importance of group organization, leadership and planning. The Group-Effectiveness Test is a ture-false test of some 20 items. It is given to all the students as a pre-test to our discussion about group effectiveness. Invariably, they miss over half of the items on the test which, of course, stimulates considerable discussion and argument as to why their intuition is wrong.

Communication Skills

This has been one of the biggest worries in engineering education. Over the years we have required speech courses, report-writing courses, lab reports, and even enrollment in the Toastmaster's Club; and we are still not satisfied. We still get reports that our graduates are nearly functionally illiterate when it comes to good communication. I am getting to the point now that I feel like I have just about got a handle on the situation.

The clinic activity puts a tremendous social pressure on the student team to put on a "good show" for their client. All of my admonitions that they cannot "come-on to their client like a clod" when they present a written report or their verbal presentation really take hold. The students go to extra effort to make sure that they have a very professional-looking report typed and bound with clean, effective illustrations. For their verbal presentations to their clients, we require a dress rehearsal in front of a faculty jury and critiqued by all members of the class as well. Each of the student teams receives up to thirty critique sheets on all facets of their presentations so they can "clean up their act" prior to making their presentations to their clients.

As a back-up support for these activities, we require that each student prepare a seven-minute presentation in front of the class for the prime purpose of being critiqued by all members of the class on an elaborate critique sheet. The very fact that each of the students becomes a critic of his peers' presentations has had a dramatic impact on their sensitivity about good and bad presentation techniques. To reinforce their graphical presentation skills, all reports and verbal presentations are supported by graphs, charts, and drawings. Their verbal presentations must use 35 mm color slides, charts, and/or models.

In the pursuit of activities that would improve the engineering student's communication skill, I have also become aware of the power of nonverbal communication skills that are a part of a person's communication process. The PONS Test is an effective means for diagnosing a person's skill at reading the nonverbal messages that people send out when they are communicating. The PONS Test is a TV-taped dramatization of 220 nonverbal scenes (messages). The test can be immediately scored and compared against national norms. It is selfdiagnostic and a focal point for class discussions on what to do about it. The emphasis on the development of nonverbal skill behavior is particularly important in engineering since we have a large number of socially inept introverts among us.

Professionalism

Professionalism is more of an attitude than a skill. It is an attitude that all engineering educators have a concern for since we regard engineering as a profession. We are anxious that our engineering students understand what a professional is and what a professional does. Many of us accomplish some facet of this concern in our "senior seminars," and a few curricula include a three-credit-hour course dealing with professional ethics, etc. During the course of our clinic activity, when the students are engaged in problem-solving activities with their client, the stage is set for us to discuss the engineer's responsibility to cost, quality control, style aesthetics, liability, maintenance, finite-life design, etc. We also get into such topics as to whether engineers should join unions, including some rather heated discussions regarding an engineer's responsibility to his company in ethical and unethical situations. Some time is devoted to an engineer's opportunities with inventions, patents, and entrepreneurship. The psychological analysis of our students has shown that a very small percentage of the engineering students have the psychological type that tends to become an entrepreneur, which gives us even more incentive to deal with the skills and attributes of the entrepreneur.

Personal Development

This is a controversial area. Most engineering educators believe that they have neither the time, the skill, nor the necessity to dabble in this area. There is a widespread belief that whatever a student is or will become is his own business. I have become convinced over the years that whatever a student is or can become is our business. I became particularly reinforced in this concept by Dr. Mary McCaulley's prize-winning

ASEE paper describing the Myers-Briggs Personality Type characteristics of engineering students. I have observed that the MBTI type that an engineering student has chosen to be is both an asset and a liability. In order to be successful, our graduates have to learn how to manage their personal preferences of behavior and skills to optimize their success.

I have been experimenting by introducing a number of activities that seem to be having an impact. I use five different self-diagnostic tests to assist the student in determining where he is. These include the Myers-Briggs Personality Type Indicator, the University of Georgia Student Development Task Inventory (SDTI), the Brown-Carlsen Listening Test, and the Telemetrics Conflict Management Style Inventory. The students take the MBTI early in the term. This is a very popular personality inventory since it is a positively oriented, non-threatening, description of personality characteristics. Being aware of the psychological types of their peers has done a great deal in assisting the student to better know himself and to know how to deal with the characteristics of other people.

The SDTI Test is essentially a test of maturity. It is specifically designed for the college-level individual and is a pretty clear self-diagnostic index on how well the student has progressed toward self-actualization. Comparative results of the SDTI tests we have given our freshmen and seniors in engineering indicate that there is very little personal growth going on among our engineering students during the four years they are on campus. This appears to be partly because so many of our engineering students are socially shy introverts and because the heavy demands of the engineering curriculum keep many of the students out of the social activities on campus.

We use the Brown-Carlsen Listening Test primarily to focus the student's attention on his ability to concentrate on verbal communication and to point out some of the skills and attributes that are relevant to proficiency in this area.

The Conflict Management Style Inventory Test is an excellent diagnostic tool to help the student become aware of his proficiency in handling conflicts on several levels: between himself and someone else, between two associates, between his group and another group, and between his organization and another organization. The diagnostic test serves as an excellent focal point for bring home some important concepts on how to handle people.

Another activity seems to have an important formative impact on a student's personal development. At the end of each team activity, each team member fills out a personnel evaluation form (similar to those used by supervisors in industry) on himself and each of his teammates. The form requires the student to make judgments on several of the skills and attributes of his colleagues in their performance as team members. Throughout the clinic, during the various team activities, teammates scrambled so that each student over this period of time receives a number of different personnel evaluations. It has been interesting to note how similar the patterns of responses are for each individual from one team to the next.

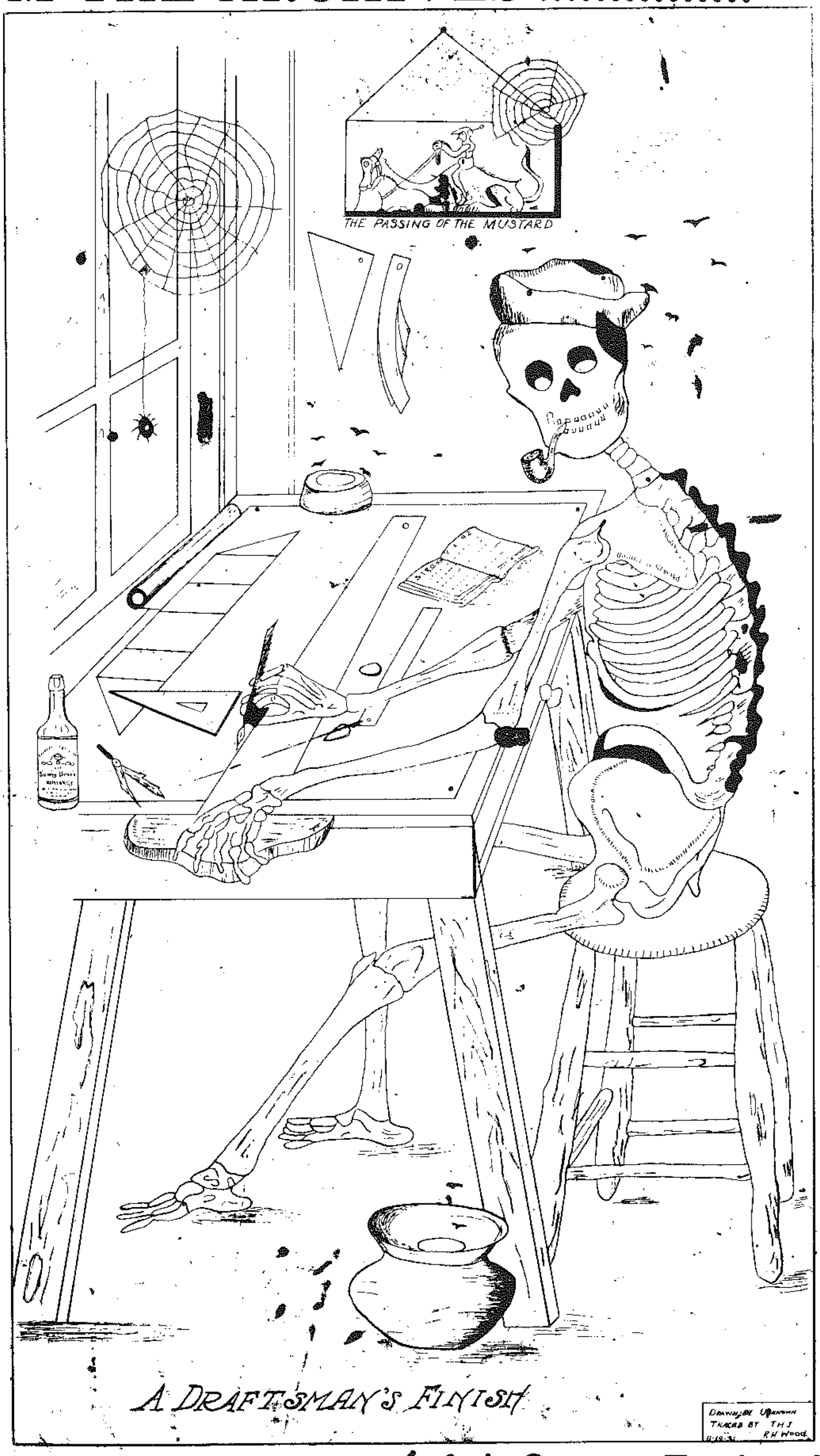
So What?!!

All of the learning activities described here have been experimented with over the past two years with the intent of making a difference in the overall career competency of our engineering graduates. I am persuaded that they do make a difference with an increase in sensitivity, awareness, and an improvement in skill among the students who have participated in this work. I was particularly impressed by how attentive and conscientious the students were in engaging in these activities. The students perceive these skills as very important to them and their career. To many of them, it was the first time that it had ever come to their attention that these skills would be valuable, and it seemed to hit them right where they live. Having introduced these learning activities during the senior year and in a client-oriented team project environment, it seemed to make them even more important and more relevant. I am still unsure whether these career-type competencies would "take" if introduced earlier in other courses and out of context within the clinic-type engineering experience. Nevertheless, I am even more convinced that attention to these career competencies is extremely important in the development of the compleat engineering graduate.

EDITOR'S NOTE: This is an edited version of the original paper/presentation given by Lee Harrisberger at the Frontiers in Education meeting, 1979, held at Niagara Falls in October of last year. Copyright is held by Harrisberger in conjunction with the ASEE and IEEE.

Many thanks to Dr. Harrisberger for editing the version printed here; to Ed Knoblock for preparing the article for publication in the Journal and to Joe Biedenboch for allowing us permission to use this edited version.-ED

FROM THE ARCHIVES ....



(of J. Grover Taylor, M.S.U.)

THE RATIONALE OF THE FUNICULAR DIAGRAM

Hugh W. Munson
Engineering Fundamentals
V.P.I. & S.U.
Blacksburg, VA

Many textbooks address the use of the funicular diagram in the graphic solution of a nonconcurrent coplanar force system. The procedure is described, and the theory is variously explained as, "The fact that the string polygon closes means that $\Sigma M = 0$.", "The funicular polygon is in effect a summation of moments . . .", and "The string or funicular polygon must close. If this condition is satisfied the resultant cannot be a couple."

This type of superficial explanation of the physical significance of the funicular diagram lessens true understanding and confidence. The example below is intended to more fully explain the reasons for the procedure and also to correlate the graphic and the algebraic solutions.

The free body diagram of Figure 1 represents a beam loaded as shown supported on the left by a roller, and on the right by a pin.

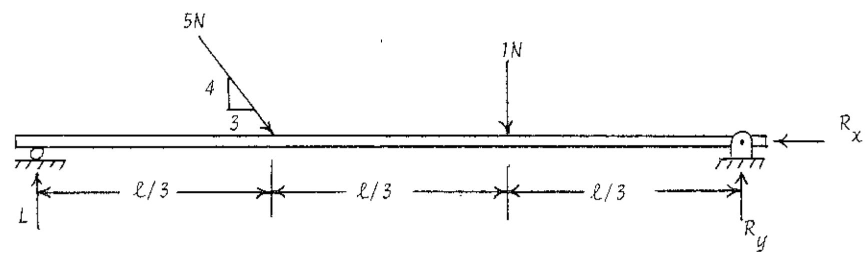


Figure 1

An algebraic solution is as follows:

$$\xrightarrow{+} \Sigma F_x = 0;\quad (3/5)(5) - R_x = 0; \qquad R_x = 3N$$

$$\circlearrowleft\!+\ \Sigma M_L = 0;\quad (4/5)(5)(\ell/3) + (1)(2\ell/3) - (R_y)(\ell) = 0; \qquad R_y = 2N$$

$$\circlearrowleft\!+\ \Sigma M_R = 0;\quad (L)(\ell) - (4/5)(5)(2\ell/3) - (1)(\ell/3) = 0; \qquad L = 3N$$

The algebraic solution used three equations of equilibrium available in a nonconcurrent coplanar force system to solve for the three unknowns. In this instance, the two unknowns of the pin reaction were represented by its vertical and horizontal components. One of the equations of equilibrium was used in determining the horizontal component.

The remaining two equilibrium equations were chosen to be two independent moment equations - one producing the value of the roller reaction and the other producing the vertical component of the pin reaction.

In the graphic solution which follows, the vector diagram will use two of the available equations ($\Sigma F_x = 0$ and $\Sigma F_y = 0$). The funicular diagram as will be explained later, will use the third and last available equation which will, in effect, be a moment equation of equilibrium.

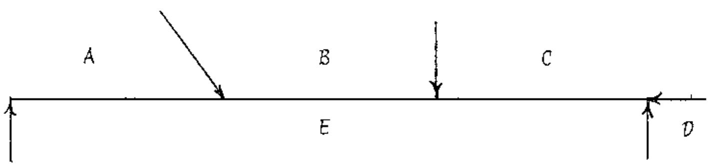


Figure 2

In Figure 2, the free body carries Bow's notation; and a corresponding vector diagram is shown in Figure 3. The vector diagram shows that the horizontal component of the pin reaction (CD) is equal and opposite to the horizontal component of the inclined load (AB). This property of the vector diagram corresponds to one of the equilibrium equations: namely, $\Sigma F_x = 0$. The second of the eqilibrium equations ($\Sigma F_y = 0$) is also contained in the vector diagram. The sum of the forces DE and EA (the vertical component of the pin reaction and the roller reaction) is equal to the vertical component of the inclined load (AB) plus the vertical load (BC).

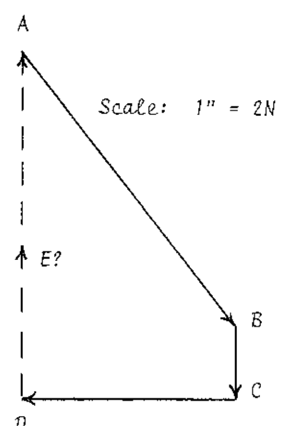


Figure 3

The relationship between the vertical component of the pin reaction and the roller reaction is not known. On the vector diagram, this question is manifest in the unknown location of point E. In the algebraic solution, this question was answered by using a moment equation. The funicular diagram does likewise in the following manner:

a. All of the known forces in the system are resolved into equal and opposite components, and

b. The distribution of the unknown forces is determined by adhering to the fact that for an equilibrium situation the sum of the moments of all of the forces about any point must be equal to zero.

In order to resolve all of the known forces into components which are equal and opposite, the vector diagram is modified as shown in Figure 4.

A "pole" 0 is established at an arbitrary location, and "rays" are drawn from 0 to the known points on the vector diagram. It is now possible to resolve adjacent vectors into components having their mutual components equal, opposite, and therefore self-cancelling. For example, AB can be resooved into AO and OB; and BC can be resolved into BO and OC. The mutual component (OB and BO) self-cancel and the result is AC which has components of AO and OC. This concept can be carried on around the vector diagram back to the starting point at which time the graphic equivalent of $\Sigma F_x = 0$ and $\Sigma F_y = 0$ is reached.

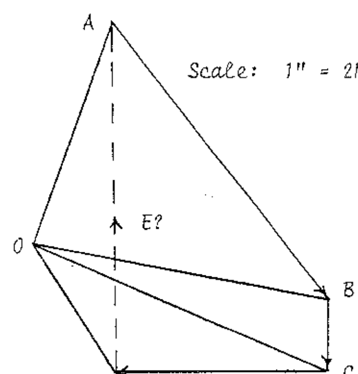


Figure 4

However, point E on the vecotr diagram has not yet been located. It can be by resolving the forces on the free body into components corresponding to the "rays" of the modified vector diagram and using the concept that $\Sigma M = 0$.

In Figure 5, the inclined load (starting at any point on its line of action) and the vertical load have been resolved into their components AO and OB and BO and OC.

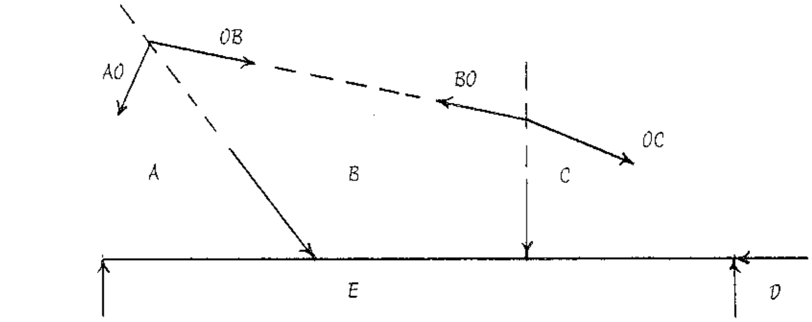


Figure 5

It is evident that OB and BO are not only equal, opposite, colinear, self-cancelling but they also have equal and opposite moments about any point.

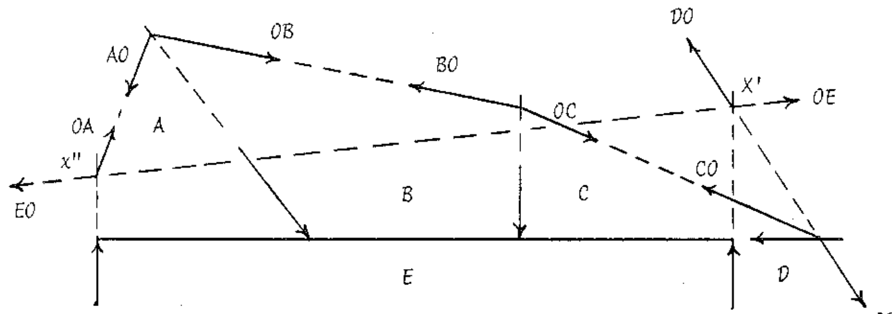


Figure 6

Figure 6 extends this concept to include the components (parallel to the "rays" of the modified vector diagram) of all of the known forces. Point E still has not been located on the vector diagram; but it is evident that E will lie on the line DA and the components from D to A through E will be DO and OE and EO and OA. The components of the vertical component of the pin reaction (DO and OE) will, of course, intersect on the line of action of the force - shown as x'. Similarly, the components of the roller reaction will be EO & OA and will intersect at x". OE and EO lie along the line x'x" and are, of course, equal, opposite, and have equal and opposite moments about any point. The inclination of the line x'x" can now be transferred to the vector diagram and the division of labors between DE and EA can be determined (Figure 7). The values taken from the vector diagram correspond to the algebraic values.

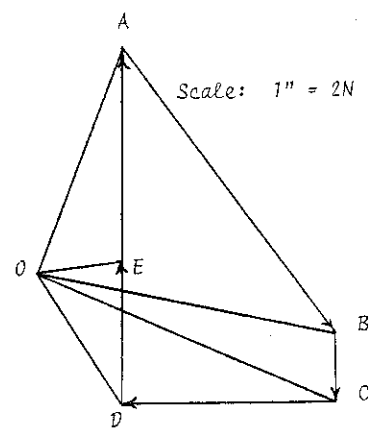


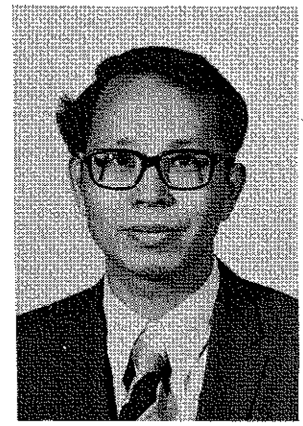
Figure 7

After it is all done, a quick review shows the following:

a. The vector diagram incorporates two equilibrium equations ($\Sigma F_x = 0$ and $\Sigma F_y = 0$), and

b. The funicular diagram, which is a space diagram drawn to scale and is used in conjuction with a modified vector diagram, uses the third equilibrium equation by setting the moments of the components of the forces equal to zero.

THE SINE DOUBLE-ANGLE EQUATIONS OF AXONOMETRIC PROJECTION FOR SOLVING ANGLES AND SCALE RATIOS



Ming H. Land
Miami University
Oxford, Ohio

INTRODUCTION

Graphical solutions to angles and scale problems in axonometric projection are not only tedious but also time-consuming. Therefore engineers have looked for convenient mathematical solutions to these problems. One of the mathematical techniques for solving these problems is Odaka's equations for axonometric projection (Odaka, 1978). However, the mathematical calculations using Odaka's equations are still somewhat complicated. A new method, using the sine double-angle equations, has recently been developed by the author. The calculations of the sine double-angle equations are considerably shorter and quicker than Odaka's equations.

THE SINE DOUBLE-ANGLE EQUATIONS

To produce an axonometric projection it is necessary to rotate the object a certain angle ϕ about an imaginary vertical axis, and then tilt it forward at a certain angle θ about an imaginary horizontal axis. Let the three foreshortened scales of a cube shown in Fig. 1 be d, e, and f, the axonometric angles α, β, and γ, and the drawing angles x, y, and z in which $x = \alpha - 90^\circ$, $y = \beta - 90^\circ$, and $z = \gamma - 90^\circ$. The ratios of foreshortened scales d, e, and f are as follows (Levens, 1962, p. 708):

$$d = \sqrt{\sin^2\phi + \cos^2\phi \sin^2\theta}$$

$$e = \sqrt{\cos^2\phi + \sin^2\phi \sin^2\theta} \quad . \; . \; . \; . \; . \quad (1)$$

$$f = \cos\phi$$

Now, from equations (1)

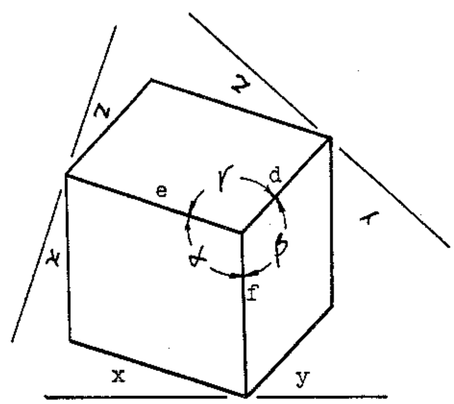


Fig. 1

$$\frac{d^2}{e^2} = \frac{\sin^2\phi + \cos^2\phi \sin^2\theta}{\cos^2\phi + \sin^2\phi \sin^2\theta}$$

$$= \frac{\sin^2\phi \left(\frac{\sin^2\phi}{\sin^2\phi} + \frac{\cos^2\phi \sin^2\theta}{\sin^2\phi}\right)}{\cos^2\phi \left(\frac{\cos^2\phi}{\cos^2\phi} + \frac{\sin^2\phi \sin^2\theta}{\cos^2\phi}\right)}$$

$$= \tan^2\phi \; \frac{\left(1 + \frac{\cos^2\phi \;\sin^2\theta}{\sin^2\phi}\right)}{\left(1 + \frac{\sin^2\phi \;\sin^2\theta}{\cos^2\phi}\right)} \;. \quad (2)$$

The angles x, y, z as defined in Fig. 1 are given by (Levens, 1962, p. 708):

$$\tan x = \tan\phi \;\; \sin\theta \;\; \ldots\ldots\ldots\ldots (3)$$

$$\tan y = \frac{\sin\theta}{\tan\phi} \;\; \ldots\ldots\ldots\ldots\ldots (4)$$

$$z = 90^\circ - (x + y) . \;\ldots\ldots\ldots\ldots (5)$$

From Eq. (3)

$$\tan^2 x = \frac{\sin^2\phi \;\sin^2\theta}{\cos^2\phi} \;\; \ldots\ldots\ldots (6)$$

From Eq. (4)

$$\tan^2 y = \frac{\cos^2\phi \;\sin^2\theta}{\sin^2\phi} \;\; \ldots\ldots\ldots (7)$$

Substituting Eqs. (6) and (7) into Eq. (2),

$$\frac{d^2}{e^2} = \tan^2\phi \cdot \frac{1 + \tan^2 y}{1 + \tan^2 x}$$

$$= \tan^2\phi \;\; \frac{\sec^2 y}{\sec^2 x}$$

$$= \tan^2\phi \;\; \frac{\cos^2 x}{\cos^2 y} \;\; \ldots\ldots\ldots (8)$$

Also from Eq. (3)

$$\tan\phi = \frac{\tan x}{\sin\theta} \;\; \ldots\ldots\ldots\ldots (9)$$

And from Eq. (4)

$$\tan\phi = \frac{\sin\theta}{\tan y} \;\; \ldots\ldots\ldots\ldots (10)$$

From Eqs. (9) and (10)

$$\tan^2\phi = \frac{\tan x}{\sin\theta} \cdot \frac{\sin\theta}{\tan y} = \frac{\tan x}{\tan y} . \;.(11)$$

Substituting Eq. (11) into Eq. (8)

$$\frac{d^2}{e^2} = \tan^2\phi \cdot \frac{\cos^2 x}{\cos^2 y}$$

$$= \frac{\tan x \cdot \cos^2 x}{\tan y \cdot \cos^2 y}$$

$$= \frac{\frac{\sin x \cdot \cos^2 x}{\cos x}}{\frac{\sin y \cdot \cos^2 y}{\cos y}}$$

$$= \frac{\sin x \cdot \cos x}{\sin y \cdot \cos y}$$

$$= \frac{2 \sin x \cos x}{2 \sin y \cos y}$$

$$= \frac{\sin 2x}{\sin 2y}$$

Thus we have

$$\frac{d^2}{e^2} = \frac{\sin 2x}{\sin 2y} \;\; \ldots\ldots\ldots\ldots (12)$$

In the same way

$$\frac{e^2}{f^2} = \frac{\sin 2y}{\sin 2z} \;\; \ldots\ldots\ldots\ldots (13)$$

and

$$\frac{f^2}{d^2} = \frac{\sin 2z}{\sin 2x} \;\; \ldots\ldots\ldots\ldots (14)$$

also $x + y + z = 90^\circ$ . . . . (15)

Equations (12), (13), and (14), together with Eq. (15) are called the sine double-angle equations of axonometric projection. We may state from these equations that in any axonometric projection the squares of the axonometric scales are proportional to the sines of the double drawing angles opposite the scales. It can also be seen that if two drawing angles and an axonometric scale are given, the third angle and the remaining two scales can be obtained quickly and accurately from these equations.

Sample Solution in Trimetric Drawing. Consider a trimetric drawing where two drawing angles $x = 15^\circ$, $y = 25^\circ$ are given and a relative scale $f = 1$ is assumed.

Solution:

Since $x + y + z = 90^\circ$,
We have $z = 90^\circ - 15^\circ - 25^\circ$

or $z = 50^\circ$

From Eq. (13)

$$\frac{e^2}{f^2} = \frac{\sin 2y}{\sin 2z}$$

or

$$\frac{e^2}{1^2} = \frac{\sin 2\cdot(25^\circ)}{\sin 2\cdot(50^\circ)} = \frac{\sin 50^\circ}{\sin 100^\circ} = \frac{0.7660}{0.9848}$$

$$e^2 = 0.7778$$

or

$$e = 0.8819$$

From Eq. (14)

$$\frac{f^2}{d^2} = \frac{\sin 2z}{\sin 2x}$$

or

$$\frac{1^2}{d^2} = \frac{\sin 100^\circ}{\sin 30^\circ} = \frac{0.9848}{0.5} = 1.9696$$

$$d^2 = 0.5077$$

or $d = 0.7125$

Thus, the relative scale ratios of a trimetric drawing where $x = 15^\circ$ and $y = 25^\circ$ are d : e : f = 0.71 : 0.88 : 1 as shown in Fig. 2.

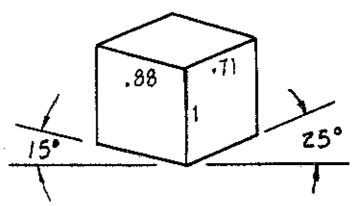


Fig. 2

Sample Solution in Dimetric Drawing. Consider a dimetric drawing where $x = y = 13.5^\circ$ and $f = 1$ are given.

Solution:

Since $x = y = 13.5^\circ$

then $z = 63^\circ$

From Eq. (14)

$$\frac{f^2}{d^2} = \frac{\sin 2z}{\sin 2x} = \frac{\sin 126^\circ}{\sin 27^\circ} = \frac{0.8090}{0,4540}$$

Since $f = 1$

then $d^2 = 0.5612$

or $d = 0.7491 \doteq \frac{3}{4}$

and $e \doteq \frac{3}{4}$

Thus, the relative ratios of a dimetric drawing where $x = y = 13.5^\circ$ are d : e : f = 3/4 : 3/4 : 1 as shown in Fig. 3.

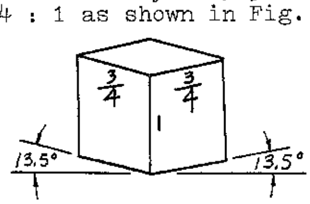


Fig. 3

PROVING ODAKA'S EQUATIONS

From Eq. (12) and Fig. 1

$$\frac{d^2}{e^2} = \frac{\sin 2x}{\sin 2y} = \frac{\sin 2(\alpha - 90^\circ)}{\sin 2(\beta - 90^\circ)} = \frac{\sin(2\alpha - 180^\circ)}{\sin(2\beta - 180^\circ)}$$

$$= \frac{-\sin 2\alpha}{-\sin 2\beta} = \frac{\sin 2\alpha}{\sin 2\beta} = \frac{2\sin\alpha\cos\alpha}{2\sin\beta\cos\beta}$$

$$= \frac{\sin\alpha\cos\alpha}{\sin\beta\cos\beta}$$

Multiply both the numerator and the denominator by $\sin(\alpha + \beta)$, the right-hand side becomes:

$$\frac{\sin\alpha\cos\alpha\ \sin(\alpha+\beta)}{\sin\beta\ \cos\beta\ \sin(\alpha+\beta)}$$

$$= \frac{\sin\alpha\ \cos\alpha\,(\sin\alpha\cos\beta + \cos\alpha\sin\beta)}{\sin\beta\ \cos\beta\,(\sin\alpha\cos\beta + \cos\alpha\sin\beta)}$$

$$= \frac{\cos\alpha\ (\sin^2\alpha\cos\beta + \sin\alpha\cos\alpha\sin\beta)}{\cos\beta\ (\sin\beta\sin\alpha\cos\beta + \sin^2\beta\cos\alpha)}$$

$$= \frac{\cos\alpha\ (1-\cos^2\alpha)\cos\beta + \sin\alpha\cos\alpha\sin\beta}{\cos\beta\ \sin\beta\sin\alpha\cos\beta + (1-\cos^2\beta)\cos\alpha}$$

$$= \frac{\cos\alpha\ \cos\beta - \cos^2\alpha\cos\beta + \sin\alpha\cos\alpha\sin\beta}{\cos\beta\ \sin\beta\sin\alpha\cos\beta + \cos\alpha - \cos^2\beta\cos\alpha}$$

$$= \frac{\cos\alpha\ \cos\beta - \cos\alpha\ (\cos\alpha\cos\beta - \sin\alpha\sin\beta)}{\cos\beta\ \cos\alpha - \cos\beta\ (\cos\alpha\cos\beta - \sin\alpha\sin\beta)}$$

$$= \frac{\cos\alpha\cos\beta - \cos^2\alpha\ \cos(\alpha+\beta)}{\cos\alpha\cos\beta - \cos^2\beta\ \cos(\alpha+\beta)}$$

$$= \frac{\cos\alpha\cos\beta - \cos^2\alpha\ \cos(360^\circ - \gamma)}{\cos\alpha\cos\beta - \cos^2\beta\ \cos(360^\circ - \gamma)}$$

$$= \frac{\cos\alpha\cos\beta - \cos^2\alpha\ \cos\gamma}{\cos\alpha\cos\beta - \cos^2\beta\ \cos\gamma}$$

$$= \frac{\dfrac{\cos\alpha\cos\beta - \cos^2\alpha\cos\gamma}{\cos\alpha\cos\beta}}{\dfrac{\cos\alpha\cos\beta - \cos^2\beta\cos\gamma}{\cos\alpha\cos\beta}}$$

$$= \frac{1 - \dfrac{\cos\alpha\cos\gamma}{\cos\beta}}{1 - \dfrac{\cos\beta\cos\gamma}{\cos\alpha}}$$

Thus we have

$$\frac{d^2}{e^2} = \frac{1 - \dfrac{\cos\alpha\cos\gamma}{\cos\beta}}{1 - \dfrac{\cos\gamma\cos\beta}{\cos\alpha}} \quad . . . . (16)$$

In the same way

$$\frac{e^2}{f^2} = \frac{1 - \dfrac{\cos\alpha\cos\beta}{\cos\gamma}}{1 - \dfrac{\cos\gamma\cos\alpha}{\cos\beta}} \quad . \; . \; . \; . \; . \; (17)$$

Equations (16) and (17) are Odaka's equations for axonometric projection and thus proved by the sine double-angle equations.

PROVING THE DIMETRIC EQUATIONS

In dimetric drawing, two axes are foreshortened equally and, therefore, two angles are equal. Let us assume that two axonometric angles α and β are equal, that is, $\alpha = \beta$.

From Eq. (13)

$$\frac{e^2}{f^2} = \frac{\sin 2y}{\sin 2z} = \frac{\sin 2\beta}{\sin 2\gamma} = \frac{\sin\beta\cos\beta}{\sin\gamma\cos\gamma}$$

Since $\alpha = \beta$,

$$2\beta = 360^\circ - \gamma$$

$$\beta = 180^\circ - \frac{\gamma}{2}$$

Thus

$$\frac{\sin\beta\cos\beta}{\sin\gamma\cos\gamma} = \frac{-\sin\frac{\gamma}{2} \cdot \cos\frac{\gamma}{2}}{\sin\gamma\cos\gamma}$$

$$= \frac{-2\sin\frac{\gamma}{2} \cdot \cos\frac{\gamma}{2}}{2\sin\gamma\cos\gamma}$$

$$= \frac{-\sin\gamma}{2\sin\gamma\cos\gamma} = \frac{-1}{2\cos\gamma} = \frac{e^2}{f^2}$$

Therefore

$$2e^2\cos\gamma = -f^2$$

or

$$\cos\gamma = -\frac{f^2}{2e^2} \quad . \; . \; . \; (18)$$

$$(90^\circ < \gamma < 180^\circ)$$

Equation (18) is the equation of dimetric projection developed by the author (Land, 1979). It can be used conveniently to solve for angles and scale problems in dimetric projection.

Also from Eq. (13)

$$\frac{e^2}{f^2} = \frac{\sin 2y}{\sin 2z} = \frac{\sin\beta\cos\beta}{\sin\gamma\cos\gamma}$$

since $\alpha = \beta$, $\gamma = 360^\circ - (\alpha + \beta)$

$$\gamma = 360^\circ - 2\beta$$

Thus

$$\frac{\sin\beta\cos\beta}{\sin\gamma\cos\gamma} = \frac{\sin\beta\cos\beta}{\sin(360^\circ - 2\beta)\cos(360^\circ - 2\beta)}$$

$$= \frac{\sin\beta\cos\beta}{-\sin 2\beta\cos 2\beta}$$

$$= \frac{\sin\beta\cos\beta}{-2\sin\beta\cos\beta\cos 2\beta}$$

$$= \frac{1}{-2\cos 2\beta} = \frac{e^2}{f^2}$$

and

$$-2e^2\cos 2\beta = f^2$$

$$-2e^2(2\cos^2\beta - 1) = f^2$$

$$\cos^2\beta = \frac{2e^2 - f^2}{4e^2}$$

Since $90^\circ < \beta < 180^\circ$,

$$\cos\beta = -\frac{\sqrt{2e^2 - f^2}}{2e} \quad . \; . \; . \; (19)$$

Equation

Equation (19) is the commonly known formula (Giesecke et al, 1974, p. 516; Luzadder, 1977, p. 219) for dimetric projection and proved by the sine double-angle equations.

References

Giesecke, F. E., et al. Technical Drawing. New york: Macmillan, 1974.

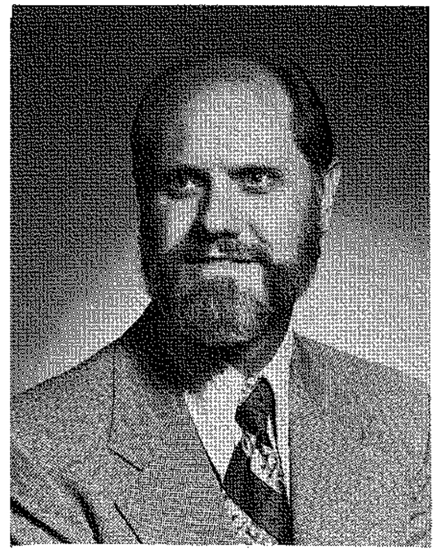
Land, M. H. "Applications of Odaka's Equations of Perspective Projection To the Determination of Scales and Ellipse Guides in Axonometric Projection," Engineering Design Graphics Journal, Spring 1979.

Levens, A. S. Graphics. New York: John Wiley & Sons, 1962.

Luzadder, W. J. Fundamentals of Engineering Drawing. Englewood Cliffs, NJ: Prentice-Hall, 1977.

Odaka, S. "Fundamental Equation of Perspective Projection and its Application," Proceedings International Conference on Descriptive Geometry. June 1978.

USING INSTRUCTIONAL TELEVISION FOR PSI IN ENGINEERING GRAPHICS



DR. WILLIAM J. VANDER WALL
Assistant Professor in Engineering Graphics
North Carolina State University
Raleigh, North Carolina

INTRODUCTION

It has been eight years since the first PSI course in Engineering Graphics was first offered at North Carolina State University. Basically, the course is organized into fifteen units of work, each of which must be passed at a prescribed proficiency level before proceeding to the next unit.

Students receive grades based upon the number of units completed by the end of the semester. No Incomplete Grades are given in the course.

Because of the increased number of students enrolling in graphics each semester, it has been necessary to employ various supplementary instructional media to help lighten the teacher work load resulting from the high frequency of one-to-one student-teacher contact. One such supplementary media has been in the realm of instructional TV. The basic concepts, procedures, and content most often requested or required by the majority of students have been video taped. In all, there are forty-five video taped mini-lectures in cassette form that may be checked out by the students as the need arises.[1]

Essentially, the video-tapes allow students to:

1. Progress through more difficult course material on their own and at their pace.
2. Select only those tapes containing information of immediate use to them.
3. Review the subject matter as much as necessary to master it.
4. Receive additional supplementary help at their convenience even outside regularly scheduled classroom hours.
5. Visually reinforce subject matter that has been read from books by observing someone actually manipulating drawing instruments and solving problems similar to their own.

STUDENTS' REACTION TO VIDEO

Students who have utilized the instructional video tapes have been asked to fill out Tape Evaluation Forms. This procedure has enabled us to determine the effectiveness of the video and also to improve certain segments of the program either by retaping, up-dating information, and adding to or changing course material. Figures 1 and 2 show an example of Tape Evaluation Form as originally used. For further information on the subject of video tape evaluation, see the article entitled, "Evaluating Classroom Video Tapes", to be presented at the ASEE Southeastern Section Annual Meeting at Orlando, Florida in March/April 1980, and subsequently published in the meeting's proceedings.

Student evaluation and feedback indicated that aside from some minor technical difficulties such as poor lighting, background noise, and cameral vibration on limited portions of a couple of the video tapes, the subject matter was covered quite satisfactorily.

By and large, most students felt that video used as supplementary resource material (the textbook being the prime source of information in our course) was very beneficial, particularly in the more difficult areas of the course; Pictorial Drawing, Orthographic Drawing, First and Second Auxiliaries, Sections, and Dimensioning. As it turned out, video proved particularly invaluable to students' evaluations and comments, a tape tended to be most beneficial if it included the following elements:

- Short review of the preceding tape before introducing new material.
- Concise outline given at the beginning of each tape delineating the material to be covered and the relative importance of specific content in understanding the subject area being discussed.
- Extra large illustrations and examples of work problems so the complicated ones could be followed more easily.
- Instructional pace slow enough to allow important information to be copied from the tape.
- Discussion putting graphical ideas and concepts into proper perspective with respect to their importance and relationship to one another.
- Complete development of a graphical idea or concept utilizing several examples whenever possible.
- Short final summary of the topic covered at the end of the tape.

INSTRUCTORS' REACTION TO VIDEO

In short, professors using the tapes in their classes agree that they are useful as supplementary instructional material. The use of video tapes allows the instructor time to concentrate on helping those students who are experiencing more profound visualization difficulties, while at the same time, permitting the majority of the class to proceed individuality to and through other more advanced material at their own rate. In addition, the use of video allowed unlimited review. If so desired, a student could replay a tape indefinitely until the subject was understood and mastered. Always as a last resort, the professor was available for finer definition or more precise and detailed explanation. A most beneficial result of the tapes was that students were actually able to see an instructor solving problems, drawing, and creating an object image right in front of them on the screen. Many students complete engineering drawing courses and never actually see a professor using equipment they themselves are expected to become proficient with. The importance of teacher modeling is often overlooked in the classroom.

Among the other advantages in using instructional TV were that (1) students not needing instruction on a topic did not have to sit through a mini-lecture with others requesting such information, and consequently, this resulted in less classroom disruption; (2) those students who were not proficient readers, but more visually oriented in their learning were able to use a more compatible media in proceeding through the program; (3) the tape viewer could stop the tape at any point in order to study the picture and/or take notes directly from the video monitor and, if need be, rewind the tape any desired distance to quickly review some portion of subject matter, and (4) questions which came to mind that were not answered by the various reading materials, nor by the video, as a last resort could be brought before the instructor for a more satisfactory explanation or definition.

SUMMATIVE STATEMENT

Overall, the concept of using video tapes as supplementary instruction for PSI in Engineering Graphics appears encouraging. The concept was favorably received and student reaction suggested that the tapes helped them considerably over the "rough places" in the course. The instructors who have experimented with the instructional TV have also indicated their favorable impressions and have pointed out the advantages of being able to direct students to an additional source for further information. This allowed them time to concentrate on helping those students with more profound difficulties.

Plans are underway to place complete sets of tapes in all the Media Centers on campus thus enabling students to check out and view tapes at their own discretion at any hour of the day. Ideally, the most beneficial arrangement would be to have complete video programs on reserve in the Media Centers <u>and</u> in the classroom along with a video tape player and monitor. To date, no such arrangement has been possible.

Finally, it is worth noting that it takes a considerable amount of time and effort to design, prepare, organize, and video-tape all the necessary subject matter required for a one-semester graphics course. The undertaking requires total support from administrative sources in the form of money, time and encouragement. A video program also requires continual and periodic improvement.

FOOTNOTE: [1]During the 1977-78 School year, the author and one of his colleagues, John L. Crow, conducted a classroom research to determine whether video taped graphics material improved students' 3-D visualization ability. Based upon data collected and analyzed from a pre- and post-visualization test, it was concluded that video did not affect the students' 3-D visualization abilities in one way or another during the course of the semester. For more details of the research conducted, a copy of the original research report as it appeared in the April 1-3, 1979 Southeastern Section Meeting Proceedings may be obtained by writing directly to the author at the following address: North Carolina State University, 510-E Poe Hall, Raleigh, North Carolina 27650. Please include a stamped, self-addressed envelope for return postage.

FIGURE 1. Tape Evaluation Form - Front

Vander Wall

Tape Evaluation Form
(Self-Paced Engineering Graphics, E 101)

Below are a number of items pertaining to the tape you just saw. Please circle the number from 1 to 7 that best describes how you would rate each item, or check the appropriate box and note your comments, so we may improve the tapes. Thanks for your help.

Note: Please do not circle more than one number per item and do not mark between numbers.

Tape Number __________ Subject: ______________________________

		DISAGREE			AGREE			
		Strongly	Moderately	Slightly	Slightly	Moderately	Strongly	Most Strongly
1.	The length of the tape was just right	1	2	3	4	5	6	7
2.	The objectives of the tape were made clear	1	2	3	4	5	6	7
3.	The amount of information covered was just right	1	2	3	4	5	6	7
4.	The introductory and general information covered was just right	1	2	3	4	5	6	7
5.	The technical and factual information covered was just right	1	2	3	4	5	6	7
6.	The information covered was useful and informative	1	2	3	4	5	6	7
7.	There was good material flow and continuity	1	2	3	4	5	6	7
8.	The delivery rate was at a good speed	1	2	3	4	5	6	7
9.	The level of presentation made the material easily understood	1	2	3	4	5	6	7
10.	The instructional models and teaching aids used were adequate	1	2	3	4	5	6	7
11.	The illustrative examples and visuals used were adequate	1	2	3	4	5	6	7
12.	The summary of material and emphasis of major points was adequate	1	2	3	4	5	6	7
13.	The instructor raised challenging questions and/or problems which encouraged thinking	1	2	3	4	5	6	7
14.	The instructor exhibited annoying mannerisms, habits, and/or behavior that was disturbing	1	2	3	4	5	6	7
15.	Overall evaluation of the instructor (1 = poor, 4 = good, 7 = excellent)	1	2	3	4	5	6	7
16.	I felt frustrated during the presentation because I was unable to raise questions	1	2	3	4	5	6	7

17. If you had questions during the tape presentation, did you note them so they could be raised later? Yes ☐ No ☐

18. Do you plan to review any part of the tape you just saw? Yes ☐ No ☐

If yes, which part and for what reason? ______________________________

____

____

Care to make a comment about any of the above? ______________________________

____

Tape Evaluation Form (Cont.)

19. The subject (knowledge and techniques) were covered adequately enough to meet my needs and questions? . . . . . . Yes ☐ No ☐
If not, please explain. ______________________________

	DISAGREE: Strongly	Moderately	Slightly	AGREE: Slightly	Moderately	Strongly	Most Strongly
20. I feel the tape will help me: master the material	1	2	3	4	5	6	7
pass the unit proficiency test	1	2	3	4	5	6	7
21. Overall evaluation of the need for having a tape for this part of the course (1 = not needed, 4 = useful, 7 = absolutely necessary)	1	2	3	4	5	6	7

22. Did you notice any errors in the material presented that were not corrected? . . . . . . Yes ☐ No ☐
If so, where exactly? ______________________________

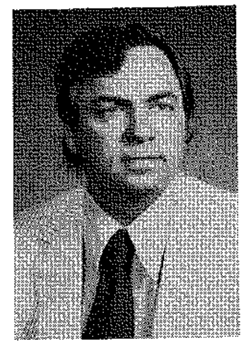
23. What is your overall evaluation of the tape? (1 = poor, 4 = good, 7 = excellent)	1	2	3	4	5	6	7
24. How would you evaluate the overall mechanics of tape production? (1 = poor, 4 = good, 7 = excellent)	1	2	3	4	5	6	7
25. I thought the following Production Techniques were handled adequately:							
Camera Manipulation	1	2	3	4	5	6	7
Lighting	1	2	3	4	5	6	7
Close-ups (Zoom)	1	2	3	4	5	6	7
No Camera Vibration	1	2	3	4	5	6	7
Picture Clarity & Resolution (Focus)	1	2	3	4	5	6	7
Color Production	1	2	3	4	5	6	7
Sound Quality (Clearness)	1	2	3	4	5	6	7
Sound (Volume)	1	2	3	4	5	6	7

26. Suggestions for improving the tape? (Any and all suggestions are welcomed.) ______________________________

27. Additional comments you would care to make? ______________________________

FIGURE 2. Tape Evaluation Form - Back

THE GEOMETRY OF AESTHETICS -- A CASE STUDY



Robert P. Kelso
Louisiana Tech University
Ruston, LA

BACKGROUND

In regard to consumer products, who is it that designs the final casing so that it is eye appealing? Is it the artist who has learned technical design or is the technical designer who has an "eye" for aesthetics? In either case a standard approach is to draw a "box", boxing-in a given assembly drawing within a coordinate system and then to construct random straight lines within the coordinate box and around the assembly drawing until a final design emerges from the maze of lines.

The reason this process works is the subject of almost no inquiry, but the writer speculates it is due to the unconscious creation of geometrically similar areas within the coordinate system. Furthermore it is postulated that this is the basis of all design beauty and although this precept is not acknowledged in this way, master designers use the principle without exception.

AN APPLICATION

In an example of an artist's painting, the start is with the rectangular coordinate (canvas) area. Greatest aesthetic success occurs when the geometrically similar areas (plus square areas) within the canvas are also geometrically similar to the overall canvas shape. Furthermore, since growth rates in nature are usually irrational numbers and natural components usually have irrational ratios, e.g., the ratio of the leg length to the body length, it is found that if the ratio of the coordinate dimensions is an irrational number, then the greatest degree of beauty will result.

These phenomena with their ultimate ramifications is so closely held by successful designers, that it is virtually an inside secret. The following is an analysis of how one master artist and designer applied these techniques to a painting of a very interesting subject.

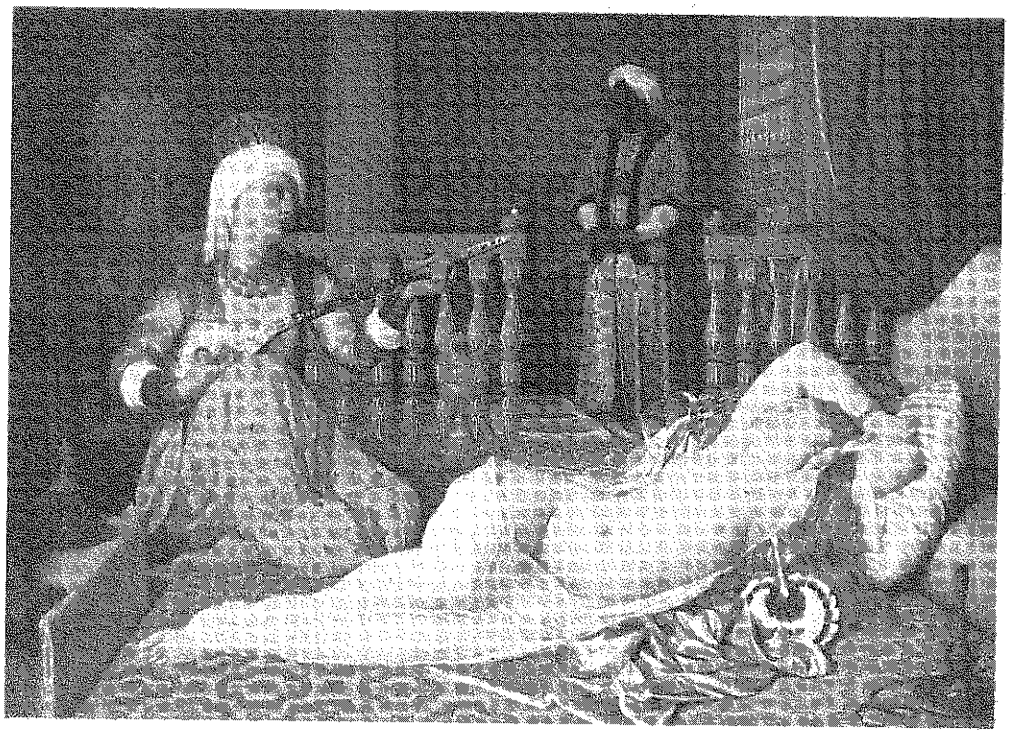


FIGURE "A"

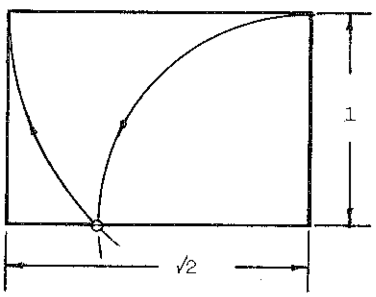


FIGURE 1

1) The classical method of constructing a "root two" rectangle to achieve a dimensional ratio which is irrational. This invariably signals that the designer is familiar with the concepts below (coined: "Dynamic Symmetry" by J. Hambdige) and the steps through Figure 4 are automatic.

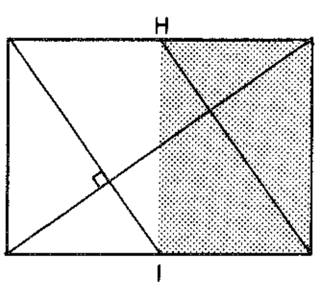


FIGURE 2

2) A diagonal and its reciprocals are constructed. These divide the rectangle into a rectangle (shaded) which is geometrically similar to the whole. Note that the shaded rectangle also has its diagonal and a reciprocal already constructed which divides its area into a similar rectangle and so on ad infinitum. The operations below on the parent rectangle may be done with equal legitamacy on the shaded rectangle and/or its similar rectangles.

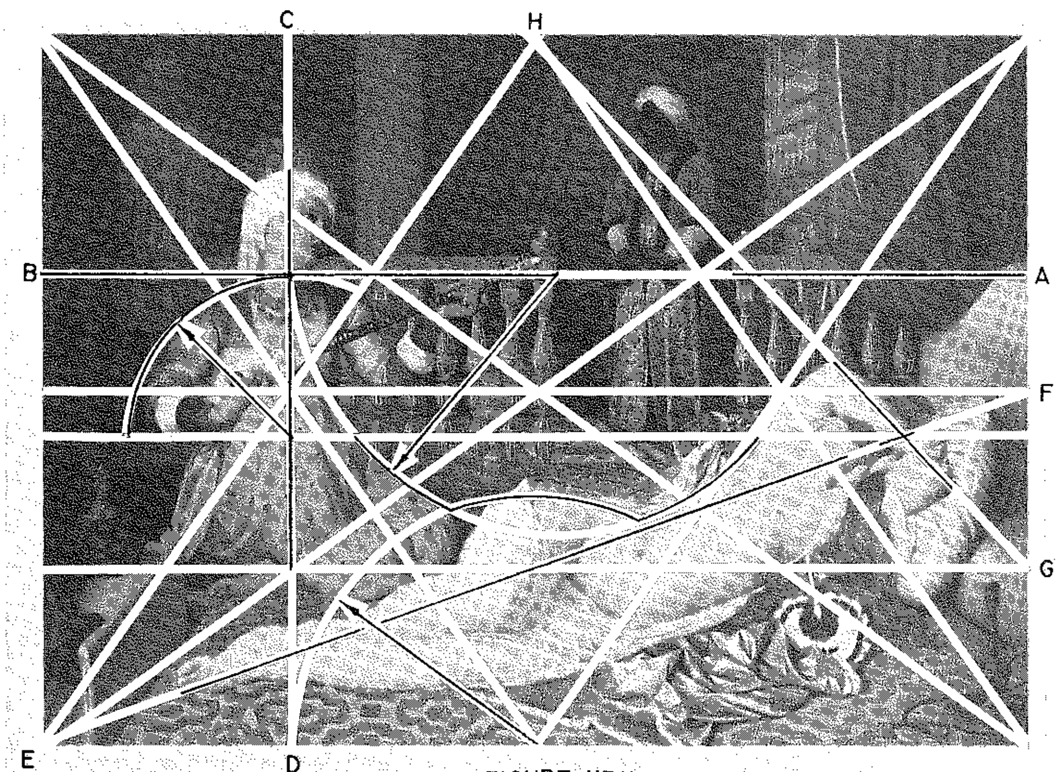


FIGURE "B"

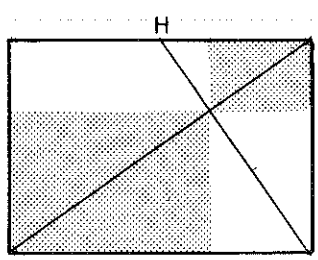


FIGURE 3

3) The diagonal also defines other similar rectangles as shown by the shaded rectangles and the unshaded rectangle on the right. Note the large shaded rectangle together with the unshaded rectangle above it define a square. In addition, the large shaded rectangle is the reciprocal of the whole. Trying to define the similar (and similar-plus-squares) relationships quickly becomes a labyrinth, but any line which may be drawn between points defined by the diagonal and reciprocal will set up some sort of a geometrically similar relationship.

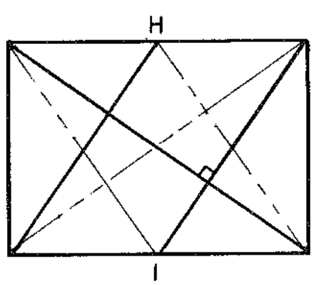


FIGURE 4

4) The other diagonal and its reciprocals are constructed.

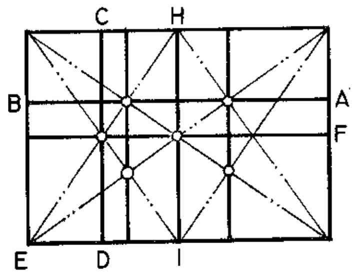


FIGURE 5

5) The intersections ("eyes") of the diagonals and reciprocals locate the verticals and horizontals. The choice of which "eyes" to use is arbitrary. New eyes are created by the newly created intersections and this process may be continued ad infinitum.

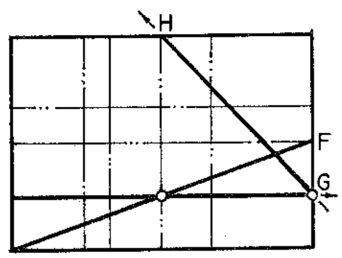


FIGURE 6

6) The process is continued now using inclined lines, confident that one cannot fail to create an aesthetically successful design by this method.

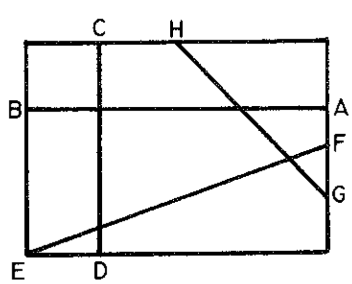


FIGURE 7

7) Four principal design lines (armatures) chosen by the designer, J. A. D. Ingres in 1839 for his painting.

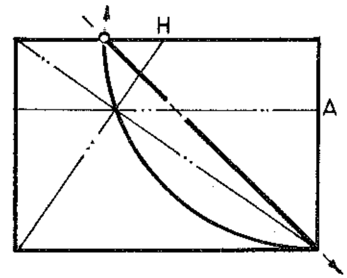


FIGURE 8

8) A circle center is determined. The rebatement of the short side on the long is the routine method of defining a square -- which classically denotes Static (rational) Symmetry, but peculiar to the root two rectangle is the phenomena that the rebatement arc passes through a principal dynamic eye. This, then, given this square and the diagonal constructed on it Dynamic (irrational) as well as Static qualities.

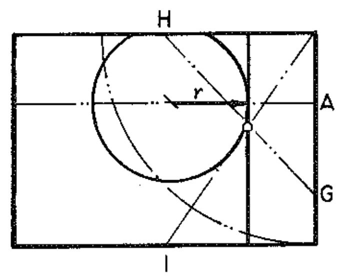


FIGURE 9

9) The radius is determined.

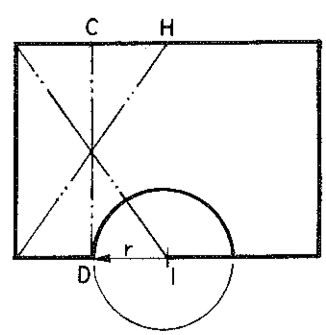


FIGURE 10

10) A circle center and radius is determined.

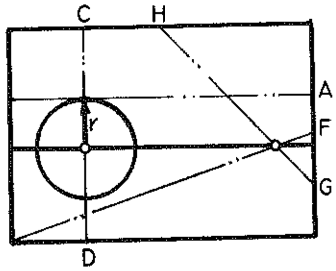


FIGURE 11

11) A circle center and radius is determined. Note the use of the four armature lines for the derivation.

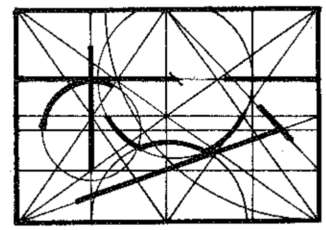


FIGURE 12

12) An integrated drawing showing all construction lines and the derived armatures and primary contour lines (upper reclining torso and drape over the knees of the seated figure, shoulder line of seated figure) truncated (shown in bold lines) to the length applicable to the design. All other armature lines and primary contour lines may be similarly located by this method as well as most of the minutiae.

NEW PRODUCTS

JAMES RIVER GRAPHICS ANNOUNCES A NEW GRID-LINE DRAFTING FILM

James River Graphics announces the introduction of TECNIFAX™ Grid-Line Drafting film, a new product from the manufacturer of TECNIFAX Drafting and Diazo Intermediate films.

The new product has non-reproducible, blue-line grids which will not be duplicated when using photographic, diazo or blueprint reproduction methods.

The fade-out, blue-line grids provide the use with: preprinted measuring without the need of referring to drafting seals; easier and neeter lettering and dimension notation and ease of establishing various component positions.

The new product's blue-line grids are gravure printed on TECNIFAX drafting film and available in both single and double matte surfaces in a variety of sheet and roll sizes.

Samples and literature are available from James River Graphics' dealers, or readers are invited to write directly to the company.

James River Graphics, Inc.
South Hadley, MA 01075

CALL FOR PAPERS

Abstracts of papers to be given at the 1980 ASEE/EDGD midwinter meeting are solicited. General areas of discussion include " The teaching of graphics" and " The business of graphics." Send a 100 word abstract to:

Jon M. Duff
Department of Engineering Graphics
The Ohio State University
Columbus, OH 43210

PUZZLE CORNER

Robert P. Kelso
Louisiana Tech University
Ruston, LA

Spring 1980 Puzzle

Given: Adjacent orthographic views of two skew lines in general positions and of general lengths.

Determine: An orthographic view(s) such that the apparent lengths of the given lines are of a specified ratio.

The new puzzle is from a suggestion by Walter Brown of Santa Rosa Junior College, Santa Rosa, CA. Solutions received before September 15, 1980, will be included in the Fall Issue.

Please submit solutions to:

Robert P. Kelso
Assistant Editor
Engineering Design Graphics Journal
Department of Industrial Engineering
and Computer Science
Louisiana Tech University
Ruston, LA 71272

Please make your submissions of reproduceable quality and also include a pictorial if it will be helpful.

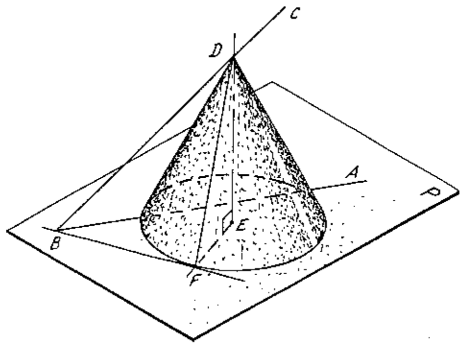
Fall-Winter 1979-80 Puzzle

Given: Two adjacent orthographic views of an angle of general size defined by intersecting lines of general lengths and in general positions.

Determine: A non-normal orthographic view* of the plane of the angle such that the angle appears true size.

*and, if possible, all views such that the angle appears true size as defined by a General Solution (see Puzzle Corner Winter, 1979, Spring, 1979 and below).

Figure 1 is a solution by Abe Rotenberg of the University of Melbourne, Australia to the Fall-Winter '79-'80 puzzle. A view in the direction of FB shows angle EFD true size and since angle EFD = angle ABC, a view in the direction of FB also shows angle ABC true size. We are puzzled with the note, though. Is it possible for the angle between the line BC and the plane P to be greater than angle ABC?



AB and BC are two arbitrary intersecting non-perpendicular lines.

Step 1: Draw any*) plane P containing AB;
Step 2: Draw a right circular cone with
i. its vertex D on the line BC;
ii. its base in the plane P;
iii. its axis of rotation DE ⊥ P;
iv. its generators forming with the plane P an angle equal to ∡ABC.
Step 3: Draw BF tangent to the base circle of the cone.
-BF is the required direction of orthogonal projection.

*) NOTE. Though the plane P is arbitrary, it must satisfy the following condition: the angle between the line BC and the plane P is not greater than ∡ABC.

FIGURE 1

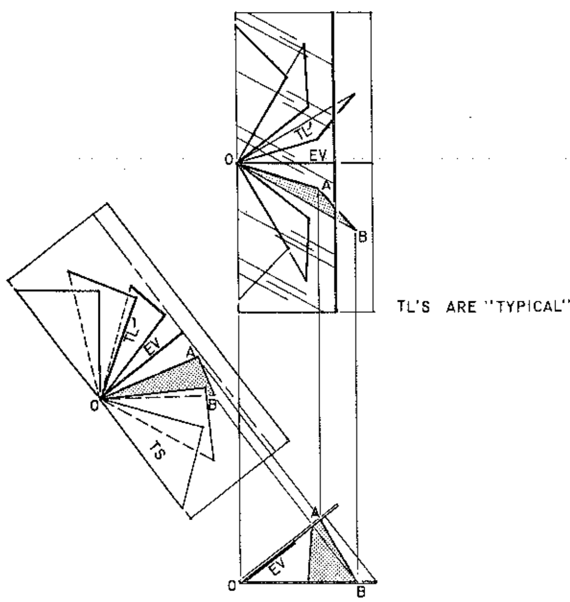


FIGURE 2

Figure 2 is an orthographic of the 'Corner's imagery of the solution -- a plastic triangle which has the given angle as one of its angles at point O and which is wedged between two fixed planes of glass. In the front view in the "beginning" position, if the triangle is viewed normally, the fixed planes are seen as edges, i.e., the given angle (of the triangle) is the same as that between the planes of glass. If the triangle is then rotated about point O while contact is maintained with

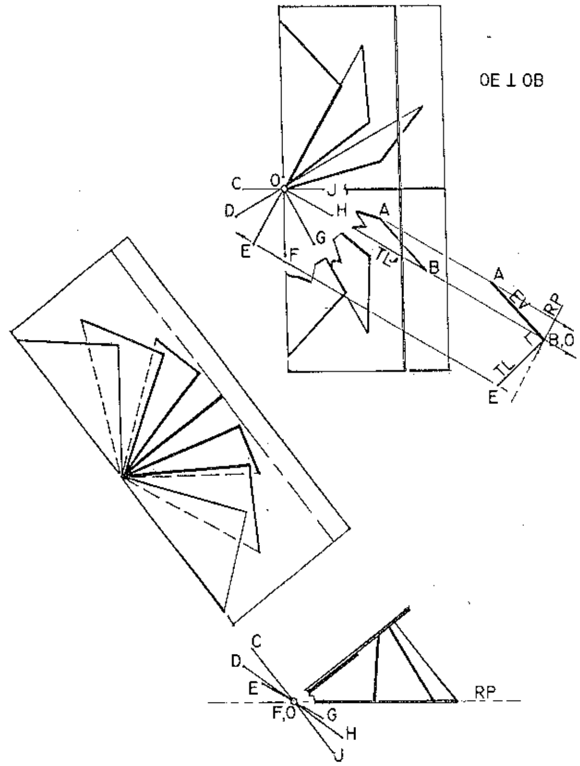


FIGURE 3

the planes, the angle of the triangle will appear unchanged (true size) in the Front view although the triangle, i.e., the given angle, is no longer viewed normally. The elements of the General-Solution-of-all-lines-of-sight-such-that-a-stationary-angle-appears-true-size will be the same as perpendiculars at point O to the rotating triangle in the different rotated positions. (Figure 3) If the elements are made equal length, the General Solution turns out to be a general condition of a cone with apex at O and base formed by a helical directrix. (Figure 4) The defining parameters of this helix are a function of the size of the angle being viewed and we are happy to defer to anyone who wants to work out that relationship.

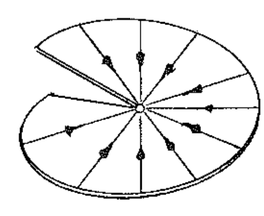


FIGURE 4

Figure 5 is another solution by Abe Rotenberg to the Perplexahedron (Winter '79, Spring '79, and Fall '79). This solution predates our Fall '79 issue but due to difficulty we had with the economy of the presentation it is only now being presented.

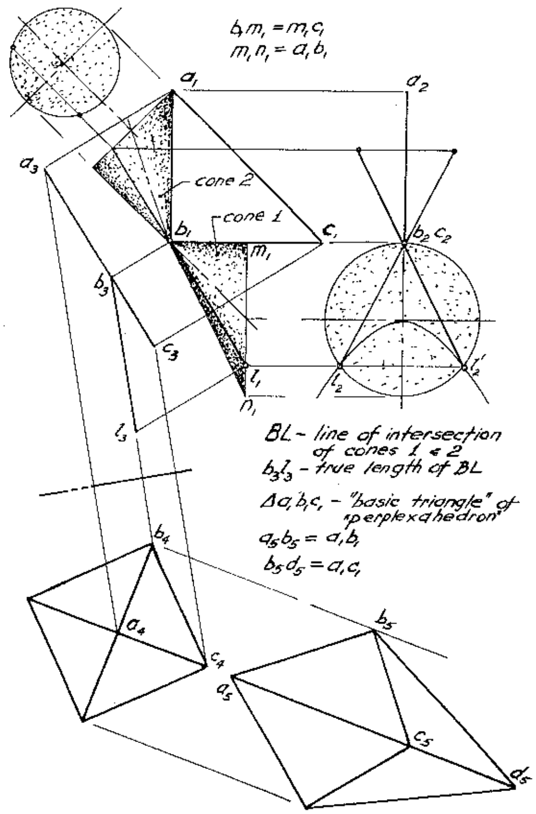


FIGURE 5

The following represents our understanding after corresponding with Prof. Rotenberg.

Cone 1 is Abe's equal-length-appearing-pairs-of-nonparallel-lines-General-Solution-Cone (derived Spring '79). In order to accommodate his technique of determining the line of intersection between the two cones, the apex has been translated from its originally derived position at point a to point b.

Cone 2 is the 'Corner's perpendicular-appearing-pairs-of-nonparallel-General-Solution-cone (derived Fall '79). But with a variation! Figure 6 shows the derivation of the cone with direction #1 being the same as that used in the original Fall '79 column. However, the direction #2 also leads to a solution and it is this direction which Abe uses. In Figure 5 this cone's apex is also shown translated to point b, but on the "other side" of the apex from cone 1.

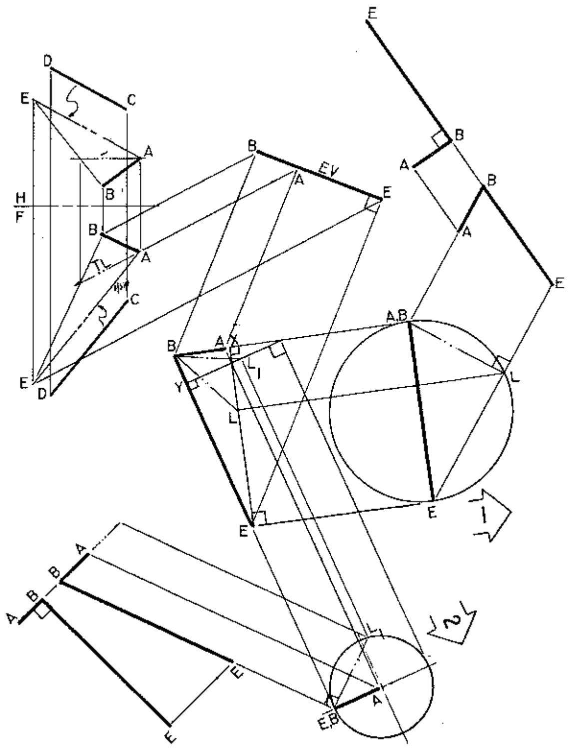


FIGURE 6

In order to achieve the line of intersection between cone 1 and cone 2, cone 2 is extended (not so shown in Figure 5) to lie on both sides of the apex, and the intersection of the extended cone 2 with the base plane of cone 1 is determined. This is the parabolic curve in Figure 5. Figure 7 is our isometric. The isometric Cone-2-extended is shown with a free-form base except for that part which intersects the base plane of cone 1. Of course, one point of intersection between the bases, together with the common apex, determines one of the lines of intersection between the two cones. In Figure 5, this line

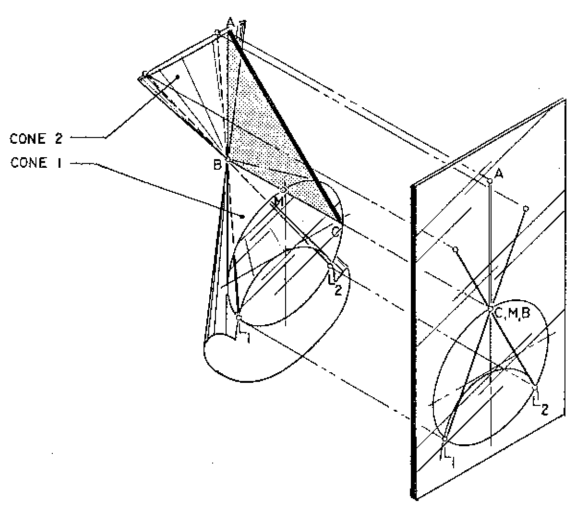


FIGURE 7

of intersection, b1, is then shown projected into a point view in order to achieve a view such that ac and ab will appear perpendicular and equal length per the solution described in the Fall '79 issue. Although the final auxiliary in Figure 5 seems plotted in first angle projection, perhaps unintentionally, this has no bearing on the approach used.

A question arises with respect to the directions #1 and #2 derivations in Figure 6, however. Does the direction #2 circle represent the circle view of the same cone as that of direction #1? Or are the two views circle views of two separate cones? The second auxiliary normal view of plane ABE may accommodate the triangular views of an infinite number of elliptical cones!

To resolve this, in Figure 8, the EV of a cutting plane is generally passed through the apex to form the line(s?) BL on "one" cone and BL_1 on the "other". If there is only one cone, all the points on the "two" lines should be co-linear, and if there are two cones, there should appear to be two distinct lines of intersection in a general view. The general view projection of Figure 8 shows the points to be co-linear, ergo, there is truly only one cone!!

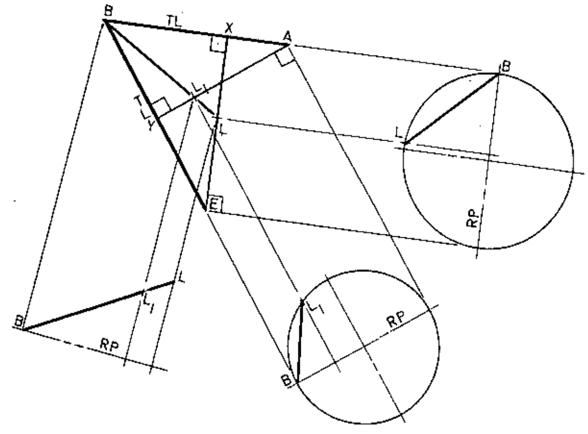


FIGURE 8

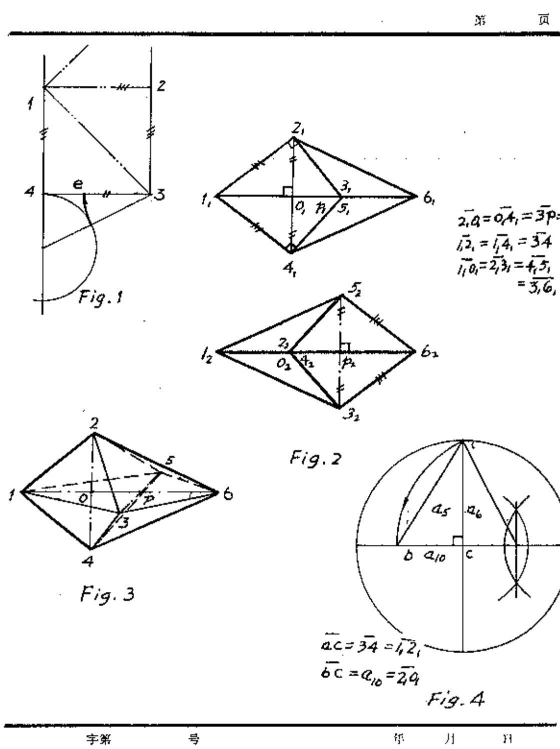


FIGURE 9

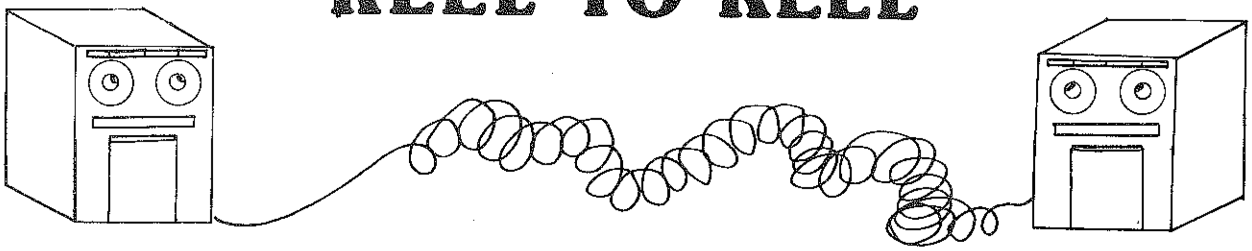
Figure 9 is a solution to the Perplexahedron by Professor Chao Ching-Huan of Peking Normal University, Peking, China. He utilizes the calculation that 2-0 and 0-4 are equal to the Golden Section (Mean) ratio, 0.618. . ., and performs the geometric operations (his Figure 1) to yield that ratio as shown by line length 3-e. He also volunteers one of the many curiosities associated with the Golden Mean in that each side of a regular decagon inscribed within a circle of radius 3-4 (which will equal 1 in a 1-1-$\sqrt{2}$ triangle) will be equal to the Golden Mean. Another geometric derivation of this length, a_{10}, is shown in his Figure 4. (We inked his drawing for reproduction purposes with an off-size template and as a result Figure 1 and Figure 4 are no longer to the scale of his original figures.)

Have a good Summer (or to Abe, have a good Winter!).

'See ya at the Mid-Winter meeting.

Pat

REEL TO REEL



A Report of the COMPUTER GRAPHICS Committee

COMPUTER GRAPHICS COMMITTEE / EDGD / ASEE

Memebership of the Computer Graphics Committee of the Engineering Design Graphics Division of the ASEE.

Chairman

Francis A. Mosillo
Systems Engineering Department
University of Illinois
at Chicago Circle
P.O. Box 4348
Chicago, IL 60680
312/996-2260 or 3444

Members (alphabetical order)

Robert J. Beil
Box 1571, STA B
Vanderbilt University
Nashville, TN 37235
615/322-4730

James Burnett
College of Engineering
Michigan State University
East Lansing, MI 48824
517/355-5123

John N. Clausen
Room 104 Lind Hall
207 Church Street S.E.
University of Minnesota
Minneapolis, MN 55455
612/373-7531

John Demel
Engr. Design Graphics Dept.
Texas A&M University
College Station, TX 77843
713/845-4451

Eugene F. Fichter
Industrial & Gen'l Engr. Dept.
Oregon State University
Corvallis, OR 97331
503/754-2250 or 4645

Robert Harvey
College of DuPage
Glen Ellyn, IL 60137
312/858-2800

Darryl F. Janowicz
Department of Industrial Engr.
College of Applied Sciences
Western Michigan University
Kalamazoo, Michigan 49008
616/383-1948

Rollie Jenison
Dept. of Freshman Engr.
Iowa State University
Ames, IA 50011
515/294-8355

Klaus Kroner
IE/OR Dept.
Univ. of Massachusetts
Amherst, MA 01003
413/545-0737

Robert D. LaRue
Ohio State University
2070 Neil Avenue
Columbus, OH 43210
614/422-2493

Robert N. McDougal
303 Bancroft Hall
Dept. of Engr. Mechanics
University of Nebraska-Lincoln
Lincoln, NE 68588
402/472-2379

Edward V. Mochel
School of Engineering &
Applied Sciences
University of Virginia
Charlottesville, VA 22901
804/924-7421

Jacob J. Wolf
Ohio State University
2070 Neil Avenue
Columbus, OH 43210
614/422-2080

Subcommittees of the Computer Graphics Committee of the Engineering Design Graphics Division of the ASEE

Subcommittee - Descriptive Titles and Members

A. Computer Graphics at the Freshman Level

1. Mosillo
2. Beil
3. Jenison
4. Wolf
5. Clausen

B. Computer Graphics Utilized in Advanced Engineering Graphics Courses

1. Mochel

C. Grantsmanship to start or Inhance an Engineering Graphics Computer System

1. Harvey
2. Demel
3. Janowicz

D. Workshop Development

1. LaRue
2. Kroner
3. Burnett

E. Directory of Computer Graphics, text materials, syllabi

1. McDougal

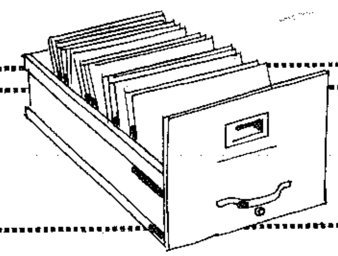
F. Computer Graphics as a Visualization Tool

1. Fichter

G. Study of the Common Transferable CAD/CAM Characteristics

1. McDougal
2. Burnett

Members Listed first are assumed to be the prime movers and should contact the other members.

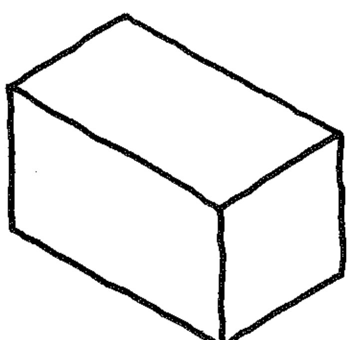


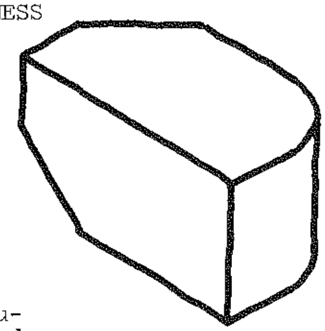
file to file

Many "on the line" teachers have ideas, suggestions, techniques, problems and questions they would like to share with the society. "File to File" provides the place for exchange of professional information. If you have an item for exchange, submit it to "File to File", EDGD Journal, PO Drawer HT, Miss State, MS, 39762.

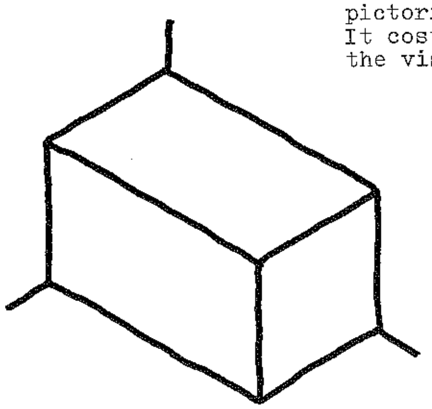
A QUICKIE IN BLACKBOARD EFFECTIVENESS

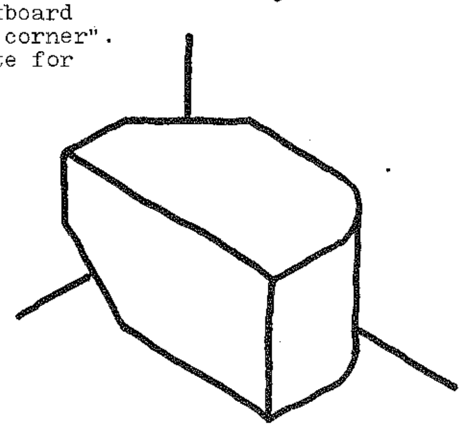
Robert P. Kelso
Louisiana Tech. University
Ruston, LA



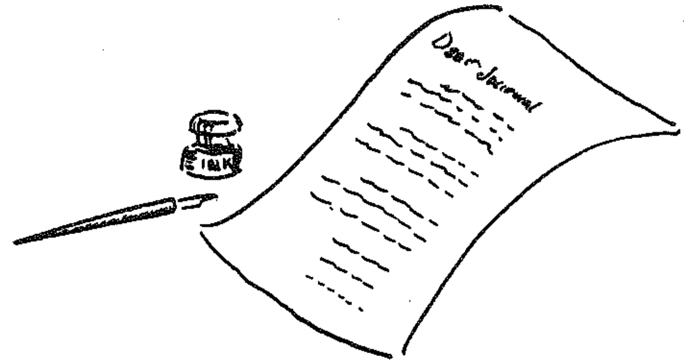


An ultra-simple technique to aid students in visualizing a freehand blackboard pictorial is to put the object "in a corner". It costs nothing and is often dynamite for the visually inexperienced.





Letters to the Editor



Professor Mary A. Jasper
Dept. of Engineering Graphics
Miss. State University
Drawer HT
Miss. State, Ms 39762

Dear Professor Jasper:

There is an error in the "Index, 1936-1978" compiled by Irwin Vladaver and distributed in the Fall of 1979 as Vol. 42, No. 4 of the "Engineering Design Graphics Journal". On page 65 there is a listing of the Divisions Summer Schools and the Summer School listed in 1961 at Carnegie Institute. The Summer School Which should have been held in 1961 at the University of Kentucky was not held because the University would not schedule it. The Summer School was held at the Air Force Academy in Colorado in June, 1962.

I was chairman of the Division in 1961-62 and in a large measure responsible for that Summer School, although Irwin Vladaver had a big hand in it, too. We started planning it when Vlad was chairman in 1960-61. I would be greatly surprised if this mistake was Vlad's.

I am enclosing a Xerox copy of page 34 from Vol. 26, No. 2 of the Journal of Engineering Graphics to substantiate my claim. The whole program and details are printed on Pages 34-38 of Vol. 26, No. 2.

I know that this printing cannot be changed. But some reference should be made to the error so that in a future printing of the "Index" it will be corrected. This should be done in all fairness to the U.S. Air Force Academy where they really rolled out the "red carpet" for us and for all the people who took part both as faculty and students.

As for me, I have long since retired and am enjoying retirement. There is no difficulty with finding things to do. The days are often not long enough. My wife is not able to travel long distances so we have not been able to get to any of the Division Meetings for a number of years. The University of Massachusetts is not so far away. I am hoping to get there for one day, at least.

May I offer my congratulations on an excellent issue, your first one as editor. Borah Kreimer's article "Who Needs Graphics? Indeed!" strikes an all too familiar note. In 1960 this trend to cut out Graphics was first beginning to gather steam and courses were being cut right and left.

Would you believe that I was unable to find anyone who would conduct a Workshop on the subject of design at the 1962 Summer School? Yet, four years later a whole summer school was devoted to design.

Keep up the good work with the "Journal".

Sincerely,

Ed Griswold
141 Washington Ave.
Chatham, NJ 07928

Feb. 20, 1980

Dear Prof. Griswold:

Thank you very much for pointing out the mistake in the latest edition of the Index. Please consider that this error will be duly noted, and the next Editor of the Index will see that it is corrected.

Those of us who are involved in the teaching of Engineering Graphics courses today sometimes feel that we are working in a vacuum, and don't realize that the problems which we are experiencing have been present for a long time.

We cherish the past experience and the vast store of knowledge that the retired members of our Division, like yourself, bring to our meetings and publications. Thank you for your comments -- but, most of all, thank you for your continued support.

Sincerely,

The Editor.

1980 ASEE ANNUAL CONFERENCE Amherst, MA

MONDAY — June 23, 1980

1137 Judging Criteria for Creative Design Display

7:30-9:45 a.m. **CC 9th Floor** **Breakfast Buffet $3.50**

ENGINEERING DESIGN GRAPHICS DIVISION
Moderator: E.W. Knoblock, University of Wisconsin-Milwaukee

Closed business meeting.

1637 Computer Graphics at the Freshman Level

3:45-5:30 p.m. **GTWR 201** **Open Lecture**

ENGINEERING DESIGN GRAPHICS DIVISION
Moderator: Francis Mosillo, University of Illinois–Chicago Circle

A look at several universities to examine what can be done to prepare students for work on computer graphics terminals.

1237 Special Programs for the 1980's

8:00-9:45 a.m. **GOES Auditorium** **Open Lecture**

ENGINEERING DESIGN GRAPHICS DIVISION
Moderator: Blaine Butler, Purdue University-West Lafayette

Freshman engineering related programs and expected changes in the next decade will be examined.

1737 Engineering Design Graphics Executive Committee Dinner

6:00 p.m. **CC 11th Floor** **Dinner Buffet $8.00**

ENGINEERING DESIGN GRAPHICS DIVISION
Moderator: Leon Billow, United States Naval Academy

Closed business meeting.

TUESDAY — June 24, 1980

2237 Special Problems with Entering Freshmen

8:00-9:45 a.m. **SBA 1** **Open Panel**

ENGINEERING DESIGN GRAPHICS DIVISION
Co-sponsor: Mathematics Division
Moderator: Donald L. Cole, University of Louisville

Engineering schools have been experiencing an apparent decline in the academic preparation of their engineering students, particularly in mathematics. Panelists will describe efforts (e.g. placement exams) to overcome this problem and will respond to questions from the audience.

2537 Engineering Graphics: What is Given—What is Needed?

1:45-3:30 p.m. **SBA 116** **Lecture**

ENGINEERING DESIGN GRAPHICS DIVISION
Moderator: Robert Foster, Pennsylvania State University

A national survey of what and how much engineering graphics is taught in colleges will be counterpointed by representatives from industry discussing attributes of engineering graphics desired within the entry level engineer.

2437 Engineering Student Luncheon

12:00-1:30 p.m. **SU—The Hatch** **Luncheon**

ENGINEERING DESIGN GRAPHICS DIVISION
Moderator: Barbara L. Ramey, ASEE Headquarters

Open to all students of engineering. Prominent members of ASEE will be invited to meet with students informally, providing an opportunity for students to obtain immediate feedback to their questions, problems and ideas. Pay-as-you-go luncheon.

2737 Engineering Design Graphics Division Awards Banquet

6:00 p.m. **New Townhouse** **Dinner $14.00**

ENGINEERING DESIGN GRAPHICS DIVISION
Moderator: Leon Billow, United States Naval Academy

Social Hour — 6:00-7:00 p.m. (Cash bar)
Dinner — 7:00 p.m.
(Bus leaves at 5:30 p.m.)

WED — June 25 1980

3237 Human Factors Engineering Influence in Design

8:00-9:45 a.m. **HERT 227** **Symposium**

ENGINEERING DESIGN GRAPHICS DIVISION
Moderator: Louis Skubic, South Dakota State University–Brookings

Academic and industrial representatives will discuss their view of current involvement, future needs, and developments in human factors engineering.

3437 Engineering Design Graphics Division Luncheon

12:00-2:00 p.m. **1704 Restaurant** **Luncheon $7.50**

ENGINEERING DESIGN GRAPHICS DIVISION
Moderator: Leon Billow, United States Naval Academy

Bus leaves at 11:30 a.m.

THURSDAY — June 26, 1980

4237 Interactive Computer Graphics Workshop

June 26–July 2, 1980 Thursday–Wednesday **CC 904-908** **Workshop**

ENGINEERING DESIGN GRAPHICS DIVISION
Director: Robert D. LaRue, Ohio State University
Associate Director: Klaus Kroner, University of Massachusetts

Many engineering schools are including computer graphics in courses ranging from freshman through graduate levels. The objective of the workshop is to provide individuals interested in introducing computer graphics into engineering or engineering technology curricula with experience that will aid them in attaining their goals.

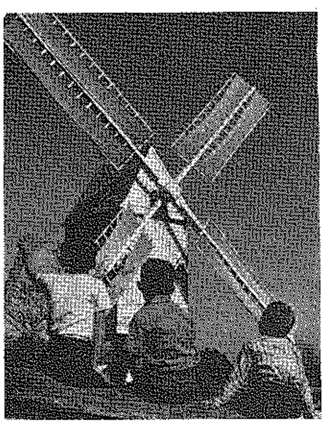
Hands-on experience on various interactive computer graphics systems will be included in the workshop. A programming background (FORTRAN, BASIC, etc.) is desirable, but not required. Advanced sessions (including CAD/CAM material) will be available for those with previous experience in programming, and/or computer graphics.

Staff will include experienced personnel from schools including University of Massachusetts, Michigan State, Ohio State, and Texas A&M Universities.

Fee for ASEE members is $225. Housing and meals (NOT included in fee) will be available in Campus Center. This event will be limited to 25 participants. Pre-registration by June 1, 1980 is required.

Additional information and registration forms may be obtained from:
Mark Spengler, Director
University Conference Services
Campus Center
University of Massachusetts
Amherst, MA 01003

Rediscover Alternate Energy in Colonial Williamsburg



Our fore-fathers (and mothers) might have been more "fore-sighted" than we have given them credit for. Robertson's windmill is but one of the interesting and historic sites in Colonial Williamsburg.

See them all -- and all of your old friends at the

EDGD Midwinter Meeting
Colonial Williamsburg
November 23,24,25, 1980

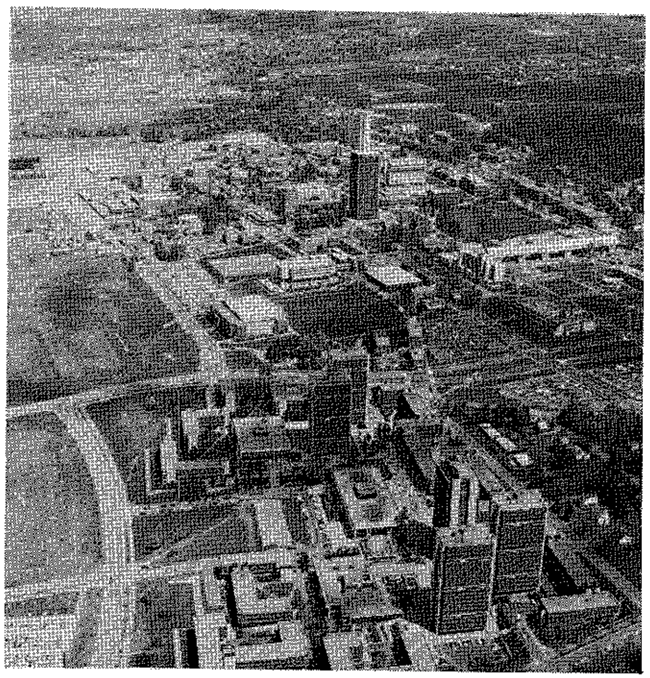
I finally got it all together & then I forgot where I put it.

Keyes · 1980 · Weber

METRIC

ENGINEERING DESIGN GRAPHICS JOURNAL

SPRING 1980 VOLUME 44 NUMBER 2



ASEE ANNUAL MEETING
UNIVERSITY OF MASSACHUSETTS

JUNE 22–26, 1980

Engineering Design Graphics Journal
G. K. Hilliard, Circulation Manager
510 POE HALL
NORTH CAROLINA STATE UNIVERSITY
RALEIGH, N. C. 27607

(Address Correction Requested)