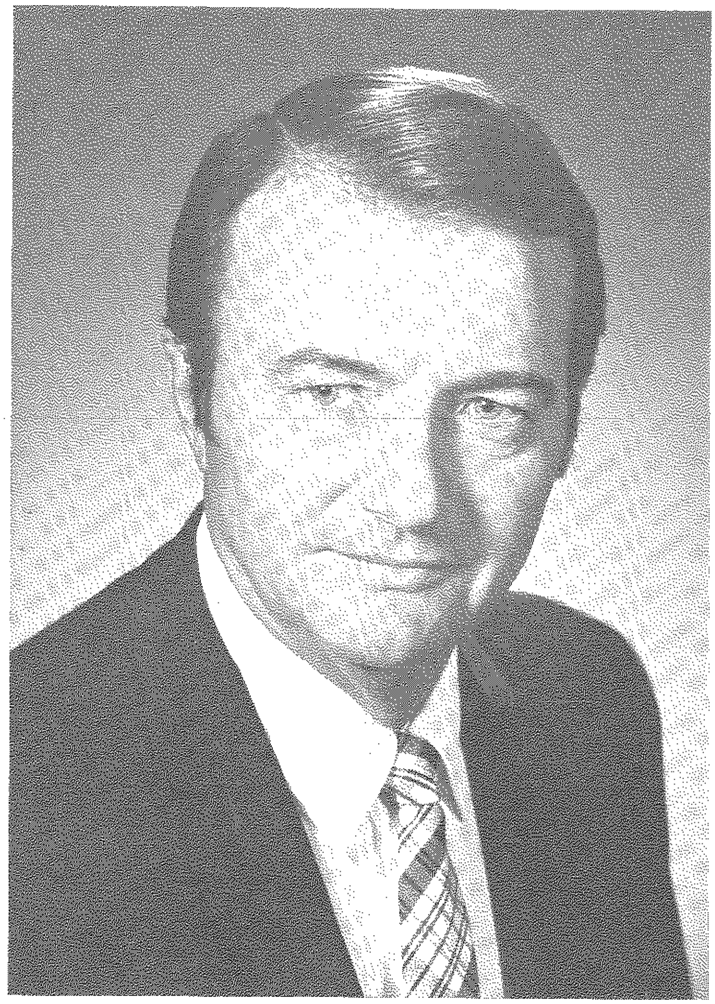
ENGINEERING DESIGN GRAPHICS JOURNAL

FALL 1978 VOLUME 42 NUMBER 3



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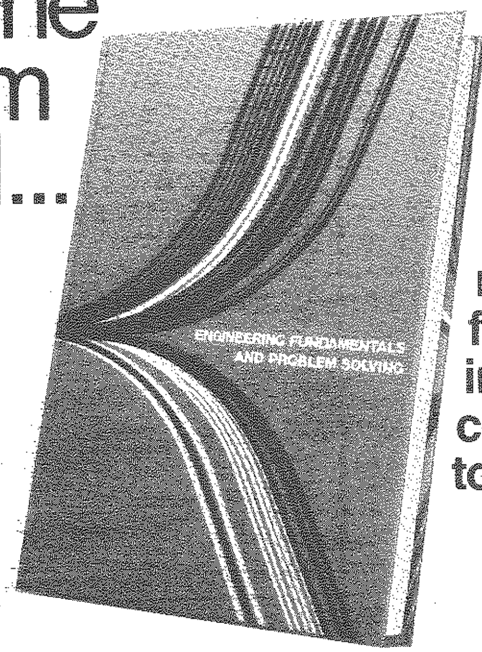

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ENGINEERING DESIGN GRAPHICS JOURNAL

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1979 - Louisiana State University, Baton Rouge. June 25 - 28

1980 - University of Massachusetts, Amherst. June 22 - 27

1981 - University of Southern California

EDGD MIDYEAR CONFERENCES

1979-Mississippi State

1980-Cogswell College

1981-North Carolina State

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 practioners of Engineering Graphics, Computer Graphics, and Design Graphics, and Creative Design.

The views and opinions expressed by the individual authors do not necessarily reflect the editorial policy of the ENGINEERING DESIGN GRAPHICS JOURNAL or of the Engineering Design Graphics Division of ASEE. The editors make a reasonable effort to verify the technical content of the material published; however, final responsibility for opinions and technical accuracy rests entirely upon the author.

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ENGINEERING DESIGN GRAPHICS JOURNAL OBJECTIVES:
The objectives of the JOURNAL are:
1. To publish articles of interest to teachers and practioners 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 appropriate 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.

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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 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 such material accordingly, either on the front or back of each.
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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 8-1/2 x 11. If necessary, make 8-1/2 x 11 or smaller photo copies 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.

6. Please make all changes in your manuscript prior to submitting it. Check carefully spelling, structure, and clarity 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 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:
Paul S. DeJong, Editor
403 Marston Hall
Iowa State University
Ames, Iowa 50011

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

deadlines for author

DEADLINES FOR AUTHORS AND ADVERTISERS
The following deadlines for the submission of articles, announcements, or advertising for the three issues of the JOURNAL:
Fall--September 15
Winter--December 1
Spring--February 15

THE AMERICAN SOCIETY FOR ENGINEERING EDUCATION

Engineering Design Graphics Journal

FALL 1978 VOLUME 42 NUMBER 3

EDITORIAL

Well, this is this Editor's last year on the job, and this is the first issue of the JOURNAL to be distributed to all members of the Division. We hope the new readers are pleased with it. For those who may not be fully aware of the events leading up to this action, the history of the Division dues is discussed on page 6.

Some new readers may also observe the "narrow" appearance of the JOURNAL. The JOURNAL is published in metric proportions and measures 198 x 280 mm. It is at least somewhat controversial, but I hope a very permanent measure. Several letters on page 7 are directed at that change.

The readership should be enlarged somewhat by the "automatic" subscription, and we hope our new readers will take an active part by contributing high-quality material for consideration.

On the other side, new readers should find some interesting material coming up. The ICDG has already precipitated several articles for the coming issues.

All in all, it looks like a very good year for the JOURNAL. We're glad to have you all "aboard".

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CHAIRMAN'S MESSAGE

Clyde H. Kearns
Ohio State University

As the Engineering Design Graphics Division of the American Society for Engineering Education completes the observance of its 50th anniversary, and looks forward to the next half century, it can take great pride in its accomplishments. The oldest of the ASEE divisions, it is also one of the most active. The roster of its former Chairmen and the list of recipients of its Distinguished Service Award include almost all the leaders in the establishment of graphics as one of the fundamental disciplines of engineering. Division members have played key roles in defining the role of graphics in engineering practice, in establishing standard terminology and procedures, and in developing the educational programs and materials in use in graphics classes in our engineering and technical schools. The Division has always been blessed with a nucleus of very active and devoted members willing to spend long hours planning, organizing, and performing the many tasks that must be accomplished if the Division is to function as a worth-while professional activity.

As part of its 50th birthday, the Division hosted at Vancouver, during the week prior to the 86th ASEE Annual Conference, a very successful International Conference on Descriptive Geometry. The program included some 12 sessions and 3 workshops. It drew attendees from 11 countries, 6 Canadian provinces, and 30 states, a total of 115 registrants and 53 spouses and guests. The success of the Conference is a tribute to the dedicated and hard-working committee members who conducted it, Amogene DeVaney, Clarence Hall, Jack Brown, Garland Hilliard, and Robert Foster, and to workshop directors Mary Blade and Robert LaRue. In spite of the skepticism of some, who doubted that a traditional topic such as descriptive geometry could attract a crowd, the meeting was a success quality-wise, attendance-wise, and financially.

The Division takes an active part in ASEE Annual Conferences. It sponsors many sessions, and they are among the best organized and presented. The Division shares common interests with other ASEE divisions, and acts as co-sponsor with them. In addition the Division holds each year a 3-day Mid-Year Conference. This winter meeting is unique, a fine opportunity to interact with a smaller group in a less hectic and more relaxed atmosphere. If you have not attended a Mid-Year Conference in recent years, you should plan to be at Mississippi State University in January.

The Engineering Design Graphics Journal is in its 42nd year of continuous publication. A truly top-notch professional publication, it serves as a forum for the presentation of scholarly papers and the interchange of information among the members of the Division. The Journal documents the activities and history of the Division. The quality of the Journal is attested to by the many engineering libraries that have long maintained paid subscriptions, carefully collecting all issues and binding them for use as a technical and historical reference. Approval by Division members, in Spring 1978, of $1.50 annual dues to cover an automatic subscription to the Journal, was a significant event. The Journal will now serve all members and member awareness of Division activities will increase.

A well-attended event at ASEE Annual Conferences is the Creative Engineering Design Display. The Division presented the 11th annual Display at Vancouver. Here again, the excellence of the Display was a result of the efforts of a hardworking and dedicated committee consisting of Borah Kreimer, Byard Houck, Mary Jasper, and Edward Knoblock. Many ASEE Conference attendees visit the Display and the Society continues to support it by budgeting money for the Display from its limited funds.

We have a fine organization. The nature of our activities, the variety of conference session topics, the quality of the papers presented and published, and the excellence of our publication, all attest to a program which will benefit all who participate in it. Individually and collectively, we constitute an element which will continue to have a great deal of influence on the manner in which we educate our engineers. To all Division members, thank you and keep up the good work.

LOOKING FOR SOMEONE?

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American Society for Engineering Education

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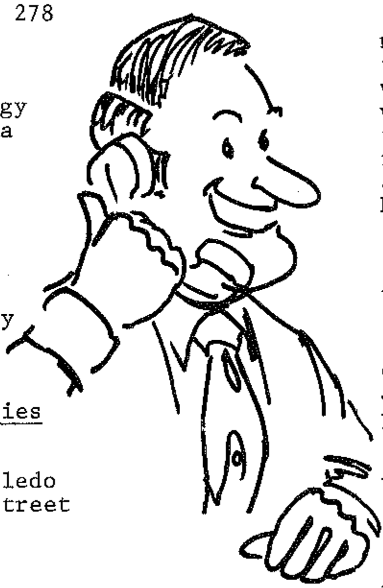

ABOUT THOSE DUES...

The Division executive committee was quite concerned that many Division members would be dropped from our roster this year because of failure to remit the newly established $1.50 dues. It now appears that Joyce Henderson of ASEE is acting to alleviate the situation with a dues reminder being mailed to those who fail to pay Division dues. We hope we can enlist the aid of those who read the Fall issue of the Journal. With this account of the following events that led to the establishment of Division dues.

(1) Approval by the Executive Committee, on January 4, 1978, of a proposal to "poll the membership to determine their willingness to accept $1.50 annual dues which will include an automatic subscription to the Journal, with a refund of current subscription upon request", this action reported to the Division Business Meeting on January 5.

(2) Approval of dues by 88% of the 162 members who voted the issue on the ballot which closed March 15, 1978.

(3) Request by Chairwoman DeVaney on April 4, 1978, through Prof. Gerald J. Thuesen, Chairman PIC III, for approval of dues by ASEE Board of Directors.

(4) Establishment of Division dues by ASEE Board of Directors at its April 1978 meeting.

(5) Addition of Division dues to ASEE dues invoices mailed in June 1978. Division members who receive the Fall issue of the Journal check with their colleagues who do not receive it and suggest that payment of dues is in order.

> Division members who wish to apply for a partial refund of their subscription payments should write to Garland Hilliard, Circulation Manager.

Recent issues of the Journal have included a copy of the ASEE Individual Membership Application. Since the 1978-79 form is a special one, we call your attention to the new-member dues schedule (1st year $15.00, 2nd year $20.00, 3rd year $25.00) in effect between June 1978 and June 1979. At the ASEE New Officers Orientation at Vancouver on June 22, John Lisack, Director or ASEE Member Activities, reminded all present of the $5.00 credit against first-year dues for those non-members who are registered for a Section, Division, or Annual Conference, and apply for membership during the conference. Thus, a person attending our Mid -Winter Conference, or the Annual Conference at Louisiana State University, can join ASEE for 1st-year dues of $10.00.

LETTERS

SOME "PRO"S AND "CON"S

The editorial on metric paper size in the Winter 1978 issue of EDGJ initially was of interest because of the statement ending in "aspect ratio $(1:\sqrt{2})$ when any sheet size is cut in half." The questions and comments that come to mind are:

1. Would the usual interpretation be that the length and width of sheets are cut in half or that the area of the paper is cut in half? If dimensions were not listed, the reader likely would assume that original length = 1.41 x original width and that the new dimensions are half of those.

2. It would not seem advisable to advocate another standard for metric drawings based on the problem of publishers and printing presses.

3. Two well used fundamental drawing textbooks published in 1977 and 1978 do not include the metric standard for paper size!

This is not meant to be critical of the "neck-out" posture so much as to let you know there was interest in your suggestions.

-W.G.G. Blakney
Auburn University

In reply to your Volume 42, Number 2 editorial, I'm in love with the new 198 x 280 mm size. Count me as pro.

-Edward V. Mochel
University of Virginia

We owe Ed an apology. Somehow he was listed incorrectly as "E.J." instead of his real "E.V." in a couple of recent issues. Sorry about that, Ed!

- P.S.D.

My concern about your "Rational Metric" size of the Journal was whether it would fit on the current Xerox type reproduction machines. Since it does, you may consider using this as an additional justification for your proposed size.

-Francis Mosillo
University of Illinois
(Chicago Circle)

I am taking this opportunity to "react" to your Editorial in the EDGJ, Winter 1978, Volume 42, Number 1.

First, it is promising to hear that the Division in general, and the Journal specifically support the effort of "going metric". But then there is your proposal of the "Rational" metric paper size in comparison to the "European" metric paper sizes.

I wholeheartedly disagree with this proposal of "Rational" metric paper sizes. As you know, right now we have these basic paper sizes:

1. the 8½ x 11 series, the so-called regular size

2. the 8 x 10½ "school size"

3. the 8½ x 14 size, the "legal" size

For drawing paper we have the 8½ x 11 series, and the 9 x 12 series.

It is time to eliminate this mess once and for all and adopt one size, and one only; the basic metric A-size series. An artificial "creation" of another odd size as the proposed "Rational" sizes are, brings on only more confusion, and works against a smooth transition to a proven standardized system.

May I suggest to use the old paper sizes until it is time to replace some printing presses, it a conversion to metric sizes depends on these. The inconvenience of having "old" and new sizes for a while longer together with a definite fading out of the old size is bearable compared to another "century" of confusion, or "permanent" inconveniences.

Do we have to be a leader for creating an oddity, or are we wise enough and adopt a system which is simpler than our own. To simplify should be our only rational behind this change-over. Your "Rational" metric proposal does not suggest this.

-B. W. Strack
Memphis State University

MANY THANKS TO YOU ALL - PRO AND CON - FOR YOUR TIME, INTEREST, AND LETTERS.

- P.S.D.

International Conference on Descriptive Geometry

SUCCESS IN VANCOUVER

The International Conference on Descriptive Geometry was held June 14-18, 1978 in Vancouver, B.C., Canada. The conference was sponsored by the Engineering Design Graphics Division of ASEE in commemoration of the Division's fiftieth anniversary. The conference accomplished much in the communication of new ideas worldwide in various areas of descriptive geometry. This article is a brief summary of the events that took place during the ICDG.

The Engineering Design Graphics Division, ASEE assumed the responsibility of sponsoring the ICDG approximately four years before it became a reality. In hindsight, one could look back and summarize the entire conference with one word - SUCCESS. This conference was perhaps the largest undertaking that the EDG Division has attempted in its long history. The conference was planned by the Division, funded by the Division, and its overwhelming success can be attributed to the diligent work of the Division. The EDG Division "pulled this one off" on its own without the benefit of help from any other Division within ASEE or from the ASEE National Headquarters.

Attendance at the ICDG can be used as one indicator of success. Over 80 registrants from all over the world came to share their expertise and learn new concepts in the fascinating world of descriptive geometry. Another indicator of success is the quality of speakers on the program. The program of the ICDG had many speakers who are known worldwide as giants in the field of graphics with impeccable credentials. With these indicators coupled with the hard work by many people within the EDG Division, a successful conference was inevitable.

The conference was opened on Wednesday evening, June 14, 1978 by Amogene F. DeVaney, the General Chairman of the ICDG and the Chairman of the EDG Division. The welcome was given by Clarence E. Hall, the Program Chairman for the ICDG. These two individuals deserve the plaudits of all the Division membership for their tireless work to help make the ICDG the success that it was.

Following the opening remarks and welcome, Arther Loeb's presentation "Synergetics: The Structure of Ordered Space" started the conference on a positive note that continued through the final day which involved workshop activity.

Jack Brown and Edward Knobloch at The Registration Table.

The University of British Columbia Campus.

On Thursday, June 15, Klaus Kroner of the University of Massachusetts was Chairman of Session 2 of the ICDG. Presenters in this session gave capsule descriptions as to how descriptive geometry is taught in other parts of the world.

Following the coffee break, the remaining sessions of the ICDG were split and conducted simultaneously. Topics ranging from the very practical "Descriptive Geometry and Graphics Solve Product and Machine Design Problems" to the most abstract "Computer-Aided Tracing of an Equilibrium Line on Intersecting Surfaces of Revolution" were covered. Most everyone in attendance at these presentations must have felt that descriptive geometry has assumed a different dimension in the world than ever was thought possible. Its relevance to practical problem solving and to theoretical research is a true testament to its importance in the engineering world.

On Friday, June 16, Edward Knobloch was Chairman of the Session entitled "Breakfast With The Experts". This delightful session enabled all conferees to discuss informally and in great detail any and all topics of interest in the area of descriptive geometry with the conference speakers.

Amogene DeVaney, General Chairman of the ICDG.

Following "Breakfast With the Experts" the workshops began. Workshop 1, directed by Mary Blade of the Cooper Union, dealt with Applications of Descriptive Geometry to the Solution of Space Problems and Graph Theory. Workshop 2, directed by Robert LaRue of Ohio State, was the Computer Graphics Workshop. This workshop was geared for both the beginner in the field and the person who was advanced in his knowledge of computer graphics. Separate sessions were conducted so that each participant was working at an appropriate level of expertise. Workshop 3 was directed by Amogene DeVaney of Amarillo College. This workshop was designed to give the participants a working knowledge of instructional modules. All three workshops continued through Saturday, June 17, ending in the mid-afternoon with a summary discussion of all activites.

On Saturday evening the conference came to a close with the reception and banquet. All will remember for many years to come the stirring message delivered by Dr. William E. Street concerning the history and past activities of the EDG Division.

In concluding this summary, the work of all who made this conference possible must be recognized. Listed below are the names of the EDG Division members who worked so diligently to guarantee the success of the conference. Their work and the success of the conference has other people in the field of descriptive geometry throughout the world contemplating another conference on descriptive geometry to be held within 4 years. It would be a tremendous achievement by our Division if a conference of this nature was held on a regular basis, for it was our success in Vancouver that would have inspired it.

Clarence Hall, Program Chairman of the ICDG.

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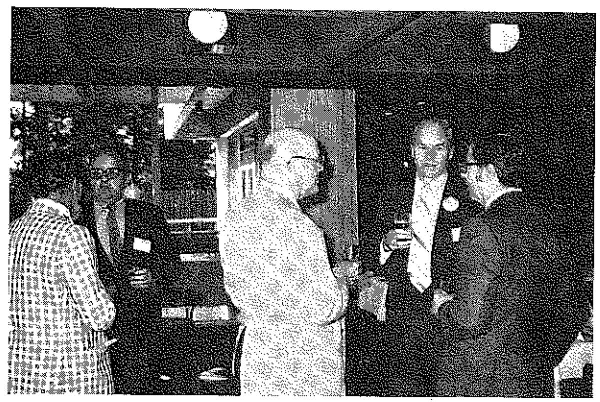
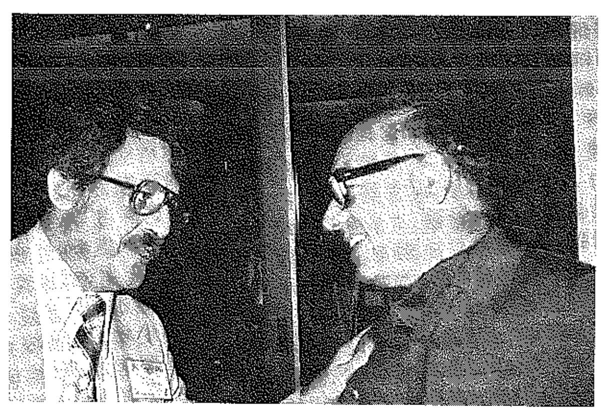
Breakfast With The Experts-Computer Graphics Table.



Social Hour at the ICDG.

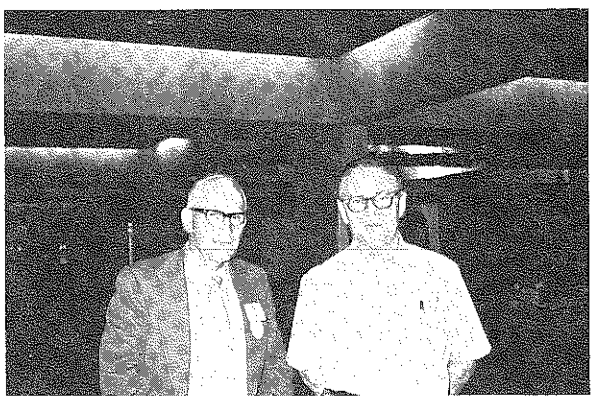


Marc Savageau of Ecole Polytechnique and Arthur Loeb of Harvard Exchange Views.

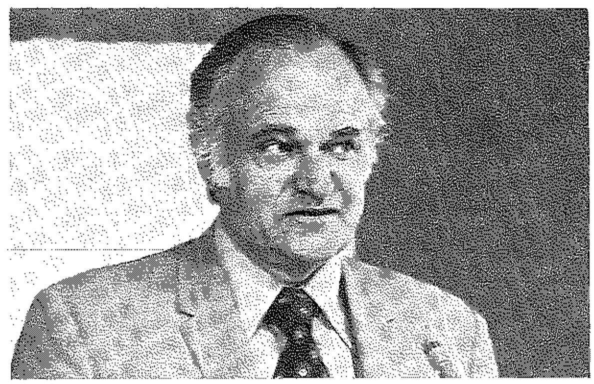
MORE PICTURES OF THE ICDG

Breakfast With the Experts - Informal Discussion

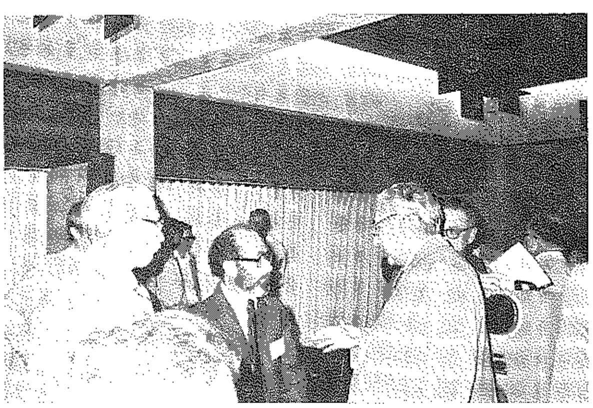
Yehuda Charit of Technion - Israel Institute of Technology, Haifa, Israel.



Dr. William E. Street, and Clarence E. Hill of Louisiana State University.



Steve M. Slaby of Princeton University.



Informal Discussion Following One of the Sessions of the ICDG.

The pictures displayed in this article were the work of two industrious people - Larry Goss of Indiana State University of Evansville, and Margaret Eller of Louisiana State University. The division owes a great deal of thanks to Larry and Maragret for their fine work. Summaries, like this one, are often incomplete and can't tell the whole story. However, pictures add a new dimension to the article and they show everyone the great experience that was had by all in attendance at the ICDG. Thanks Larry and Margaret.

Frank M. Croft, Associate Editor

VANCOUVER IN RETROSPECT

Arvid R. Eide
Director of Programs

This review of the past annual conference will highlight two events: the location and the program.

The selection of the conference site was particularly noteworthy. Vancouver is a city of half a million in the Canadian province of British Columbia. The territory is immense in size and magnificent in beauty, stretching from the U.S. border to the Yukon and 400 miles east from the Pacific to the Rocky Mountains.

The University of British Columbia, the oldest school in the province, is located on the tip of Vancouver's Point Grey, overlooking the blue waters of the coast line. This superb location, together with almost perfect weather, made the conference in itself memorable for those that attended.

The EDG Division Program series began with a review of three workshops conducted at the end of the very successful "International Conference on Descriptive Geometry". Mary Blade presented a summary of her workshop on Applications of Descriptive Geometry to the Solution of Space Problems and Graph Theory. Bob LaRue summarized his efforts on the Computer Graphics workshop and Amogene DeVaney discussed key aspects of the Design and Use of Instructional Modules. This session was concluded by a paper entitled "The Descriptive, Analytical, and Differential Geometries of Ruled-Surface Transition Ducts" by Bill Harrison, Jr. Margaret Eller coordinated and moderated this interesting series.

The second division event was an update of computer graphics as it applies to the teaching of engineering graphics. It included hardware, software, and various methods of starting computer graphics programs.

Papers that were presented included "Engineering Computer Graphics Teaching Aids" by McDougal, "Computer Graphics Software as Utilized in Engineering Graphics Courses" by Beil, and "Grantsmanship! How to Start or Improve an Engineering Graphics Computer System" by Kennedy. This session was moderated and coordinated by Frances Mosillo.

The third session was entitled Freshman Year Orientation Activities. Five panelists outlined some successes and concerns encountered in their orientation procedures for freshman engineering students. The panelists (Butler from Purdue, Keedy from Vanderbilt, McDonough from Maine, Eide from Iowa State, and Risebrough from British Columbia) each presented a brief ten minute overview followed by questions and discussion. The session was moderated and coordinated by Larry Northup.

The last event sponsored by the Division was the Practical Applications of Human Factors and Cost Analysis. This session, moderated and coordinated by John Kreifeldt, presented various case studies and application of human factors method in design. Materials for class projects were described with life-cycle costing being explained.

The papers were "Application of Human Factors Date to the Design and Development of Consumer and Computer Related Products" by Lecocq, "Consumer Product Case Studies Utilizing the Human Factors Discipline" by Meyer, and "Life-Cycle Costing and AMST Program Trade Off" by Kishline.

This year's program also included interesting co-sponsored sessions involving Engineering and Computer-Aided Design.

The Creative Design Display was well organized by Borah Kreimer, Byard Houck, and Ed Knoblock, with the location very suitable for considerable visibility.

It was a fine meeting! Hope you were there.

Note: It simply is not possible nor practical to review each session in sufficient detail to convey conclusions or results; however, below are the names and addresses of each session coordinator. If you desire more information about specific speakers or content, please contact that coordinator.

Margaret Eller
11735 Pecan Grove
Louisiana State
Baton Rouge, LA 70810

John Kreifeldt
Engineering Design
Tufts University
Medford, Mass. 02155

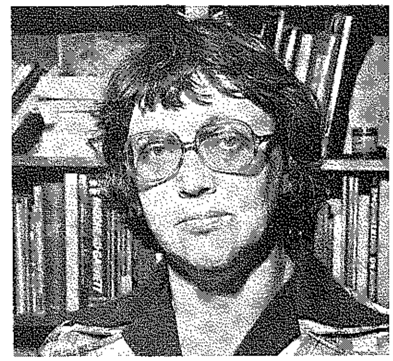
Frances Mosillo
P O Box 4348
U. Of Ill. at Chicago Circle
Chicago, Ill. 60680

Larry Northup
112 Marston
Iowa State University
Ames, Iowa 50011

Mid-Year Conference

MISSISSIPPI STATE UNIVERSITY

Y'ALL COME!!!



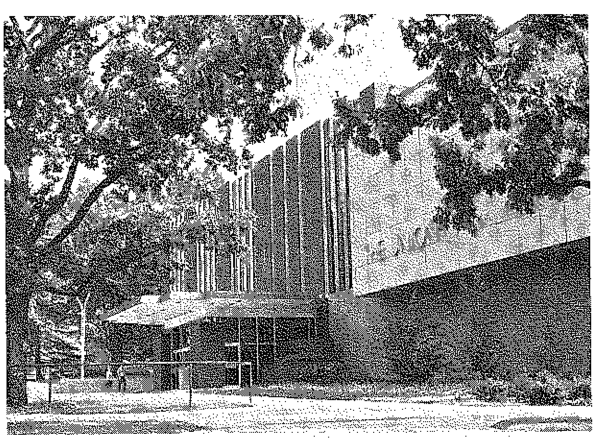
Mary A. Jasper
Program Chairman
Midwinter Meeting
Mississippi State University

The annual midwinter meeting of the Engineering Design Graphics Division will be held January 3-5, 1979, at Mississippi State University near the city of Starkville, Mississippi.

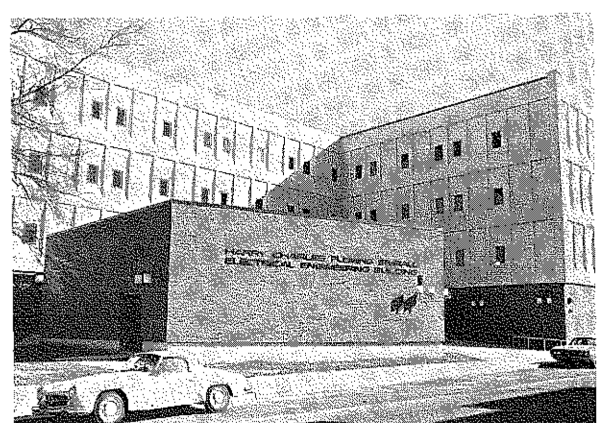
Mississippi State is located in the northeast part of Mississippi, thirty miles from the Alabama line and and one hundred thirty miles from the Tennessee border. Traditionally, it has been said that one hundred years ago, when the Mississippi legislature was deciding on a location for the proposed agricultural and mechanical college, the suggestion was made and approved that this institution be located 30 miles away from any known civilization. Times have changed, and "State" has changed with them, and as MSU concludes her centennial celebration, the Department of Engineering Graphics is proud to say that this department is among the oldest on the campus, and the oldest in the College of Engineering.

Although the Engineering Graphics Department at MSU is not a degree-granting department at the baccalaureate level, a master's degree in Graphics is offered to Industrial Education graduates. In addition, since 1967, new courses in engineering design, cartography, free-hand drawing, construction and arch-itectural drawing, interior design graphics, engineering problem solutions by graphical methods, and computer graphics are among the course offerings to sup-plement and enhance, but never to replace basic mechanical drawing and descriptive geometry.

The Department of Engineering Graphics at MSU welcomes you to "our place" for the 1979 midwinter meeting. "Y'ALL COME!"



The University Union - All Sessions Will Be Held Here.



The Newest Addition to the MSU Campus Is The Simrall Building - Tours Are Available on Request.

continued

PROGRAM

ENGINEERING DESIGN GRAPHICS DIVISION

WEDNESDAY, JANUARY 3

1:00 - 5:00 REGISTRATION
University Union

3:00 "EARLY BIRD" TOUR
Tour of Local Industry

6:30 EXECUTIVE COMMITTEE
MEETING & DINNER
Ramada Inn

8:00 SOCIAL HOUR
Ramada Inn

THURSDAY, JANUARY 4

8:00 WELCOME
Dr. W. L. McDaniel, Dean
College of Engineering
Mississippi State University
Union Small Auditorium

8:15 SESSION I - CARTOGRAPHY
Union Small Auditorium

8:20 - 8:40 "New Cartographic Methods
in Education"
Professor Frank Miller
School of Forestry
Mississippi State University

8:50 - 9:10 "New Cartographic Techniques
in the Private Sector"
Cecil Palmer, Vice President
Michael Baker, Jr.
Jackson, Mississippi

9:15 - 10:00 "USGS National Mapping
Program" - A Slide Presentation
Jerry Berry
U. S. Geological Survey
Rolla, Missouri

10:00-10:30 Coffee Break
Union Art Lounge

10:30 SESSION II - COMPUTER GRAPHICS
Union Small Auditorium

10:35-10:50 "Computer Use (s) in the
Freshman Design Project"
John Demel & Alan Kent
Texas A & M University
College Station, Texas

11:05-11:20 "Simplified Contouring
Methods"
Paul Zsombor-Murray
McGill University
Ontario, Canada

11:35-11:50 "Computer Aided Graphics
at Clemson"
Dan Ryan
Clemson University
Clemson, South Carolina

12:00 BUSINESS LUNCHEON
Union Dining Rooms 1, 2, & 3

1:30 SESSION III - METRICATION
Union Small Auditorium

1:35 - 1:55 "USGS Metric Policy"
Gerald D. McComb
U. S. Geological Survey
Rolla, Missouri

2:05 - 2:25 "Where Are We Going?"
Ed Mochel, Member ASEE
Metric Coordination Committee
University of Virginia
Charlottesville, Virginia

2:35 - 2:50 "Why Haven't We Gotten
There Sooner?"
Klaus Kroner
University of Massachusetts
Amherst, Massachusetts

3:00 - 3:30 COFFEE BREAK

3:30 SESSION IV - WITHER GRAPHICS?

3:35 - 3:50 "The Need for Graphics in
Upper Level Engineering
Courses"
Professor Jerald Henderson
Dept. of Mechanical Eng.
University of California
Davis, California

3:50 - 4:05 "Who Needs Graphics? - The
Engineering Science View"
Dr. Karl A. Brenkard, Dean
School of Engineering
University of Mississippi
Oxford, Mississippi

4:05 - 4:20 "The Total Concept of Graphics and Design in the Engineering Curriculum"
Dr. Charles A. Newlin
Dames & Moore, Consulting Engineers
Los Angeles, California

4:20 - 5:00 Question & Answer Period

5:00 Adjourn

7:00 - ? MIDWINTER BANQUET
Lakeside Country Club

FRIDAY, JANUARY 5

7:00 - 9:00 BREAKFAST WITH THE EXPERTS
Union Dining Rooms 1, 2, & 3

Come and "Chew the Fat" (or whatever) with the congenial convivium of conference Participants. Do You Agree? Disagree? Don't Care? Then say so!
Coffee, Juice, & Danish provided

9:00 SESSION V - THE MIND AND THE MEDIA
Union Small Auditorium

9:05 - 9:20 "Multi-Media - Applications to Graphics"
Peter Miller
Purdue University
West Lafayette, Indiana

9:30 - 9:50 "Positive Communicating Concepts"
Byron M. Robinson
Penn State Univ., Ogontz Campus
Arlington, Pennsylvania

10:00 CLOSING SESSION

10:00-10:20 "Eleven Months Away - EDGD Midwinter in San Francisco"
Ron Pare'
Cogswell College
San Francisco, California

10:30-11:00 Presentation of the Oppenheimer Award

11:30-1:00 Dutch Treat Buffet Lunches with Committee Chairman

1:30 - 3:30 Tours of Local Industry Continued or "Come and play with our computer graphics equipment"
Department of Engineering Graphics
Mississippi State University

PROGRAM FOR SPOUSES

WEDNESDAY JANUARY 3

Accompany husbands'/ wives' "Early Bird" tour of Herschede Hall Clock Works in Starkville, Mississippi.

THURSDAY JANUARY 4

9:30 Get Acquanted Coffee With The Antebellum Home Tours to Follow.

12:00 Dutch Treat Luncheon

P.M. Continue Antebellum Home Tours Columbus, Mississippi.

FRIDAY JANUARY 5

Meet in the Morning to go antique shopping (Don't forget your checkbook).

COMMITTEE COMMUNICATIONS

TEACHING TECHNIQUES COMMITTEE

I. The Teaching Techniques Committee will be chaired by Merwin L. Weed, Penn State University, for the academic year 1978-79. He will be replacing Larry D. Goss who has recently been elected Director of Technical and Professional Activities.

II. The Teaching Techniques Committee will be meeting at the Mid-Winter meeting of the division at Mississippi. If you have been experimenting with different ways of presenting information to your students and are willing to share with others interested in disseminating knowledge in various exciting ways, please gather your thoughts; time will be made available during the committee meeting for sharing ideas.

III. It is the desire of the Chairman of the Teaching Techniques Committee that this committee will continue to serve the division with ever-increasing enthusiasm and effectiveness.

IV. If you are interested in becoming a member of the Teaching Techniques Committee, please drop a note to the Chairman to that effect and you will be placed on the mailing list (no dues, no initiation, just state your desire to become involved).

Mail to:

Professor Merwin L. Weed
Penn State University
University Drive
McKeesport, Pa. 15132

IMPORTANT ANNOUNCEMENT FOR PAST AUTHORS

Any author who has contributed an article that was published in the JOURNAL before the end of 1965, and then discovered that the contribution was not listed in the 1955 - 1965 index, should send all important details to Irwin Wladaver. For those who are not aware of the fact, Professor Wladaver is preparing an index to cover the entire publication history of the JOURNAL. Besides being a glutton for punishment, Wlad is a stickler for perfection and wants the upcoming index issue to be as perfect and complete as humanly possible. Therefore, the entire Division and Wlad in particular would appreciate it if any known omissions were brought to his attention. Send your information pronto to Wlad at his sunny Florida address:

Dr. Irwin Wladaver
415 Morton Towers
Miami Beach, Florida 33139

The Quotation on the facing page is not only very sound advice, but comes from a widely respected authority of considerable accomplishment. It is the outstanding work of Gretchen Weber, a graduate assistant studying and teaching calligraphy at the College of Design at Iowa State University.

We are pleased to have work of this caliber for your enjoyment and hope to have more in the future.

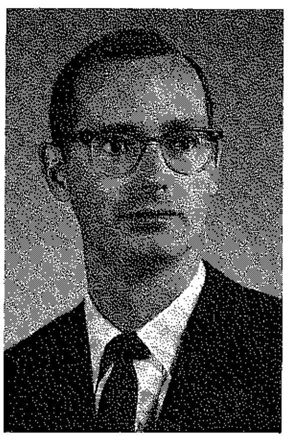
EVERY NOW AND THEN
GO AWAY
HAVE A LITTLE RELAXATION
FOR WHEN YOU COME BACK
TO YOUR WORK YOUR JUDGEMENT
WILL BE SURER;
SINCE TO REMAIN
CONSTANTLY AT WORK
WILL CAUSE YOU
TO LOSE
POWER
OF JUDGEMENT.

Leonardo da Vinci

Go some
distance away
because then the work
appears smaller,
and more
of it can be taken in at a glance,
and a lack
of harmony or proportion
is more
readily seen.

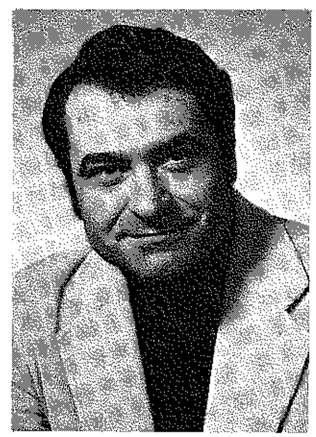
Candidates for Office

The nominations committee has nominated the candidates appearing on these pages for the membership's consideration. We hope you will consider them carefully and exercise your franchise when the ballot is mailed in February.



VICE CHAIRMAN

(1979-80)

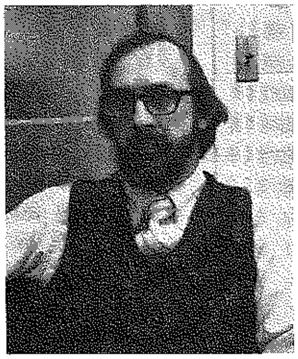


Robert J. Foster
Penn State University

Bob is Associate Professor and Group Leader of Engineering Graphics at Penn State where he has taught since 1959. He earned the M.S. in M.E. and the D.Ed. in Higher Education. Bob was the principal investigator for the ASEE Engineering Student Retention Study (1972-75). He has worked for engineering firms as a design engineer and has served on ECPD accreditation teams. He has contributed papers to the ASEE and EDG journals and has served as Assistant and Associate Editor to the EDG Journal and is now Secretary-Treasurer of EDGD.

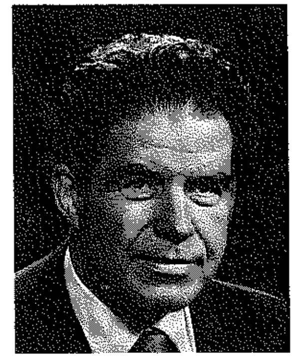
Paul S. DeJong
Iowa State University

Paul holds BS and ME degrees in Mechanical engineering. He is registered as a Professional Engineer in Iowa and South Dakota and has industrial experience as a Design engineer, draftsman, and consultant. He has been on the Freshman Engineering faculty at Iowa State since 1966 and has authored a number of publications. He joined ASEE/EDGD in 1966 and has served on several committees, as Division secretary-treasurer, and is completing a term as Director of Publications.



SECRETARY - TREASURER

(1979-82)



John G. Kreifeldt
Tufts University

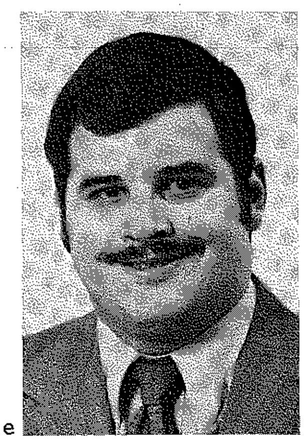
Charles W. Keith
Kent State Universit

John G. Kreifeldt (M.S.-MIT 1964, Ph.D.-Case Western Reserve-1969), is Associate Professor of Engineering Design at Tufts University, Medford, Mass. His teaching and professional areas of expertise include Human Factors Design and Biomedical Engineering. He is active in several societies and founded and chaired the Committee on Human Factors in Systems Design in the Division. He has served as Chairman of committees in other societies, organized sessions and published and presented papers regularly on a variety of topics. He is also Vice President of APPLIED ERGONOMICS CORPORATION, a company specializing in Human Factored Consumer Product Designs.

Professor Keith is a member of the Technology Division faculty, School of Technology at Kent State University teaching Engineering Graphics, descriptive geometry, tool design and machine design since 1954. He has been a member of EDG Division since 1954. He has a B.S. in Technical Education and a Ph.D. in Education from The Ohio State University and a Master's degree from Michigan State University in Industrial Education and General Engineering. Professor Keith was a co-founder of The Ohio Association for Engineering Graphics and a past president. He is Historian of the NAIT and a past president of that organization, a member of the ASEE Executive Committee North Central Region, member of and advisor to SME at KSU.

DIRECTOR OF PUBLICATIONS

(1979-82)



Mary A. Jasper
Mississippi State U.

Frank M. Croft
University of Louisville

Mary is an Assistant Professor in the Department of Engineering Graphics. She received a B.S. in Civil Engineering and a B.S. in General Business in 1959 from Mississippi State University. After two years of field work with the Mississippi State Highway Department, she returned to MSU and received her M.S. in Civil Engineering in 1963. She has worked for the U.S. Army Corps of Engineers, Waterways Experiment Station, and has taught at the University of Alabama. She has served three years on the Creative Design Display Committee, and is Program Chairman for the EDGD Midwinter meeting, Jan. 3-5, 1979. (Y'all Come!!)

Frank is an Assistant Professor of Engineering Graphics and Civil Technology. He holds a B.S. in Aerospace Engineering and a M.S. in Engineering with a major in Civil Engineering. Besides teaching, he is a registered Professional Engineer and he has had numerous years of experience in industry and as a private consultant in the graphic arts area. He has been an active member of ASEE and the EDG Division since 1973. He currently serves as the CAC at U of L and is the Associate Editor of the EDG Journal. He has been a speaker at the Annual Conference of ASEE and at the Midwinter Meeting of the EDG Division and has had articles published in the EDG Journal.

The Division of Engineering Design Graphics
American Society for Engineering Education

has bestowed upon

Charles Gordon Sanders

its highest honor

THE DISTINGUISHED SERVICE AWARD

for his unique contribution to the Division, his dedicated service to engineering education, and as an expression of respect and admiration by his professional peers.

Charles G. Sanders, Professor of Freshman Engineering at Iowa State University, has a remarkable record of service and accomplishment.

He received his B.A. degree from Iowa State Teachers College only to find his educational goals interrupted by four years in the U.S. Air Force during World War II. Along with other combat service awards, he received a special commendation from General Wood of the 9th Air Force for meritorious service in the European theater of operations. He attained the rank of Captain before returning to the United States in 1946. After his discharge from the Air Force, he continued his formal education receiving a masters degree at Colorado State University.

Professor Sanders was appointed to the faculty of the Engineering Drawing Department at Iowa State in 1949. He served in each of the academic ranks until 1968 when he was named professor and chairman of the Department of Engineering Graphics.

Gordon has served education, the profession, and his students for thirty years. He has significantly influenced the content and direction of the graphics and design programs at Iowa State and to some extent nationally. He was one of the first faculty members in the country to experiment with educational television. His foresight and effort resulted in a live, closed-circuit television system at Iowa State. He is currently coauthor of a problem book entitled Engineering Graphics. It was for outstanding and inspirational service to the University, as summarized above, that Professor Sanders was awarded the College of Engineering Faculty Citation in 1975.

Gordon has always considered teaching to be his most important role as an educator and was particularly pleased when he was selected by the student body in 1967 as "Professor of the Year." He continues to work diligently as a teacher evidenced by the recent action of the Department. This year Gordon was selected by his peers as the "Superior Engineering Teacher" for 1978.

Professor Sanders has been a member of ASEE and the Engineering Design Graphics Division since the early 1950's. He has participated at most of the sectional and national meetings since that time. He has served as Division Secretary, Division Editor, has served actively as a member of various committees, as chairman of the Teaching Techniques Committee, chairman of several different program committees and served as Director of Programs for five years. He was active for several years on the executive committee during which time one of his special contributions was the initiation, promotion and implementation of better and more complete division bylaws related to programs and the duties of officers and others involved in them. Gordon has presented several papers at various sectional and national meetings, he has participated on panel discussions and has even shared his poems and puns with the members on various occasions. He has had a variety of his writings published in the <u>Engineering Design Graphics Division Journal</u> and the <u>Iowa Engineer</u>.

In appreciation for his achievements and leadership, the Division proudly presents Charles G. Sanders its 1978 Distinguished Service Award.

Presented this day June 20, 1978

at the Annual Conference, University of British Columbia

Chairman

Secretary-Treasurer

Distinguished Service Award

C. Gordon Sanders

PROLOG

As you can surmise, it was quite a
surprise
To learn what the committee had done.
A surge of emotions, like waves on
the oceans
Swept me from shore with the honor
I'd won.

I couldn't hide the whitecaps of pride,
The self-satisfaction I knew.
But deep down below in the great under-
toe,
An uneasy feeling grew

That I hadn't deserved the homage
reserved
For those singled out for acclaim,
But huge swells of gratitude ebbed this
irksome attitude.
And the surf of self-esteem overcame.

LOG

Over a span of twenty-five years, Midge and I have been going on working-learning-pleasure adventures all over the United States, as so many of you are doing, by attending section, mid-year, and national meetings sponsered by this organization. Beginning at the center of things at Iowa State University in 1953, for the sake of professional development and because we have truly enjoyed the experiences, we have participated at North-Mid-West section meetings in Iowa, South Dakota, Minnesota, Michigan, and Wisconsin.

We have been active at mid-year and annual ASEE meetings, or directly related events, in Minnesota, Michigan, Wisconsin, Illinois, Ohio, Pennsylvania, New York, Maine, Massachusetts, the

District of Columbia, Maryland, Virginia, Tennessee, Florida, Louisiana, Texas, Arizona, California, Washington, Colorado, Nebraska, Kansas and Missouri.

During these years of activity within the Division, we have worked and socialized with the remarkable people making up the membership and with others associated with the Division. These contacts have, in themselves, been a richly rewarding experience.

To have mingled with the "great ones" of this organization (which in my book includes all the active members), to have been accepted as a peer, to have had the priviledge of taking a responsible and active part in the pursuits that continue to keep the Division strong and respected, for me, these experiences have interlaced into a common theme of rhyme and rhythm involving oceans of emotions and a tall ship, skillfully maneuvered by friendly dedicated sailors, and carrying an extremely valuable cargo.

Briefly dropping anchor at the interesting ports we have visited, cruising with committee members around the capes and coves of creative endeavor, and admiring the "tall ship" captained by our able chairman and carrying the cargo of our combined productivity, has provoked in me this attempt to say an appropriate "thank you" for an extremely high honor.

The most difficult part of this response is to add a significant force to the momentum of a fine tradition established by former recipients of the Distinguished Service Award, a tradition that has helped keep our tall ship sailing smoothly over the sometimes-stormy seas. Each awardee before me has passed on thoughtful, helpful words of advice and encouragement to members of the Division.

So, tradition contains the implication that I should do the same. An even more forceful command came from the present captain of our tall ship, Amogene DeVaney.

So, acquiescing to both tradition and Amogene, I will humbly proffer what hopefully will pass as profundities-to-posterity:

We must store only staples of substance and salability in the hold of our tall ship. On the fiftieth anniversary of the Division, it has been particularly appropriate to look astern before leaving port for another year's voyage to analyze the status of the familiar and favorite product -- descriptive geometry. This product has always been one of substance; it certainly is still salable to many merchants of engineering, so by all means, let's keep it aboard...However, let's not burst the bulkheads with an overload of any single product.

Discretion dictates that we take along salable products from harbors on both port and starboard sides of the ship to enrich our cargo and enhance our market. Many of our customers are now readily buying conceptual design, computer graphics, engineering computations, engineering orientation and student counseling from our E.D.G.D. salesmen. It is becoming increasingly evident that the hold must be stocked with a carefully considered variety of these valued commodities and that our prosperity on the busy sea-lanes of engineering will depend on the ability of the crew from the tall ship to control the merchandising of these products to assure all buyers of a dependable source of supply. There is danger that if we don't stock all of the parts required for the tenderfoot engineer's educational machine in our hold, we may not hold those parts most dear to our hearts!

Always we must keep a course watch over the bow of our ship. Apparently, the computer is replacing the compass. In time, some new magic will replace the computer. However, the fundamentals of navigation remain fixed. They are, simply, a predetermined destination, a dependable guidance system, the power to propel, and competency at the helm. Our ship is so endowed; and if the compass and computer both fail, we can still trust the "stars" in our Division to guide us along the proper course. As we enter each port of enterprise, we must analyze the situation; call up our creative talents, diligence and perserverance; synthesize our salesmanship and communicate not only with our students but also with the middle-man markets through which we must sell. Specifically, we--and I believe we are all very much in the same boat--must plow through the rough waters of communication with the administration and the degree departments in whose respective wakes we tack. It is up to us--we must trim our sails, over-take them and signal with semaphores that command their attention. Recruit them to guest lecture; shanghai them to serve as judges for your design teams' competition; solicit their questions and objections; row after them; and, if necessary, beat them with an oar to gain their attention.

I will hoist the mainsail of other serious suggestions in future issues of the JOURNAL However, I would like to waggle the semaphores with one more message which has proven to be a point of contention between our present crew members. Now take a deep breath! THE ENGINEERING DESIGN GRAPHICS DIVISION OF THE AMERICAN SOCIETY FOR ENGINEERING EDUCATION. Our NAME still hasn't caught up to our FAME. Let's rechristen the ship! I wouldn't want to fish a dead issue out of the briney deep, but perhaps future generations of E.D.G.D.A.S.E.E. should make certain that the name-change issue wasn't forced to walk the plank or to be otherwise buried at sea just because of a doggeral dithyramb with limping meters that I wrote a few months ago called "mighty like a rose". For those of you who were fortunate enough to have missed it, this "bad verse" was an abortive attempt to promote the renaming of our otherwise stately ship. Perhaps I should give up; but, if the body can be recovered and if there is a pulse, new blood might suggest the possibility of a transfusion.

In summary, we are still sailing a tall, seaworthy ship; and if we will just scrape a few barnacles off her bottom, rigger out with more sails and less mortis, this boat will stay afloat for another fifty years.

EPILOG

For a while my emotions kept me adrift
  with the notions
That had cause my ego to soar....
But a more rational tide swamped by
  vainglorious ride
And washed me back firmly on shore...

From a place on solid land, with my
  pride more in hand,
When my head had shrunked to size,
It became clear again that no one ever
  reaps without help from friends that
  he keeps
Such a great and unexpected prize.

So, for my peers at Iowa State, for
  the E.D.G.D. support that I rate,
For my loving wife, and for all others
  befriended,
I accept with great pleasure this award
  that we treasure,
In the spirit that it was intended.

C. Gordon Sanders

CALL FOR PAPERS

1979 CONFERENCE ON FRONTIERS IN EDUCATION

Place: Niagara Falls, Ontario, Canada
Date: October 15-18, 1979
Sponsors: IEEE Education Group, ASEE Education Research and Methods Division

Conference Objectives - The "Frontiers" conference is a forum for presentation and discussion of new directions and new developments in engineering education. The general objectives of the conference are to bring together those in universities, colleges, industry and government concerned with innovation in education, and to provide an opportunity for presentation and critical discussion of submitted papers.

A special emphasis of this "Frontiers" conference is the presentation of specific curriculum content and experience in new emerging topics. Papers in this area, including information on material selection and laboratory content, are particularly welcomed.

Another focus of the conference will be the evolution of mathematics for engineering curricula, with special reference to the impact of computer techniques on the selection of mathematical material to be taught in introductory and advanced courses.

Conference Topics - Papers are invited on any topic relevant to new developments in educational content, presentation, programming or organization. Among the topics on which submissions would be welcomed are the following:

- Experience Teaching Emerging Topics
- Technological Aids in Education
- Making Laboratory Education More Meaningful
- Design of Learning Experience
- Evaluation of Educational Programs
- Engineering Design Programs
- Graduate Education and Research
- Interactive Computers in Education
- Changes in Mathematics for Engineers
- Evolution of the Curriculum
- Continuing Education Programs for Engineers
- Engineering for Non-Engineers
- Multi-Disciplinary Education
- Demographic Impact in the 80's

In addition to the presentation and discussion of submitted and invited papers, the conference will include workshops and panel discussions, when appropriate, to maximize the opportunities for involvement and participation. Proposals for topics and contributors for these discussion sessions will be welcomed by the conference organizers.

Submission of Papers - An author wishing to present a paper should first prepare a synopsis, of about 300 to 500 words length, describing the essential contributions of the paper. The synopses will be reviewed by the Program Committee and authors of the selected contributions will be requested to prepare full-length papers. These papers will be printed in the conference proceedings which will be available at the conference.

Deadline dates are as follows:
January 15, 1979 - Submission of synopses
March 23, 1979 - Authors informed of acceptance of papers
June 15, 1979 - Final copy of full papers due

Synopses should be sent to:
Professor Gordon R. Slemon
Program Chairman, FIE'79
Department of Electrical Engineering
University of Toronto
TORONTO, Ontario, Canada M5S 1A4

1978 CREATIVE ENGINEERING DESIGN DISPLAY

The Annual Creative Engineering Design Display held at Vancouver was given what many considered the finest, most accessible, and most visible spcae available - right at the main entry to the student commons, which was also the conference headquarters. The CEDD committee, and Borah Kreimer in particular, has worked hard to obtain space in the ASEE Journal of Engineering Education to spotlight the Display. Be sure to look for this CEDD feature article to be coming soon.

However, for your interest the Directory to the 1978 Display is reproduced in its entirety on the following pages. The winners of the judging several divisions were as follows:

Freshman Designs:

First Place: "A Greenhouse Thermal Blanket", Iowa State University, (No.11)
Second Place: "A Safe, Energy-Efficient Clothes Iron", Florida Tech University, (No. 6)
Third Place: "A T-Square Carrying Case, Arizona State University, (No. 1)

Sophomore Designs:

First Place: "Cassette Memory", Milwaukee School of Engineering, (No. 42)
Second Place: "Underwater Talking Tube", Moody College, Texas A&M, (No. 43)

Senior Designs:

First Place: "The Log Cabin: Solar Demonstration and Testing Center", University of Pittsburgh, Johnstown, (No. 54
Second Place: "A Power Plant Design for the Florating (sic) Instrument Platform (FLIP) Operating in its Vertical Mode", U.S. Naval Academy, (No. 58)

No awards were made at the Junior or Graduate Levels due to the small number of entries received. This brings up a few important points that should be made: First, if your students' designs were not included in this year's display, they should have been. A small effort on your part will guarantee them the opportunity to be recognized for their work - and this recognition is on the national - no, International scale. Furthermore, their designs are needed by the committee to provide a suitable range of judging so that all the awards that have been promised - or at least suggested - can be awarded. Last, your team whose work is displayed will received recognition certificates, and if you work to get some local publicity, these students will become a veritable field group of public relations people for your department.

After all.

Late to Bed
Early to Rise
Work like Hell
and ADVERTISE

is probably good advice.

- P.S. DeJong

School: Arizona State University

Project Title: T-Square Carrying Case

Student(s): D.W. Jung, J.F. Heilman, R.S. Johnson, S.L. Wahl, J.A. Faugh

Instructor: J.E. Bicknell & J.K. Davidson

1

Project Title: Improved Bicycle Security Lock

Student(s): J.E. Albers, R.J. Schreiner, J.L. Kiser, S.P. Foerster, J.D. Hancock

Instructor: J.K. Davidson & E. E. Sautter

2

School: The Cooper Union

Project Title: Design of a Solar Cooker for Night Use

Student(s): T. Bruder

Instructor: Dean Chor Weng Tan

3

Project Title: Solar Retrofitting of Sasso Residence

Student(s): J. Arrigo, N. Ziemba, A. Cavallerano, J. Sasso, B. Groveman, R. Parkanyi

Instructor: Prof. J. Hollenberg

4

School: Drexel University

Project Title: Variable Pitch Drum

Student(s): Frank M. Gerber, D. Belanger, W. Hargrave, G. Kociuba

Instructor: Dr. Richard Rosen

5

School: Florida Technological University

Project Title: A Safe , Energy Efficient Clothes Iron

Student(s): Roger Uithoven, Carolyn Smith

Instructor: Dr. Robert D Doering, Dr. Charles E. Nuckolls

6

School: Green River Community College

Project Title: Combination Bunk Bed Playhouse
Student(s): Arthur Sampson
Instructor: Harold Ekern
7

Project Title: Submersible Sled
Student(s): R. O. Brown
Instructor: Harold Ekern
8

School: Hofstra University

Project Title: Off Shore Airport
Student(s): L. Buch, P. Battaglia, A. Wilminister, Z. Kharoufa
Instructor: Prof. E. R. Lewis
9

Project Title: The Electronic Mousetrap
Student(s): J. Zito
Instructor: Prof. E. R. Lewis
10

School: Iowa State University

Project Title: Solar Systems
Student(s): G. Hollins, J. Jackson, S. Lin, M. Oberhaus, T. Westbrook, D. Widick
Instructor: R.D. Jenison
11

oject Title: Central Track Systems
Student(s): J.A. Beranek, S.M. Kwok-Chee, S.E. Wilkes, C.M. Cravens, M.R. Barr, M.D. Woofter
tructor: G.A. Granneman
12

School: LeTourneau College

Project Title: Design and Testing of An Aerial Camera Airplane

Student(s): L. Yonge, J. Wicker, T. Wolf

Instructor: Dr. D. E. Hartman

13

School: Marquette University

Project Title: 'Designer' Engineering Education Gaming

Student(s): M. McCabe, R. Heytens, D. Sytkowski, A. Natanek, T. Bielinski

Instructor: J. K. Jensen

14

Project Title: PSC-1 Portable Solar Collector-1

Student(s): R. Riopelle, W. Hren, F. Schirack, S. Gage, G. Bonin

Instructor: J. K. Jensen

15

School: Milwaukee School of Engineering

Project Title: Fuel Efficiency Display

Student(s): J. Braun, R. Dibble, C. Dufek, D. Brown

Instructor: Prof. M. Heifetz

16

School: Mississippi State University

Project Title: Portable Desk

Student(s): S. Prothro, K. Butschek, F. Kitsatagou

Instructor: Mary A. Jasper

17

Project Title: Drawing Board Adjustment and Support

Student(s): A. Kerby, J. Haney, M. Strauss, J. Starling, F. Garletts

Instructor: W.W. Langerfeld (Deceased)

18

School: Ecole Polytechnique de Montreal

Project Title: Painting Positioner

Student(s): J. Gauthier, M. Houde, C. Mailhot, J. Rondeau

Instructor: Charles De Serres

19

School: University of Nebraska-Lincoln

Project Title: Four-Channel Oscilloscope Converter

Student(s): P. Skow, J. Wright, N. Sedagazedah, B. Coker

Instructor: Prof. R. McDougal

20

Project Title: Hydraulic Barrel Lifter

Student(s): J. Kennedy, R. Iwan, P. Carothers, T. Dirmeyer

Instructor: Prof. T.C. Smith

21

School: North Carolina State University

Project Title: Ambi-Desk

Student(s): C.F. Dickerson, J.P. Lee, T.M. Byrd, Jr., A.K. Hauser, C.S. Chewning

Instructor: Dr. R.J. Leuba

22

School: Northeastern University

Project Title: Methyl Alcohol, An Alternative to Gasoline

Student(s): W.P. Martin, R.J. LeBlanc

Instructor: Professors I. Katz & B. Kreimer

23

Project Title: Portable Thermotic Drainage Pump

Student(s): J.E. Barbeau, Jr., V.E. Girardi, D.A. Camara, K.J. Ryan

Instructor: Professors I. Katz & B. Kreimer

24

School: Ohio Northern University

Project Title: Solar Toy Spaceship
Student(s): J. Young, B. Beaman, R.A. Prieto
Instructor: Dr. Bruce E. Burton
25

Project Title: Passive Cooling System for Refrigerator
Student(s): M. Tyson, C. Andrews, T. LaStrappes, T. Quellhorst
Instructor: Dr. Bruce E. Burton
26

School: University of Pittsburgh at Johnstown

Project Title: Desoldering Device
Student(s): David Vella
Instructor: Barron Deetscreek
27

Project Title: Rain Sensor
Student(s): Julann Lloyd
Instructor: Barron Deetscreek
28

School: Purdue University

Project Title: Airport Design
Student(s): R.J. Unterreiner, B. Townsend, D. Malone, J. Hobaugh
Instructor: Mr. D.L. Sebolt
29

Project Title: Wheel Chair Lift
Student(s): D. Strimple, G. Matejcek, L. Galenski, J. Onak
Instructor: P.N. Pandeya
30

School: Southern Methodist University

Project Title: The One Man Team, Soccer Machine

Student(s): H.M. Erfani, L.A. Grounds, D.L. Theobold, D.O. Yates, T.H. Zajicek

Instructor: Charles M. Lovas

31

Project Title: Effective Studying in a Dorm Room

Student(s): M.L. Culligan, K.P. Eltife, A.C. Taylor, P.D. Thurston

Instructor: Charles M. Lovas

32

School: University of Tennessee at Chattanooga

Project Title: Pectometer

Student(s): Michael Snider, DeAnna McKinney, Edward Rhinehart

Instructor: Michael H. Jones

33

School: University of Toronto

Project Title: Cassette Storage Unit

Student(s): Ray Verhoeff

Instructor: Professors Kuhn and Foster

34

Project Title: Redevelopment of Owen Sound Airport

Student(s): David Legresley

Instructor: Professors Kuhn and Foster

35

School: Villanova University

Project Title: Design of a Power Car Jack

Student(s): B.A. Tempone, R.J. Meier, E.A. Skulski, C.M. Pezely

Instructor: James J. Coyle

36

School: Virginia Polytechnic Institute and State University

Project Title: Urine Glucose Tape Reader for Blind Diabetics

Student(s): Don Seeley, John Davis, Lisa Meyers

Instructor: Prof. W. P. Harrison

37

Project Title: The Design of a Single-Shafted Agitator for Electric Mixers

Student(s): Ringo Li, Mark Mathias, Joe Mensch, Steve Polansky, Tim Shepherd

Instructor: Prof. J. B. Crittenden

38

School: The University of Wisconsin-Milwaukee

Project Title: Flash Removal

Student(s): S.A. Funke, P.R. Zelewski, B.A. Pawlak, D.K. Schoeneck, S.S. Radjenovich

Instructor: Dr. Steven Salamon

39

Project Title: Third Hand

Student(s): D.R. Berger, J.A. Shepler, N.D. Stilin, R.S. Schoedler, R.J. Hamburger

Instructor: Mr. Oved Friedman

40

SOPHOMORE DESIGNS

School: University of Florida

Project Title: Wave Pump

Student(s): James P.Chamberlain

Instructor: E. H. Watts

41

School: Milwaukee School of Engineering

Project Title: Cassette Memory

Student(s): R.Mills, T. Cieslak

Instructor: Prof. J. Arlen Parker

42

School: Moody College (Texas A & M System)

Project Title: Underwater Talking Tube

Student(s): Robert W. Park

Instructor: Sal R. Garcia

43

School: University of New Brunswick

Project Title: Production of a Multicolor Map

Student(s): R.W. Balser, G.H. Eaton, G.W. Macaulay, H. Wong, K.E. Christensen

Instructor: Dr. W. Faig

44

School: Northeastern University

Project Title: Improvement Upon The Intraveneous Infusion Pump

Student(s): Brian J. Taylor

Instructor: Prof. Borah L. Kreimer

45

School: University of Pittsburgh at Johnstown

Project Title: Automatic Stereo Control

Student(s): Terry Bimle

Instructor: Barron Deetscreek

46

School: The University of Wisconsin-Milwaukee

Project Title: Communication Board for Handicapped Children

Student(s): M.V. Becker, J.C. Brusk, L.S. Resh, T.R. Witte, E.B. Woods, Jr., T.L. Zeamer

Instructor: Prof. Edward W. Knoblock

47

JUNIOR DESIGNS

School: Louisiana State University

Project Title: Toy Hovercraft

Student(s): K. Harvey

Instructor: Margaret Eller

48

School: Ecole Polytechnique de Montreal

Project Title: Lift for Disabled Persons

Student(s): C. Lussier, Y. Lacharite

Instructor: Gilbert Drouin

49

School: University of New Hampshire

Project Title: Design, Construction and Performance Evaluation of Concentrating Solar Collector

Student(s): M.J. Dresser, W. Galanis, D.H. Lenz, D. Meziane-Tani

Instructor: Dr. Ihab H. Farag

50

School: The University of Wisconsin-Milwaukee

Project Title: Determining Close Tolerance Dimensions in Shallow Counterbores

Student(s): R.W. Geracie, G.P. Goetzke, L.C. Kwong, K.J. Nilson, J.J. Nettesheim

Instructor: Dr. Steven Salamon

51

School: The Cooper Union

Project Title: Investigation of the Characteristics of a Transverse Fan

Student(s): M. Murphy, J. Sottnick

Instructor:

52

School: Milwaukee School of Engineering

Project Title: Clement Avenue School- Phase One, Feasibility Study for School Requirements; Phase Two, Proposal for Addition

Student(s): D.A. Arneson, C.L. Osberg, D.H. Kolisch, P.D. Zak, J.R. Mason, R.G. Bartoshevich

Instructor: Phase One - Prof. R.G. Galling
Phase Two - Prof. M.W. Fuchs

53

School: University of Pittsburgh at Johnstown

Project Title: The Log Cabin: Solar Demonstration and Testing Center

Student(s): Cathy Ream and Larry Patrick

Instructor: John Klavuhn

54

School: Southern Methodist University

Project Title: Improved Efficiency of Flat Plate Collectors

Student(s): M.S. Arnold, J.L. Dale, G.C. Shepard, M.E. Weynand

Instructor: Charles M. Lovas

55

School: University of Tennessee at Chattanooga

Project Title: Instrumentation for Solar Desalination Project

Student(s): James Brooks, Keith Weller, James Williams

Instructor: J. Eric Schonblom

56

School: Trenton State College

Project Title: A Universal Micro-Processor Based Speech Synthesizer

Student(s): J.T. Mangano

Instructor: Allen Katz

57

School: U.S. Naval Academy

Project Title: A Power Plant Design for the Florating Instrument Platform (FLIP) Operating in its Vertical Mode

Student(s): J.C. Orzalli, G. Ball, F. Hilder, M. McNish

Instructor: Dr. Bruce Rankin & Dr. Clyde Richard

58

School: Washington State University

Project Title: Rolled Paper Pulling Mechanism for Rewinder

Student(s): C. M. Hutchns

Instructor: Jack T. Kimbrell

59

School: The University of Wisconsin-Milwaukee

Project Title: Snap-In Pushbutton Design

Student(s): R.I. Bucko, R.J. Dobberstein, K.L. Lindsey, T.L. Maser

Instructor: Dr. Vjekoslav Pavelic

60

School: Worcester Polytechnic Institute

Project Title: Walking Beam Grinder Loader

Student(s): R.E. Skowronski, J.D. Livsey

Instructor: Prof. Carlton W. Staples

61

School: The University of Wisconsin-Milwaukee

Project Title: An Empirical Examination of the Interdependence of Parking Policy and Modal Choice

Student(s): C.C. Lueck

Instructor: Prof. Edward A. Beimborn

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JUDGES FOR THE 1978 ASEE CREATIVE ENGINEERING DESIGN DISPLAY at Vancouver, B. C. (June 19-21)

Dr. H. Maurice Carlson	Lafayette College
Dr. Leslie A. Clayton	Boyle Engineering Corp.
Mr. W. F. Cone	Hughes Aircraft Company
Dr. E. J. Cook	United States Naval Academy
Prof. Nicholas P. Dario	General Motors Institute
Mr. Paul Doigan	General Electric
Prof. Charles F. Field	Northeastern University
Mr. Carl H. Hough	The Boeing Company
Dr. W. Edward Lear	The University of Alabama
Dr. Richard S. Mayer	Ohio University
Prof. James F. McDonough	University of Cincinatti
Prof. James O. Morgan	Southern University
Dr. Basil R. Myers	Naval Postgraduate School
Mr. C. A. Powell	Baltimore Gas & Electric Company
Dr. David Reyes-Guerra	Engineers Council for Professional Dev.
Dr. Gerard H. Schlimm	The Johns Hopkins University
Mr. Norwood L. Snowden	Caterpillar Tractor Company
Dr. J. O. Storry	South Dakota State University
Prof. Lawrence J. Henschen	Northwestern University
Prof. Demetrius Zelios	Pratt Institute
Mr. E. R. Brown	Union Carbide
Prof. Dave Freeman	Northwestern University
Prof. Robert Shapiro	University of Oklahoma

Francis Mosillo
University of Illinois
(Chicago Circle)

WHAT IS THE PURPOSE OF DESIGN?

The impression one could get from listening to the participants attending the Graphics Division meetings and those who enter the Design competition, is that the purpose of design in the curriculum is to:

1. Develop new products or systems,
2. Bring recognition to one's institution,
3. Be a vehicle for teachers to work in their area of expertise, and/or
4. Motivate the student in our competitive society.

It is not meant to imply here that these are dishonorable aims, but statements at the meetings indicate that design courses are limited (or students are limited) by the instructor's field of expertise. However, if one would look at the procedure as the primary objective of Design, then the end product, as well as the instructor's expertise, is really of little consequence. It seems that we as teachers should be more interested in motivating our students toward:

1. the systematic approach of problem solving
2. Creative implementation, and
3. the communication of these ideas

Granted, the Design display and its competition is an important factor in motivating the student (or is it the instructor) to not only show the fruits of this process, but also to have a means of measuring and getting ideas of what one can do in the classroom.

It was once suggested that an overall theme be established for the Design display (possibly in parallel with the ASEE theme). It was quickly dismissed on the grounds which to the writer sounded like fear of the unknown. This attitude has given the Graphics discipline an ultra-conservative reputation, nearly to the point of extinction. The theme idea may not be appropriate, as the ASEE themes are so broad and it may not appropriately fit some school's objectives. However, to discount this idea on the basis that the instructor must be an expert in the theme area is not only ridiculous, but could indicate either a high degree of fear or possibly arrogance. If the end product of a project is infeasible or ridiculous, so what? Isn't the overwhelming factor The Design Process the student learned? An important, but secondary aim is how to make a product under the guidance of his "chief engineer" (the instructor). An example of this is associated with an article which describes the fruits of the design process under the theme of "Library Technology". (See Engineering Design Graphics Journal, 40:2, Series 120, Spring 1976, pages 24-27) The writer knew nothing about the library system, and the students were mostly freshmen. This theme was one in a series of 13 themes (one per quarter) over a 3 year period. Some of the theme areas were not as successful as others in terms of meaningful end products, but all of the students were exposed to the same Design Process and this singular course has received more positive feedback from graduates than any other design (or graphics) course over the past ten years.

The writer feels very strongly about the purpose of Design within the educational system. However, the writer is the first to admit that these options are not held too dearly by others. One of the results of this opinion is criticism from one's colleagues. The instructor must be strong enough to stand up to (or ignore) one's own colleagues who will on one hand criticize the infeasibility of the end products, while on the other hand, make statements as to the sheer impossibility of such expectations of the students. One such comment was that it was like expecting kindergarten students to split the atom. It is amazing, just as it is that the bee doesn't know he "can't" fly, how many in "kindergarten" split the atom. Even with these criticisms, it is still the writer's strong opinion that the primary purpose of design in the curriculum is to open the student's horizons through the Thought Process, and not to the physical or economic rewards at the end of the activity.

The Design feature in our courses is one of the most valuable assets available; let us not reduce its effectiveness by ultra-conservative thoughts or fear. Remember, creativity could be implemented, to some degree, merely by becoming aware of the blocks to creativity. Therefore, before one tends to totally disagree with the preceding thoughts, it might be worthwhile to review these blocks to creativity to see if the reader (or the writer) is basing opinions in violation of these principles, which is such an extremely important factor in the Design process.

Chih Wu
R.A. Hirsch
U.S. Naval Academy

COMPUTER-AIDED GRAPH PAPER CONSTRUCTION

Abstract

Curve fitting, regression analysis and graphical estimation of population distribution parameters have great appeal in statistics, engineering science, economics and business, as well as in education. To fit a certain curve or distribution model, students in experimental courses are taught to plot and check their experimental points on a linearized graph paper. Basically, in order to use the curve fitting or distribution fitting procedure, a convenient transformation of the curve or the population cumulative distribution must be available that changes it into a linear form.

Unfortunately, many odd and seldom-used curve or distribution graphical sheets are not made commercially. It is the purpose of this paper to present a method to construct the needed graph sheet by the rapidly expanding technology of computer graphics. The method is explained by some examples.

Introduction

In analyzing experimental data the question often arises as to whether or not the data fits a particular mathematical model and if it does, what are the parameters associated with that model. A typical example is the determination of the energy dissipation mechanism in a simple vibrating system. The system is set into motion and a strip chart recording of vibration amplitude versus time is taken. If the energy dissipated is due to viscous forces, then the peak amplitudes should decay exponentially with time. A quick check on this assumption is obtained by using semilog graph paper and plotting peak amplitudes on the log scale and time on the linear scale. If the data thus plotted form a straight line, the assumption is valid and the slope of the line is the viscous damping parameter. There are a myriad of real situations where this graphical technique is useful using commercially

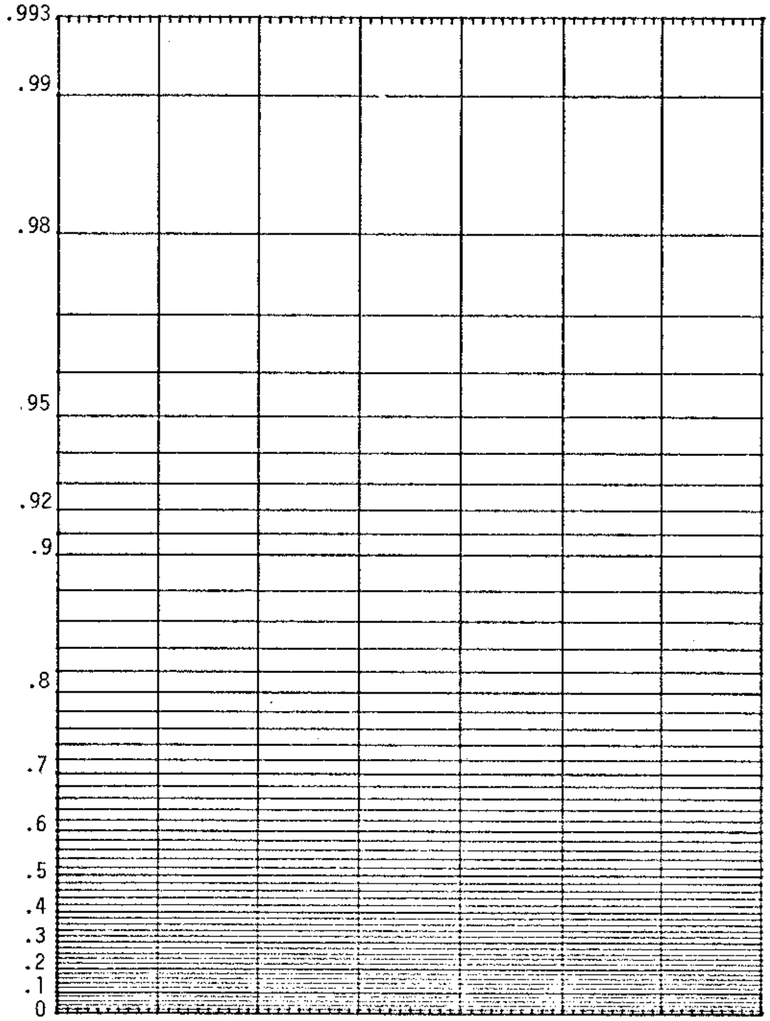


Figure 1: Exponential Graph Paper

available graph paper of linear, semi-log or log-log form. Other situations may arise, however, where a suitable graph paper is not available. How special purpose graph sheets can be constructed by utilizing the computer graphics is demonstrated by the following examples:

Example 1: Exponential Form

The step response of a first order dynamic system is given by

$$F = 1 - e^{-at}$$

where F is the ratio of the instantaneous output to its final value. Transforming to linear form

$$Y = \log\left(\frac{1}{1 - F}\right) = at = aX$$

One approach, of course, is to use rectangular graph paper and calculate Y from F as above. The alternative is

Chart 1:
Program for Exponential Graph Paper

```
10   Disp "How Many X Divisions";
20   Input N
30   Disp "What Maximum F Value";
40   Input F1
50   Y0 = 0
60   Y1 = Log (1/(1-F1))
70   Scale 0, N/10, Y0, Y1
80   For X = 0 to N/10
90   Y axis X
100  Next X
110  X axis Y0,  0.1
120  X axis Y1, 0.1
130  End
140  For D = 1 to 5 step 4
150  For F = 0 to 0.9 step 0.1/D
160  Y = log (1/(1-F))
170  X axis Y
180  Next F
190  Next D
200  For F = 0.91 to 0.99 step 0.01
210  Y = log (1/(1-F))
220  X axis Y
230  Next F
240  End
```

to distort the Y-axis so that F can be plotted directly. The resulting graph paper is shown in Figure 1, and the computer program is shown in chart 1. The program was written for the Hewlett-Packard 9830 calculator with a 9862 Plotter. Program lines 10-120 draw the borders of the graph paper, N major X-division and tic marks spaced at intervals of N/10. In the example shown in Figure 1, N=70 and the maximum F-value is 0.993. Program lines 140-190 draw lines at constant F for F = 0 to .9 at steps of 0.02 with every fifth step repeated for emphasis. Program lines 200 to 230 draw lines at constant F for F=0.91 to 0.99 at steps of 0.01.

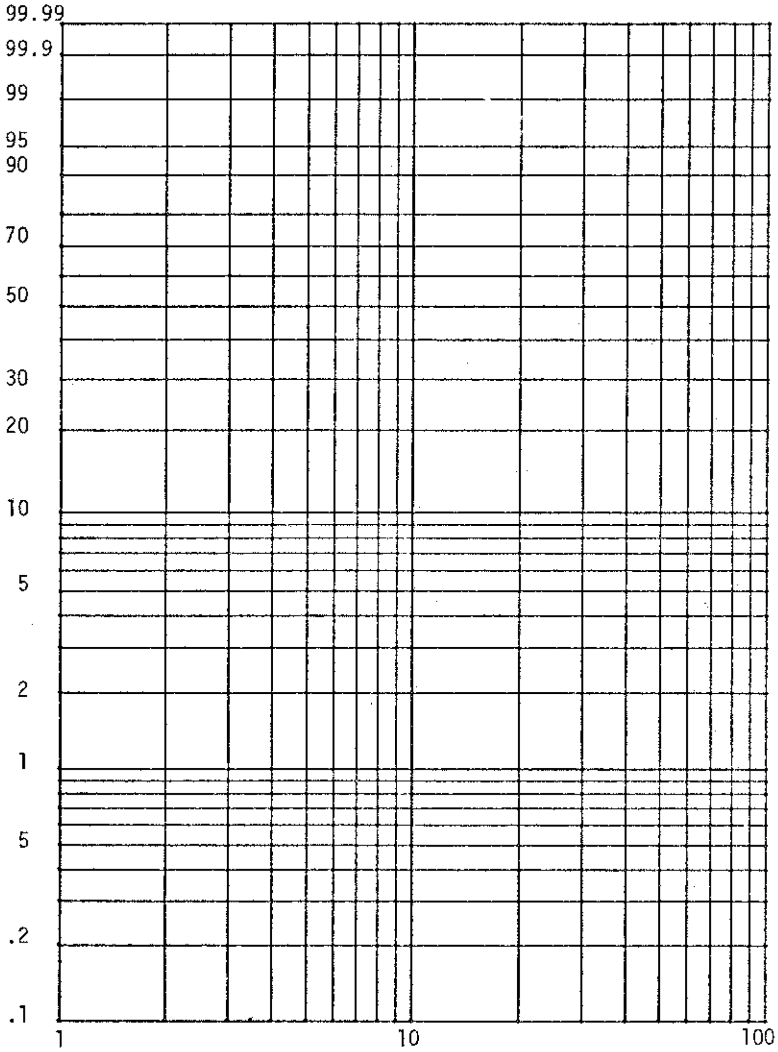


Figure 2: Weibull Probability Paper

Chart 2:

Program for Weibull Probability Paper

```
10   Disp "How Many X cycles";
20   Input N
30   Y0 = log (log(1/0.999))
40   Y1 = log (log(1/0.0001))
50   X1 = log (10↑N)
60   Scale  0, X1, Y0, Y1
70   For P=1 to N
80   For X = 10 ↑(P-1) to 10↑P Step 10↑(P-
90   Y axis log X
100  Next X
110  Next P
120  End
130  For N = -3 to -2
140  For F = 10↑N to 10↑(N+1) Step 10↑N
150  Y = log (log(1/(1-F)))
160  X axis Y
170  Next F
180  Next N
190  For F=0.1 to 0.9 Step 0.1
200  Y = log(log(1(1-F)))
210  X axis Y
220  Next F
230  Y = log(log(1(1-0.95)))
240  X axis Y
250  Y = log(log(1/(1-0.99)))
260  X axis Y
270  Y = log(log(1/(1-0.999)))
280  X axis Y
290  X axis Y1
300  End
```

Example 2: Weibull Probability Distribution

The Weibull distribution was originally proposed for the interpretation of fatigue data. It has found widespread use in describing the life of parts or components. The Weibull cumulative distribution function if given by

$$F = 1 - e^{-\left(\frac{t}{\theta}\right)^{b}}$$

where F is the fraction of parts with life less than t, and b and θ are the distribution parameters. Transforming to linear form

$$Y = \log \log \left(\frac{1}{1 - F}\right)$$

$$X = \log T$$

$$C = -b \log \theta$$

$$Y = b X + C$$

Figure 2 is the graph sheet on which F and t are plotted directly and constructed such that data following the Weibull distribution will plot as a straight line.

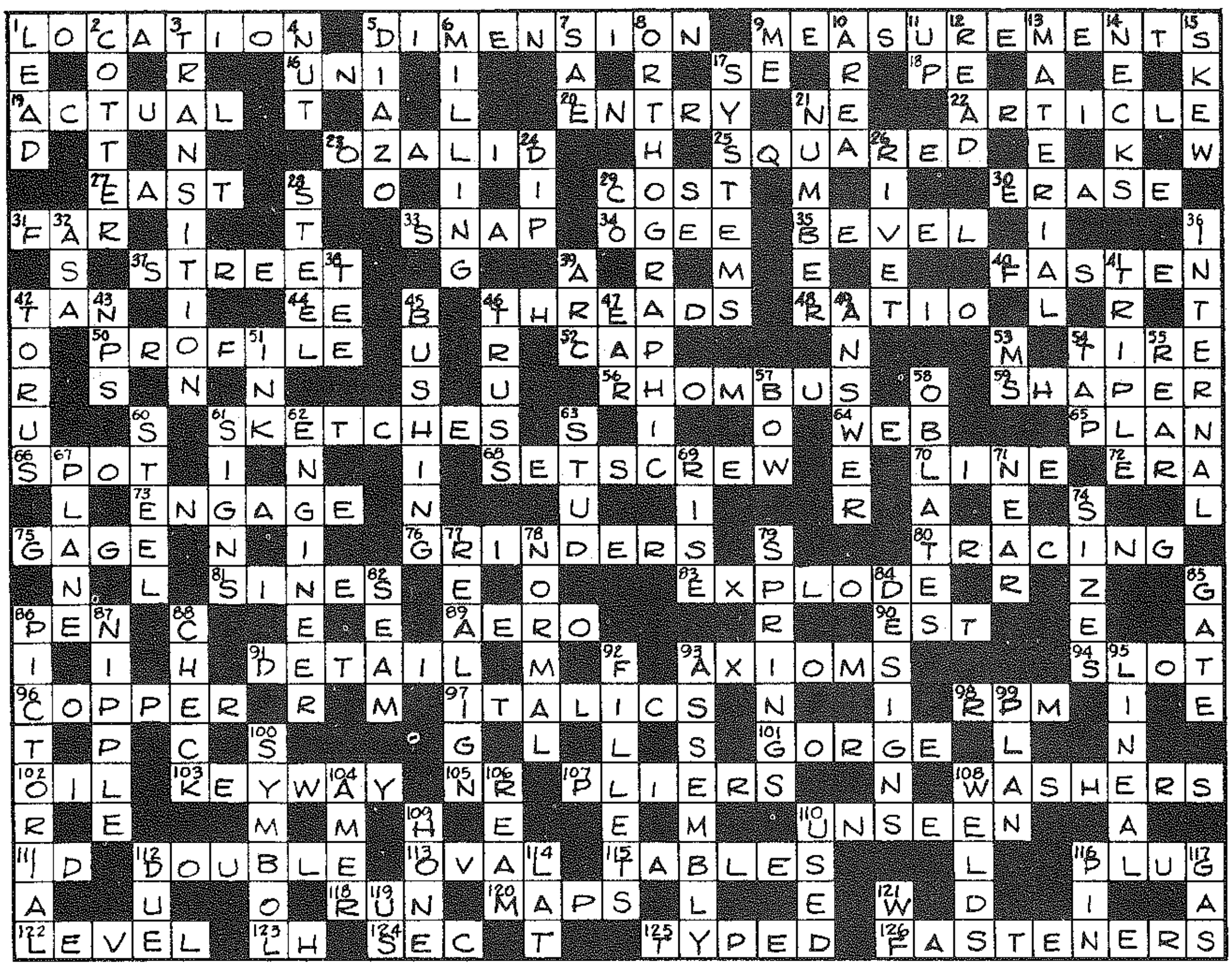
The program used to construct this graph paper is shown in chart 2. Program lines 10 - 110 set the graph limits at F = .1% and 99.99% and draw 10 X-lines per cycle for N cycles. Two cycles are drawn in Figure 2. Program lines 130 - 180 draw 10 F - lines per cycle for 2 cycles (.1 to 1%, 1 to 10%). Program lines 190 - 220 draw F-lines every 10% from 10 to 90%. Program lines 230 - 290 draw F-lines at 95, 99, 99.9 and 99.99%.

Conclusions

The advantages of linear graphs are obvious to anyone who has faced the task of analyzing experimental or other statistical data. The technique described is useful for construction of special graph sheets which yield linear plots in specific cases. The advantages of the "custom-made" graph sheet apply as well to the available linear semilog, and log-log forms namely:

1. the plotting area may be made any size within the capabilities of the available hardware.
2. major grid lines can be placed at any convenient spacing.
3. minor grid lines or tic marks can be placed at any desired spacing.
4. grid lines can be interupted to leave blank space on the grid for labels.
5. the sheets produced are quite accurate and reproducible.
6. the grids may be drawn on any paper including the originals for a report.

Solution to ALMFELDT'S CROSSWORD



Reinhard Lehnert
Dillingen
Federal Republic of Germany

LAYERED GEOMETRICAL SURFACE DESIGNS:

FORM-BASES FOR PICTURES, FILMS, AND "VISUAL MUSIC"

REVIEW

In the accompanying article Reinhard Lehnert presents an interesting and novel mathematical art form which he calls "visual music". The geometrical background is simple and yet gives rise to an infinite variety of pictures. The addition of color to the pictures shown, as Lehnert suggests, will enhance the presentation of the material as well as improve the aesthetic quality of the art form.

The detailed explanation of the various forms (innerstars, inner-squares, etc.) may become tedious for a casual reader, but a grasp of the limitless possibilities may be gathered from the picture alone. Although it produces a stimulating Journal article, the material would make an even better visual presentation once the "electronic light organs" mentioned in the text are incorporated.

A strong relationship between mathematics and art has always existed and Professor Lehnert demonstrates that this relationship is still growing.

Larry Genalo
Iowa State University

This article resumes the subject of an earlier article in this Journal (Winter 1975, Vol. 39, No. 1,) and of several articles in other magazines (cf. list of publications), but is also comprehensible without reference to any of these articles. Like its predecessors it deals with a totally novel, elementary, and voluminous class of geometrical figures (discovered by me) which I call the "inner-stars". These inner-stars form bases for drawing both non-representational pictures and films, and others showing letters. They are called "inner-pictures" and "inner-games". In this way the inner-stars make it possible to build two totally novel kinds of art - a "static" one and a "dynamic, visual music".

The plastic and graphic arts use three vast sources for forms: the worlds of the geometrical, the concrete and the accidental forms. The static visual music will make use of the geometrical source of forms in quite a novel way. The dynamic visual music will in no way make musical works visible; that would not be an artistic undertaking. On the contrary it will be an original art for the eye which, I think, will range with poetry, the graphic and plastic arts, and music as the fourth and equivalent basic art. It may be conclusively proved that the works of the dynamic visual music can offer to the eye what music offers to the ear. In this art the inner-stars will play a similar part as the scales (including the twelve-tone-scale) do in music. If use were made of electronic "light-organs" (still being constructed) and of computers, that would very much facilitate the designing and the production of inner-pictures and inner-games.

Thus the inner-starts open up an immense variety of promising possibilities for designers, artists, computer artists, teachers of art and mathematics, for the electronic industry (production of "light organs"), for the film industry and for television. The more practically interested reader need not study all details of the test, but may concentrate on the comprehensive pictorial part and the technical suggestions of the text.

A. The cell-star sC3 and the appertaining "visual music"

We imagine a square subdivided into 9 equal squares, each of these subdivided into 9 equal squares and so forth. We conceive all these squares as parts of an area, not as figures consisting of lines. We call the largest square the square of layer 0, the 9 second largest squares those of layer 1, the 81 third largest those of layer 2, etc. We call the described squares the "base-figures" or "cells", and the described total figure a "reduced cell-star", more exactly the "reduced square cell-star of the number of extension 3", shortly rsC3. Picture 27 represents the layers 0 to 3 of this cell-star in an artistic way.

We are going to enlarge the rsC3 to a full cell-star. This facilitates the definition and examination of the appertaining "strong-lines", "field-lines" and "inner-stars". We conceive the rsC3 continued beyond its border on the whole drawing plane. We also imagine the coarser layers -1, -2, -3, ...added to it. The total figure thus obtained which is infinite to the exterior and to the interior, is called the "square cell-star of the number of enlargement 3", shortly sC3.

The sC3 is already a possible "form-base", although primitive, form-color-games, hence Visual-Music-games. We describe a method, which is technically rather complicated, how to produce such plays. We transfer - with thin lines or simply in thought - the layers 0 to 2 of the reduced cell-star rsC3 on a screen. We then put up a projector focused exactly on the cell of layer 0, furthermore 9 projectors focused on the 9 cells of layer 1, and 81 focused on the 81 cells of layer 2.

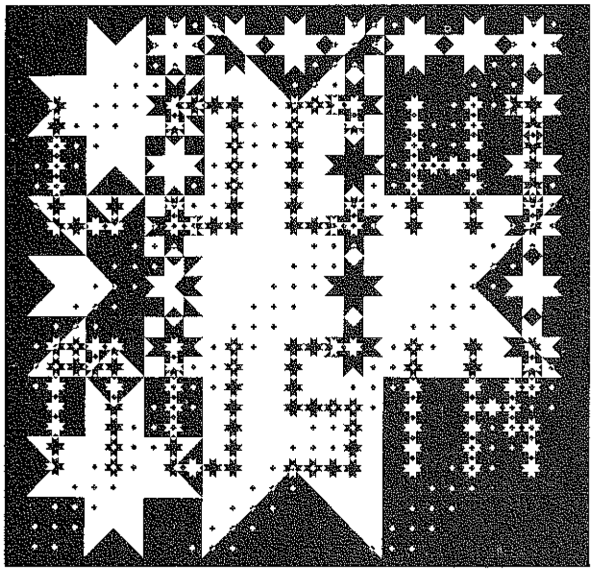
Then we cause one of the projectors to play a "color-melody", that means we cause it to change its color in some series of colors and in some rhythm. Then we cause one or several of the other projectors to repeat this melody of colors unchanged or changed or to play other melodies of colors. Of course we can also start to compose in a different way: we can cause several projectors of one of the layers 1 or 2 to play a "form-color-theme" of "one voice or several voices". The result is a "form-color-game", generally non-representational, appearing on the screen.

When creating this form-color-game, we only admit a certain quantity of colors and prescribe exactly every color according to quality, addition of white light and intensity. We call such a visual game an "inner-game" on the sC3. We call the sC3 its "form-base" and the quantity of the admitted colors its "color-base". First of all we ask about merits and imperfections of sC3 as a "form-base" of Visual Music and later on we will deal with possible corrections of this figure with regard to this task.

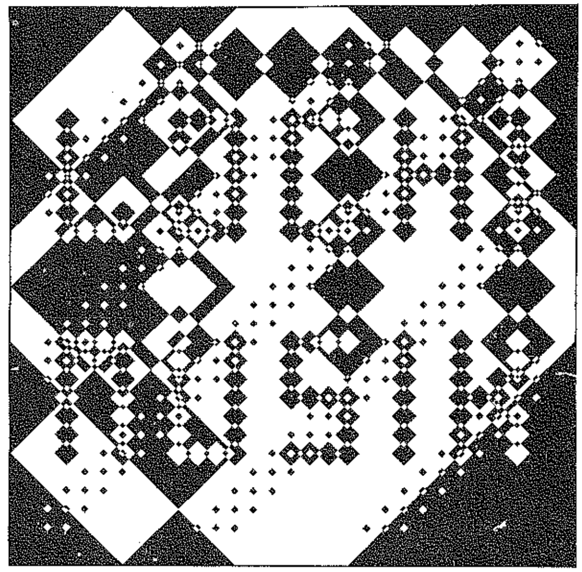
Arguments for the suitability of the cell-star sC3 as form-base of Visual Music are the following qualities: 1. sC3 is a "subdivided plane-figure": that means it consists of numerous plane-pieces in a plane which we call "base-figures". 2. The sC3 is "layered": that means it consists of base figures of different size which belong to different layers. 3. The sC3 is "homogenous" in each layer: that means it consists in each layer of equal and equally arranged figures, arranged according to the order of a regular point grid, more exactly according to the order of a regular square grid. 4. The sC3 is "similar with regard to the layers": that means the different layers are geometrically similar to each other. 5. The sC3 is "coherent": that means every base-figure is a part of the plane, coherent, and has at least one point in common with each of its four neighbors, upwards, downwards, right and left; more exactly, even all the points of a line segment.

Arguments against the suitability of the cell-star sC3 as form-base are the following facts: The sC3 is in a certain sense "non-transparent"; that means we cannot recognize in every case which base-figures light up. An example: We floodlight the cell of layer 0 with yellow color and all the cells of layer 1 with blue color. Then the cell of layer 0 will light up green. We obtain the same result if we floodlight all the remaining cells. Therefore we cannot find out from this result alone which cells light up, and not at all in which color they do.

This lack of transparency of sC3 results from the following fact: The border-lines of the cells of layer 0 coincide with the border-lines of the cells of layer 1, also with such ones of layer 2, etc. The border-lines of the cells of layer 1 coincide with such ones of layer 2, etc. In other words, base figures of different layers contend with each other for their border-lines. That means if we want to improve the sC3, we must choose the new base-figures in such a way that of two base-figures each belonging to



Picture 1



Picture 2

different layers the appertaining border lines have at best isolated points, but never whole line segments in common with each other. Before systematically disentangling the border lines of the cells of sC3 in this way, we enrich the sC3 by definition of its "strong-points", "strong-lines" and "field-lines".

B. The strong-points, the point-star sP3 and the auxiliary-star sA3.

For each n out of the series ..., -2, -1, 0, 1, 2, ... in the sC3 we call the central points of the cells of layer n the "strong-points of layer n". Then it applies that each strong-point of any layer n coincides with a strong-point of each of the finer layers (n+1), (n+2), ... The reversal does not apply, of course. Picture 28, just as picture 27, shows the layers 0 to 3 of the reduced cell-star rsC3. In addition it shows all appertaining strong-points. The figure consisting of all the strong-points of the cell-star sC3 is called the "square point-star of the number of enlargement 3", shortly sP3. The sP3 is called the "basic point-star" of sC3, and the sC3 is called an "overlaying" or a "visible representation" of sP3.

For each n out of the series ..., -2, -1, 0, 1, 2, ... we call a strong-point of layer n coinciding with a strong-point of the next coarser layer (n-1) a "bound" strong-point, every other one a "free" one. Picture 28 shows 1 strong-point of layer 0. It lies in the center of the picture. It coincides, of course, with a strong-point of each of the finer layers 1, 2, 3, ... But it coincides also with a strong-point of each of the coarser layers -1, -2, -3, ... and is therefore a bound strong-point. The center-point M of the picture is evidently the only point in which strong-points of all layers coincide. Picture 28 also shows nine strong-points of layer 1. One of them is bound, namely the one lying in M, the other eight are free. Further more, picture 28 shows 81 strong-points of layer 2: nine of them bound ones, and 72 free ones, and 6561 strong-points of layer 3; 81 of them bound ones, and 6480 free ones.

We reduce all cells in cell-star sC3 on the scale of 3 to 2 and get a new "overlaying" of point-star sP3. We want to call it the "auxiliary-star" of sP3, shortly sA3. It is eminently suited as an auxiliary figure for sketching and designing of inner-stars and inner-pictures of sP3. Picture 3 shows the layers 0 to 2 of the "reduced auxiliary-star" rsA3. The auxiliary-star sA3 overlays each strong-point of a layer n with a square whose corner points are free strong-points of the next finer layer (n+1). A comparison of the cell-star sC3 with the auxiliary-star sA3 shows: 1. The auxiliary-star is an improvement of the cell-star in that it is "transparent": The border lines of two base-figures each of different layers have at best finitely many points in common with each other, in the case in question either none or exactly two, but never whole line segments. 2. The auxiliary-star is a deterioration of the cell-star in that it is not "coherent" (see A.): Every base-figure is separated from its four neighbors by plane stripes whose thickness is half of the length of its edge.

The cell-star as well as the auxiliary-star have a quality which has not been discussed so far: They are "arranged with regard to the layers". This means that the base-figures are either not split up at all by the border lines of the respectively coarser base-figures or are split only in a finite number of ways. For the cell-star the base-figures are not split up by the border lines of the respectively coarser base-figures are not split up by the border lines of the respectively coarser base-figures at all. For the auxiliary-star the base-figures are split up by the border lines of the coarser base-figures in only eight ways which we recognize in picture 3. A base-figure is either not split up at all or it is vertically, horizontally, or vertically and horizontally halved, or a square quarter is cut out of it on one of its four corners. The "arrangement with regard to the layers" guarantees that the different layers disturb each other in a minimal way only.

C. The strong-lines and the field-lines, the universal-stars and the complete-stars.

For every n out of the series ...., -2, -1, 0, 1, 2, ... a straight line running through at least two, and therefore necessarily through infinitely many, strong-points of layer n is called a "strong-line of layer n". A strong-line of layer n coinciding with a strong-line of the next coarser layer (n-1) is called a "bound" one, every other one a "free" one. Picture 4 shows in horizontal direction (hence with the gradient 0) two free strong-lines of layer 1 and six free strong-lines of layer 2. With vertical direction (hence with the gradient infinite) it also shows two free strong-lines of layer 1 and six of layer 2. With the gradient angle 45° (hence with gradient 1) it shows four free strong-lines of layer 1 and twelve of layer 2. With the gradient angle -45° (hence with the gradient -1) it also shows four free strong-lines of layer 1 and twelve of layer 2. We call every segment of a strong-line a "strong-segment".

For each n out of the series ..., -2, -1, 0, 1, 2, ..., a straight-line which divides the plane stripe between two neighboring strong-lines of layer 0 on the scale of 1:1 (hence halves) is called a "field-line or layer n and the field number f+2". A field-line of a layer n coinciding with a field-line of the next coarser layer (n-1) is called a "bound" one, every other one a "free" one. In every layer and with every direction picture 4 presents as many free field-lines of field number 2 as free strong-lines. We call every segment of a field-line a "field-segment".

The strong-lines and the field-lines presented here have the gradients 0, 00, 1, -1. However we can also construct strong-lines and field-lines to all other gradients which are rational numbers. However, in the present article we deal only with inner-stars or inner-pictures with the listed gradients.

As already mentioned the field-lines of sP3 presented here belong to field number f=2. For the construction of field-lines we can also choose other field numbers; more exactly, all natural numbers which are relatively prime to the number of enlargement 3. In the present article we do not deal with field-lines with such field numbers.

A figure consisting of all the strong-lines and field-lines which belong to certain gradients and to a certain field number is called a "universal-star". A figure consisting of all free strong-lines and free field-lines of a universal-star is call a "complete-star". Picture 4 presents the layers 1 and 2 of a reduced universal-star. In the present article we do not deal further with universal-stars and complete-stars.

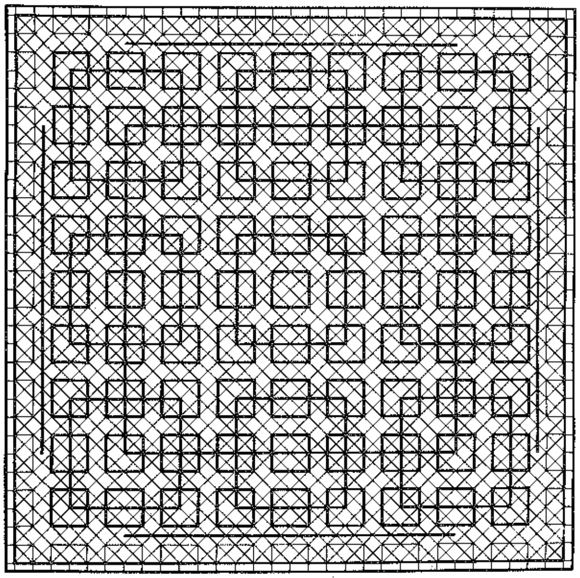
The point-star sP3 results from a square point grid by unrestrictedly repeated enlargements on the scale of 1:3 and reductions on the scale of 3:1. We can also construct other point-stars if we proceed from a different plane point grid and/or choose a different scale of enlargement and reduction. All point grids thus obtained allow corresponding definitions and constructions of strong-lines, field-lines, universal-stars, complete-stars, inner-stars, inner-pictures and inner-games.

The most important among these point-stars are the sP2 and the sP3, dealt with in the previous and the present articles. The second in importance are the (hexagonal) hP2 and the (hexagonal) hP3. The numbers of extension 4, 5, 6, ... lead to inner-stars less and less aesthetically suitable for the following reason: linear enlargement of 1: n results in an enlargement of the surface area of $1:n^2$. Point-stars of the number of extension 2, 3, 4, 5, 6, ... lead therefore to numbers of extension of the area of 4, 9, 16, 25, 36, ... of the appertaining inner-stars, inner-pictures and inner-games. This number must not become too large for aesthetic reasons: 4 and 9 are aesthetically suitable, 16 is already too large.

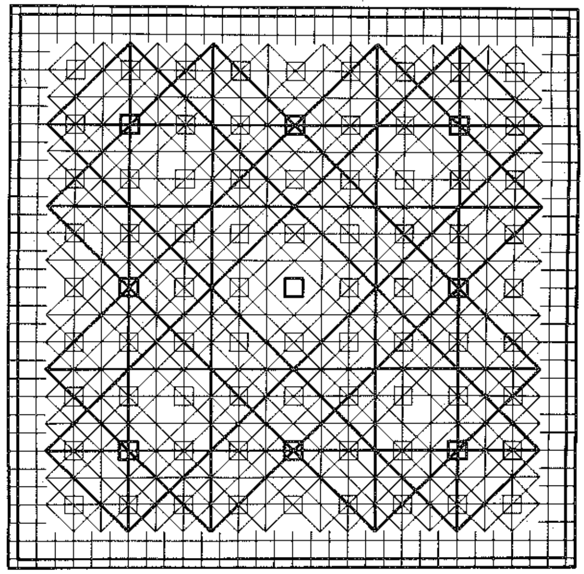
D. The inner-stars: Part 1.

An inner-star of the point-star sP3 is an overlaying of the sP3 with the following qualities: 1. It overlays every strong-point with a coherent part of the plane. 2. In each layer it overlays all appertaining strong-points in an equal way (congruent), it is therefore "homogenous in each layer". 3. It overlays different layers in a geometrically similar way; it is "similar with regard to the layers". 4. It is "transparent (see B.). 6. It is "coherent in each layer" (see A.).

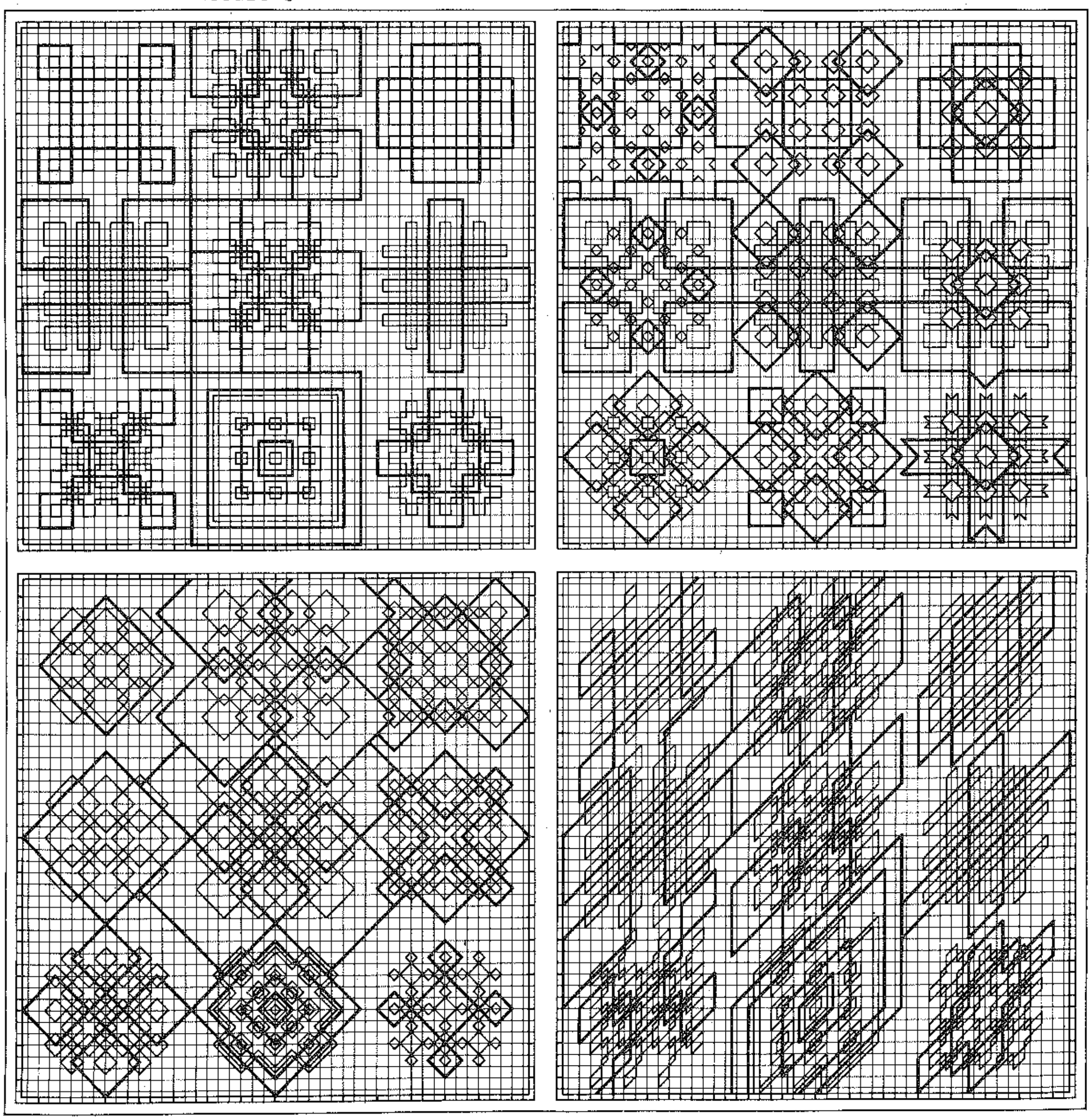
Picture 5 presents four partial pictures with nine figures each, 36 figures in all. In the following we call them the figures (5; 1; 1; 1) - (5; 4; 3; 3). (5; 1; 1; 1) means the figure in the 5th picture, in the 1st partial picture (upper left), in the 1st line, and in the 1st column. Correspondingly picture 6 presents the figures (6; 1; 1; 1) - (6; 4; 3; 3). The figures of pictures 5 and 6 except the figures (5; 1; 3; 2), (5; 3; 3; 2), (5; 4; 3; 2) and (6; 4; 3; 3) present one inner-star of sP3 each. More exactly, they present the layers 0 and 1 of the reduced inner-star of sP3. So they show in each case the central base-



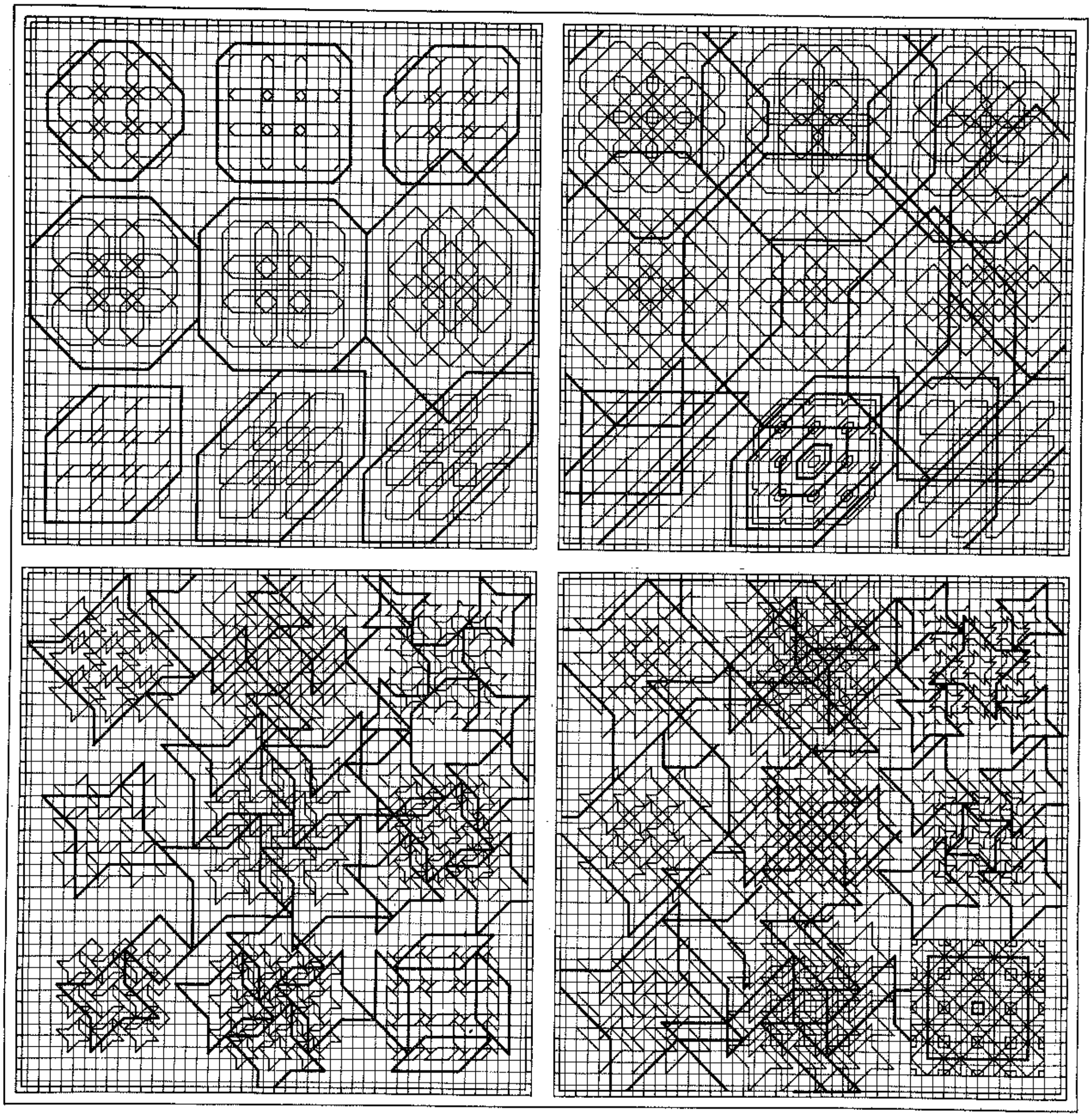
Picture 3



Picture 4



Picture 5



Picture 6

figure of layer 0 and the nine base-figures of layer 1 coordinated to this one. Let us look at the inner-stars represented by these figures more closely.

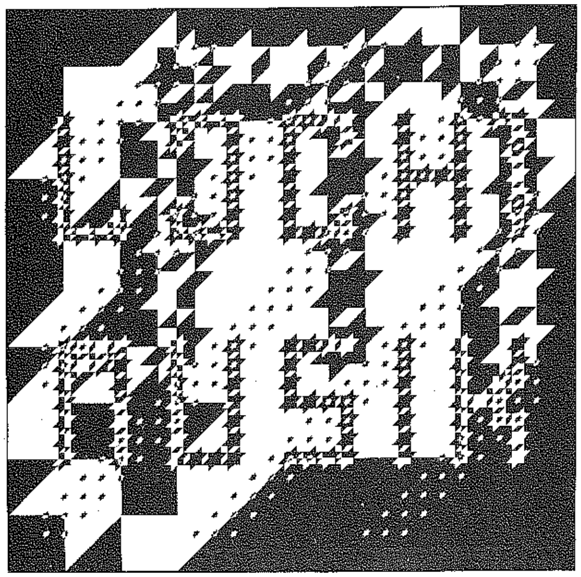
The I(6; 3; 2; 1), i.e. the inner-star represented by the figure (6; 3; 2; 1) is an "adjacent-star". Its base-figures have only isolated points in common with its four neighbors, in the present case 2 each. They touch their neighbors in these points. The I(6; 3; 3; 1) is also an adjacent-star.

The I(5; 3; 1; 1) is an "overlapping-star". Its base-figures overlap its four neighbors. The inner-stars I(5; 3; 2; 1), I(6; 1; 1; 1;) - I(6; 1; 3; 3), I(6; 2; 1; 1)- I(6; 2; 2; 2), I(6; 3; 1;1), I(6; 3; 2; 1), I(6; 4; 1; 1), I(6; 4; 2;1), and I(6; 4; 3; 1) are also overlapping-stars.

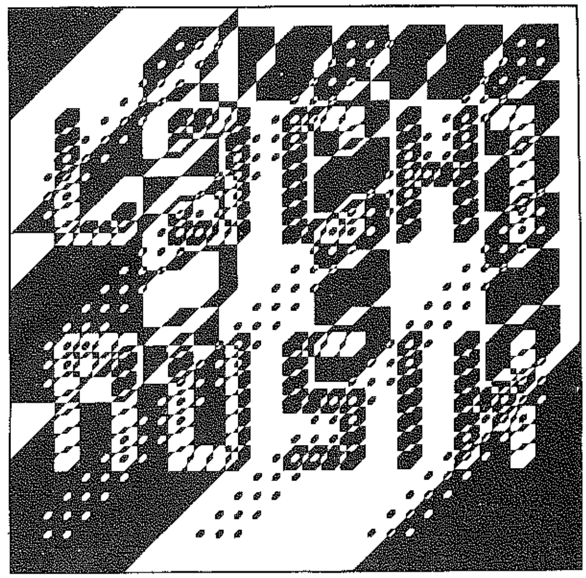
The I(5; 1; 1; 1) is a "linked-star". The base-figures consist of one square each and four smaller squares affixed on its corners. Each base-figure has two of these affixed squares in common with each of its four neighbors. It is "linked" with the neighboring base-figure by these two common squares. All figures of pictures 5 and 6 not yet mentioned also represent linked-stars.

The figures (5; 1; 3; 2), (5; 3; 3; 2), (5; 4; 3; 2) and (6; 2; 3; 2) already mentioned represent "inner-stars in a broad sense". We call them "fusion-stars". Further details about these stars are brought out in the discussion of pictures 10, 11, 19, 22, 23, 24, 25. The figure (6; 4; 3; 3) again shows (after picture 4) certain strong-points, strong-lines and field-lines of sP3.

For all inner-stars of pictures 5 and 6 and for every n, the border lines



Picture 7



Picture 8

of the base-figures of layer n are composed of strong-segments and/or field-segments of the next finer layer (n+1). This fact guarantees the "transparence" and the "arrangement with regard to the layers" of the represented inner-stars.

E. The inner-stars: Part 2 (may be omitted on first reading)

For every inner-star, not only for those of sP3, and for every n, the border lines of the base-figures of layers n are composed of strong-segments and/or field-segments. These strong-segments belong, for every gradient m_i (i=1, 2, 3, ...) with which they occur, to a layer ($n+k_i$). These field-segments belong, for every gradient n_j (j=1, 2, 3, ...) with which they occur, to a layer ($n+l_j$). k_i and l_j are any natural numbers, that is, numbers out of the series 1, 2, 3, ... This fact guarantees the "transparence" and the "arrangement with regard to the layers: of the respective inner-stars. We call k_i and l_j the degrees of complication coordinated to the directions of the inner-star concerned. We call the maximum of all these k_i and l_j of an inner-star its "(absolute) degree of complication".

As can be easily understood, the fact is that the smaller (at equal choice of the occurring gradients) the degree of complication of an inner-star is, the more simply its base-figures are divided up by the border lines of the respectively coarser base-figures, and the more perfectly the inner-star is "arranged with regard to the layers". From the above statement it ensues that all inner-stars presented in pictures 5 and 6 have the degree of complication 1. All these inner-stars belong, consequently, to the "standard of quality 1".

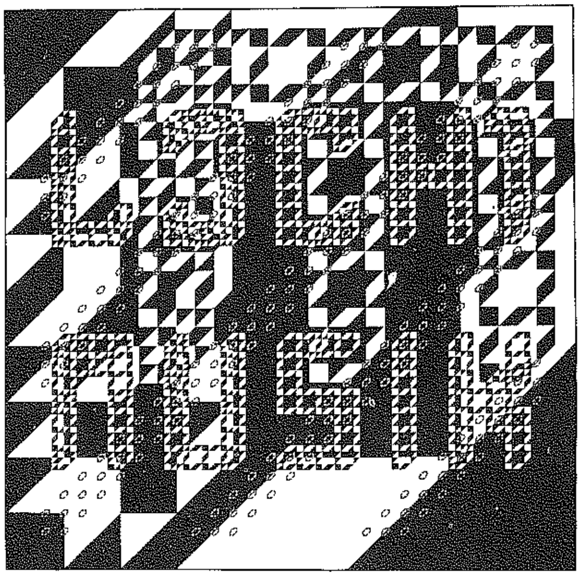
The figures (5; 1; 1; 1) - (6; 4; 3; 3) easily show which of the line-segments, of which the border lines of the base-figures are composed, are strong-segments and which are field-segments. All such line-segments through intersections of the square grid printed therewith are strong-segments, all others are field-segments. For the eye the following fact is essential according to definition strong-segments pass through strong-points and consequently "halve" base-figures of sufficiently fine layers; field-segments do not.

F. The inner-pictures.

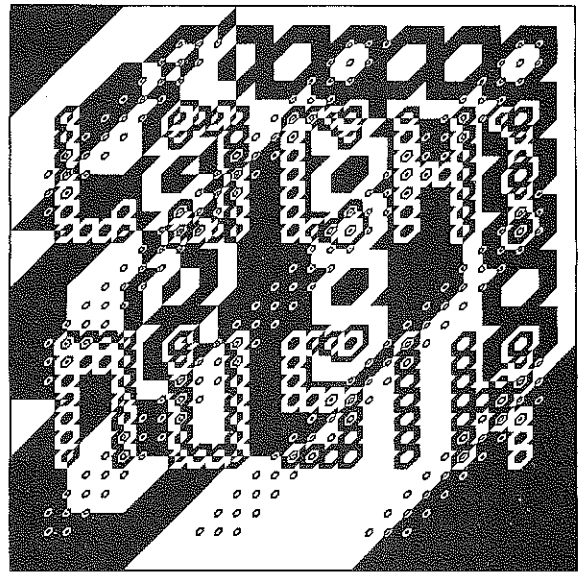
To get an "inner-0icture of sP3" we proceed in the following way: 1. We choose an inner-star of sP3. 2. From among the multitude of its base-figures we choose a finite set of base-figures and efface all the rest. 3. We color the total figure thus obtained in some way observing the following rules: a. Every part of a plane will be colored homogeneously. b. We choose the colors in such a way that by coloring no line segment of the figure to be colored will disappear, except the case that base-figures of the same layer are to melt into one another.

The simplest possible coloring is the "standard-coloring". That is, in the main, the only possible coloring with two colors such as with black and white. Proceed in the following way: The border strip and the grounding appear in black. Where base-figures in odd numbers cover the grounding the color is white, where in even numbers, it is black. As an inessential modification, the border stripe may appear in black, the grounding in white. Where base-figures in odd numbers cover the grounding the color is black, where in even numbers, it is white.

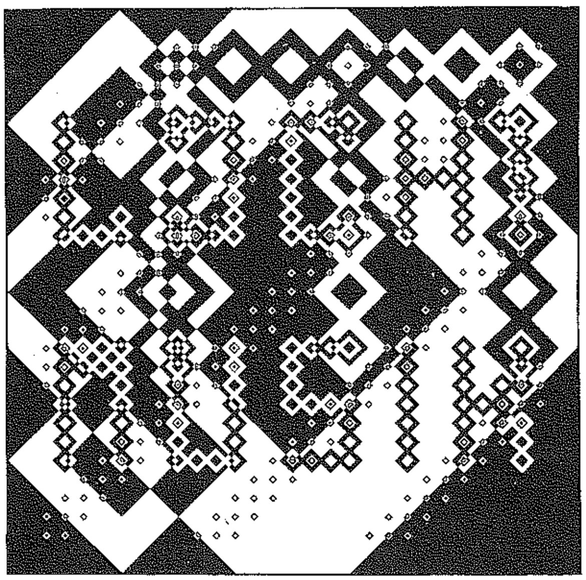
When coloring the form of an inner-picture we need not conform to the laws of the additive mixture of colors. We need not cause a part of a plane on which a base-figure overlaid with yellow and a base-figure overlaid with blue super-impose each other to appear in the add-



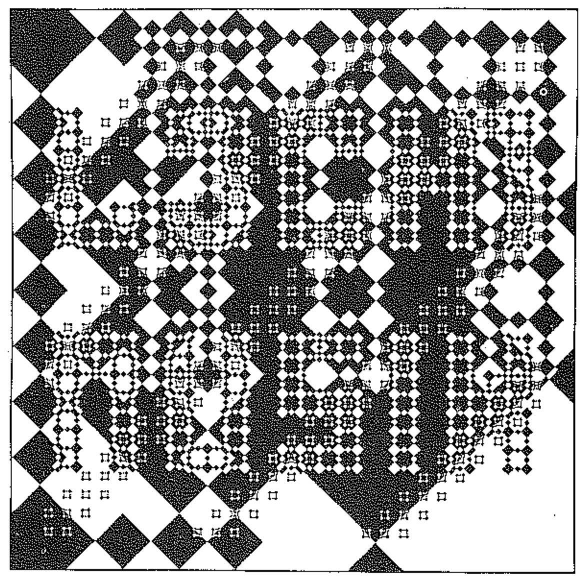
Picture 9



Picture 10



Picture 11

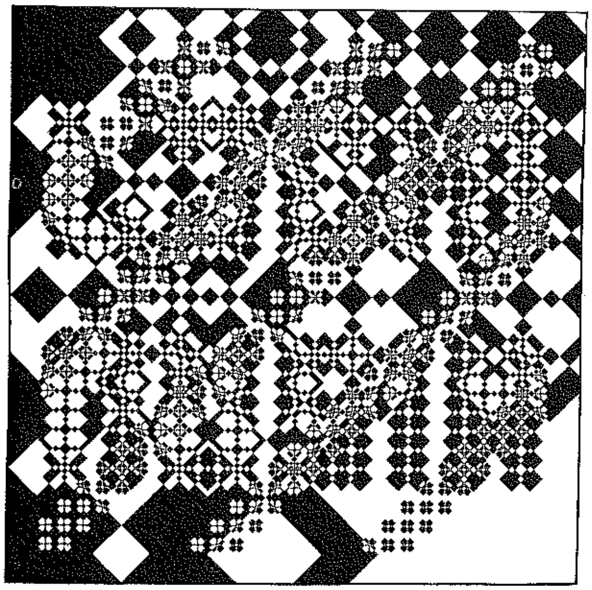


Picture 12

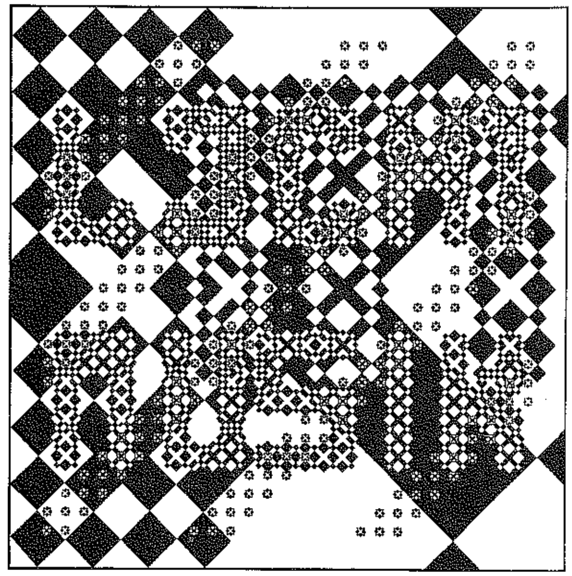
itive mixed color green. For this part of a plane we can also choose many other colors as "mixed color". We facilitate the planning of the coloring if we lay down the following rules: 1. All chosen figures of the same layer are to appear in the same color. 2. All parts of a plane superimposed in like manner by base-figures are to appear in the same color. In other words, a mixing of colors is to lead to the same result in all places. Of course, it is not necessary to lay down such rules.

Picture 1 is an inner-picture of an especially simply adjacent-star. This one is not directly represented in pictures 5 and 6, but however visible in somewhat hidden manner in figure (5; 2; 2; 1): The inner-star of picture 1, namely I(1) is a "hollow-figure" of I(5; 2; 2; 1), the I(5; 2; 2; 1) is an "enveloping-figure" of I(1). The base-figures of I(1) are stars with eight indentations which touch their four neighbors at two vertices each. The base-figures of I(5; 2; 2; 1) are rings consisting of four squares and four smaller square rhombs. For I(1) and I(5; 2; 2; 1), in every layer (n) the border lines of the base figures are composed of horizontal and vertical field-segments of layer (n+1), and of ascending and falling strong-segments of layer (n+1).

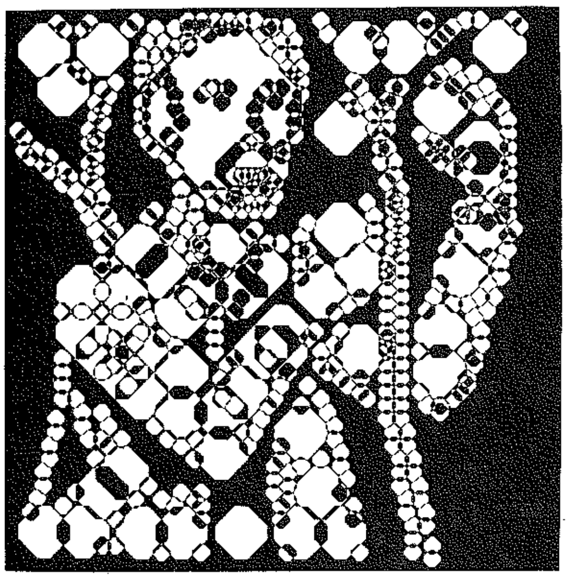
Picture 1 shows the central base-figure of layer 0, the three left base-figures of layer 1 which roughly form a vertical stick. (This stick was originally to represent an "L".) Furthermore picture 1 shows 22 base-figures of layer 2 forming the stylized word "LICHT-MUSIK", and 241 of layer 4 which form five ornamental series ascending from lower left to upper right. The picture is colored according to the "standard-coloring" described above.



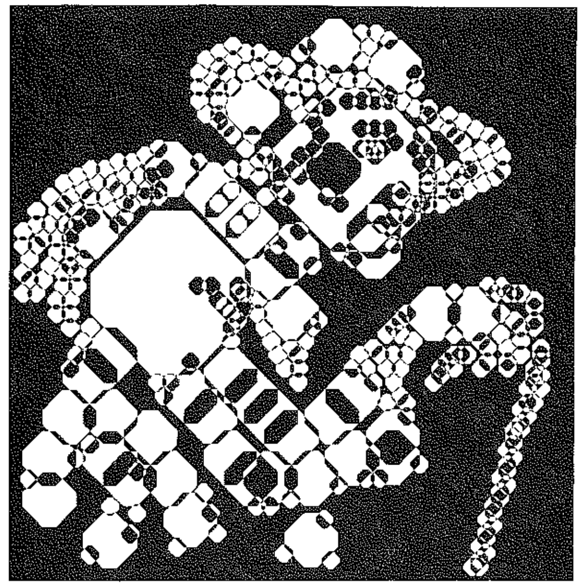
Picture 13



Picture 14



Picture 17

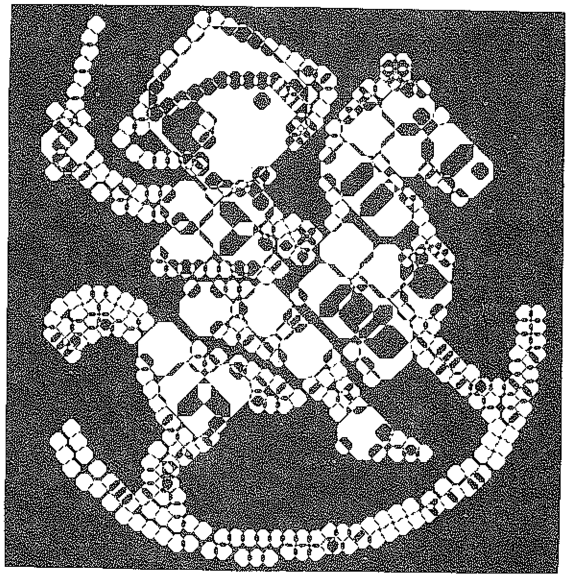


Picture 18

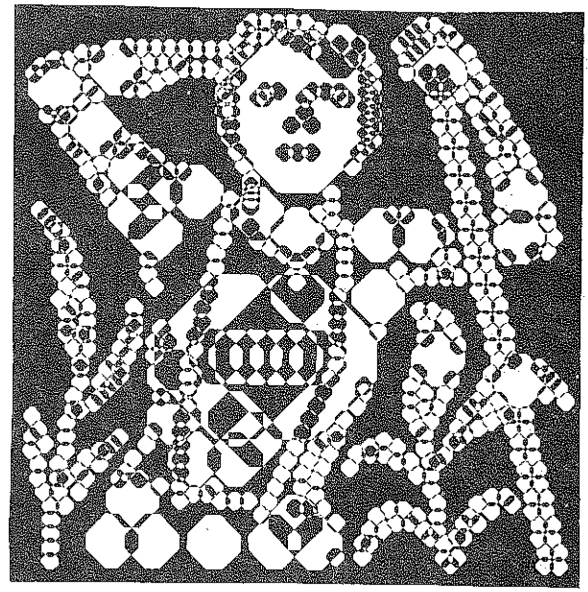
Picture 2 is an inner-picture of the overlapping-star I(5; 3; 1; 1). The base-figures are rhombs overlapping their four neighbors in smaller rhombs. The border lines of the base-figures of layer n are composed of ascending and falling strong-segments of layer (n+1). The overlaying of picture 2 with base-figures is the same as that of picture 1. In all following inner-pictures containing letters the overlaying with base-figures is also the same except for picture 14. In this one the upper bar of "M" is displaced by the smallest possible length downwards, by a mistake of the designer, but to the advantage of the series of pictures.

Picture 7 is an adjacent-picture, picture 8 an overlapping-picture, and picture 9 is linked picture. Picture 10 is a fusion-picture; in it neighboring base-figures of the same layer fuse with each other. The inner-stars of pictures 7 to 10 are not represented in pictures 5 and 6. Picture 11 is also a fusion-picture. Pictures 12, 13, 14 are linked-pictures. They are inner-pictures of the inner-stars I(5; 3; 1; 3), I(5; 3; 1; 2), I(5; 3; 2; 3).

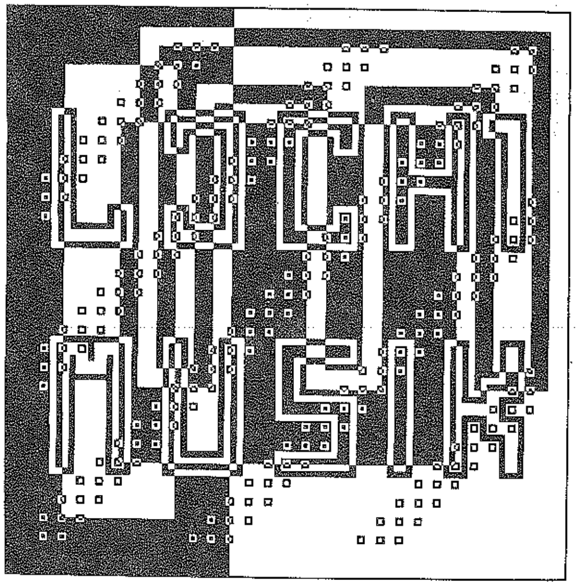
Pictures 20 and 21 are overlapping pictures. Their base-figures are octagons. Their inner-stars are I(6; 1; 1; 2) and I(6; 1; 2; 2). Pictures 19 and 22 are inner-pictures in a further sense; we call them "hollow-stripe-pictures". We can also put the linked sketches of pictures 19 and 22 one on the other and get a new hollow-stripe-picture. We can also construct numberous further hollow-stripe-pictures and stripe-pictures with the same selection of base-figures.



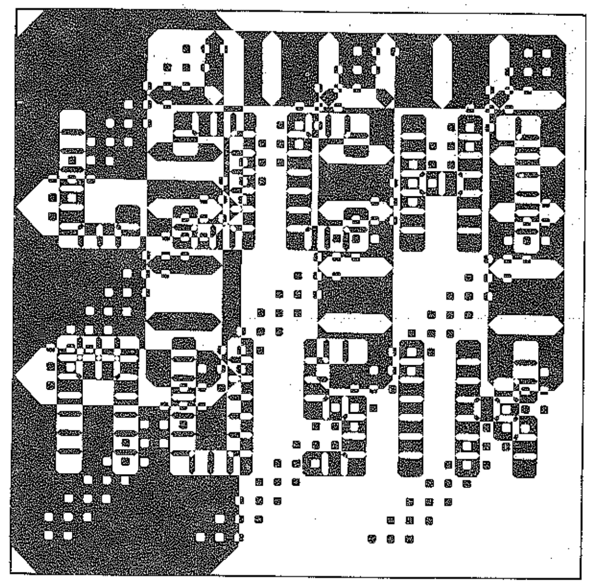
Picture 15



Picture 16



Picture 19

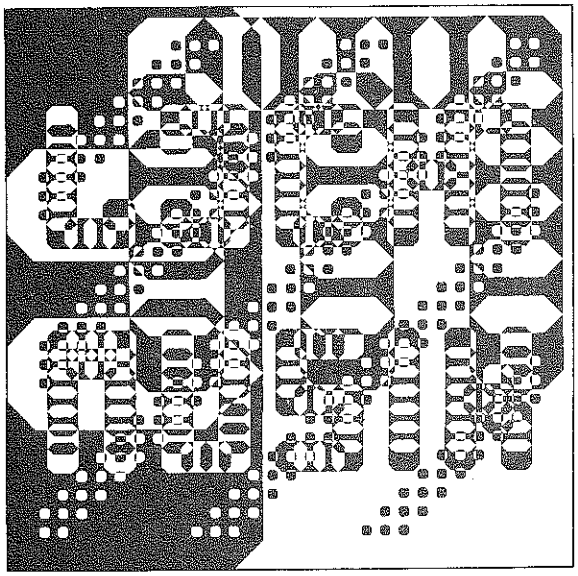


Picture 20

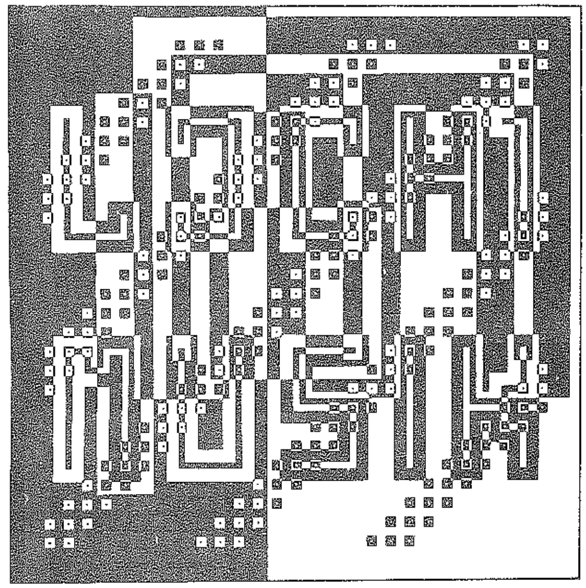
Pictures 15 - 18 are inner-pictures of I(6; 2; 2; 1). They represent the four ages of man in male figures. These figures besides others were designed at my request by Mr. Walter Schmeer in Saarbrücken. Pictures 24 to 26 are fusion pictures of I(6; 2; 2; 1). They represent heraldic animals: eagle, king of frogs (the border dark stripe in the middle represents the mouth), and the head of a lion. These pictures are among several designed at my request by Mrs. Anneliese Brandel in Dudweiler/Saar. Pictures 15 to 18, and still more pictures 24-26 show what numberous possibilities the inner-stars offer as form-bases of inner-pictures and inner-games as well.

Pictures 27 to 30 and 23 are purely geometrical pictures. As stated in part A, picture 27 makes the cell-star sC3 visible in an artistic way. In the same way picture 28 also makes the point-star sP3 visible in addition. Picture 30 makes the auxiliary-star sA3 visible in a corresponding way. Picture 29 also makes the point-star sP3 visible in addition. Picture 27 shows the layers 0 to 3 of a linked-star I(27). For I(27) the border lines of the base-figures of layer n are composed of strong-segments of layer (n+2). Picture 28 results from picture 27 if the base-figures are supplemented by adding a central square. For the linked-star I(28) the border lines of the central squares of layer n are composed of field-segments of layer (n+1).

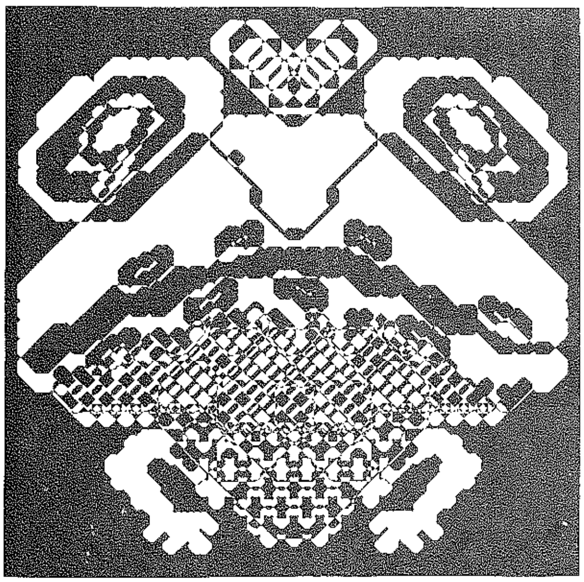
The bases of pictures 30 and 29 are not inner-stars in the strict sense of the word because they are not "coherent" (see A.). For picture 30 the border lines of the base-figures of layer n are composed of field-segments of layer (n+2). For picture 29 the border



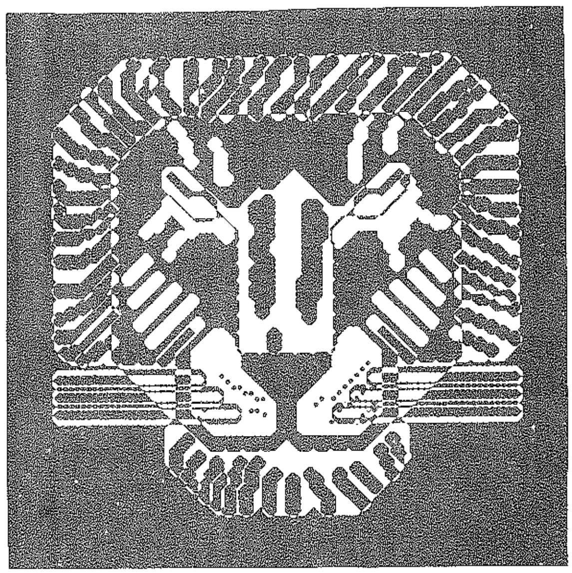
Picture 21



Picture 22



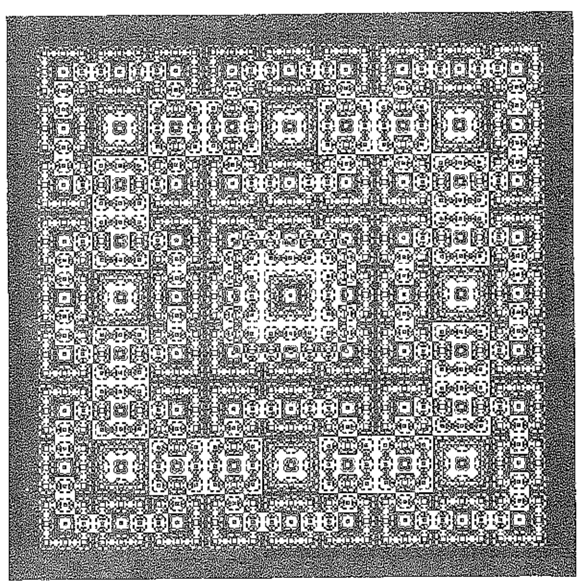
Picture 25



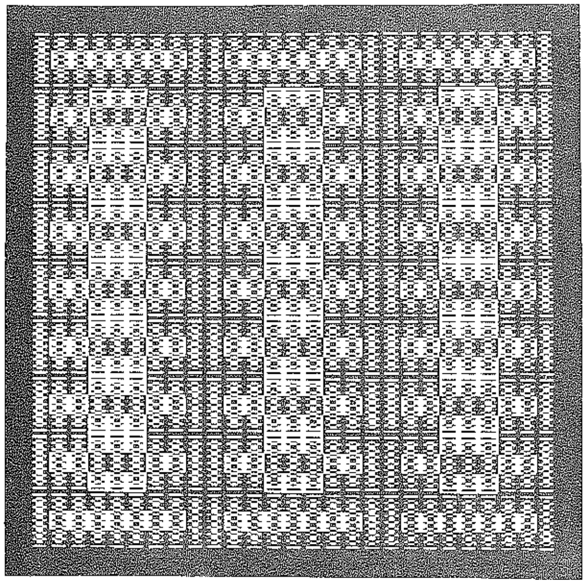
Picture 26

lines of the central squares of layer n are composed of strong-segments of layer (n+2). Picture 23 is not an inner-picture in the strict sense of the words. --- Pictures 27-30 and 23 allow us to see numerous possibilities that the idea of inner-stars opens for the production of purely geometrical inner-games (of. preface). Such pictures are suited, among other purposes, for book covers or as sacral pictures.

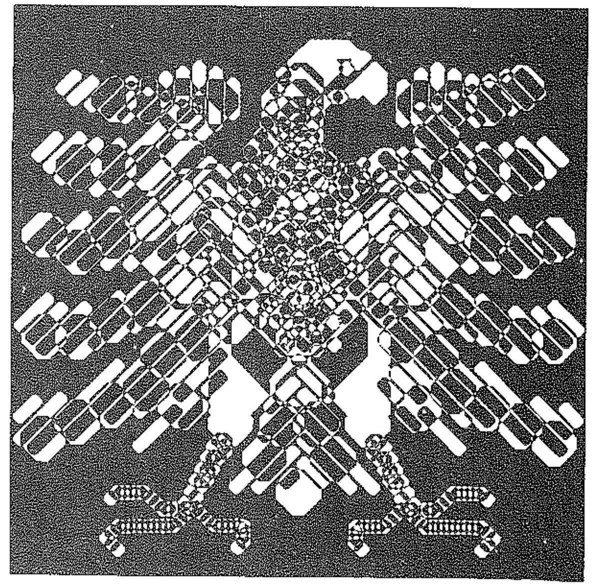
All the pictures presented only use the "colors" black and white. It is evident what additional possibilities the use of more extensive color-bases offers. In other magazines I have published some colored inner-pictures.



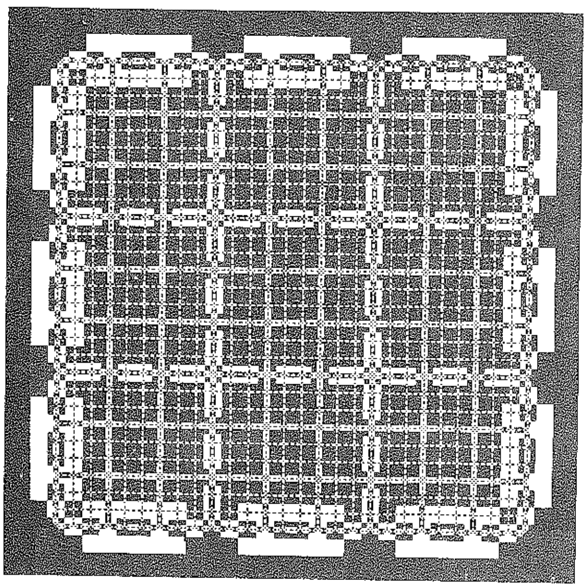
Picture 29



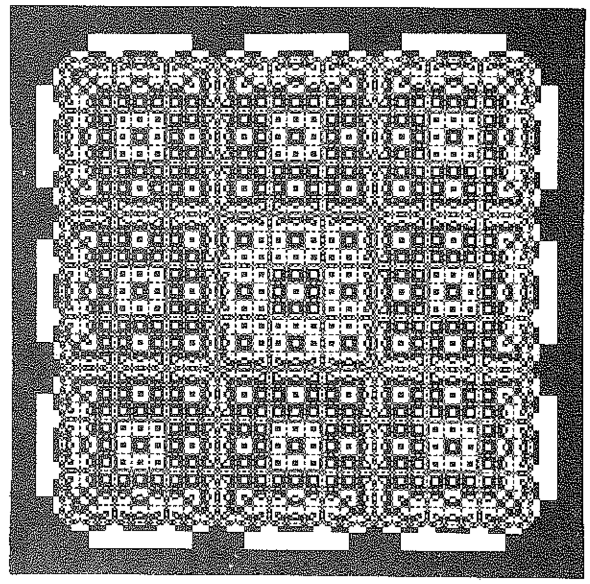
Picture 23



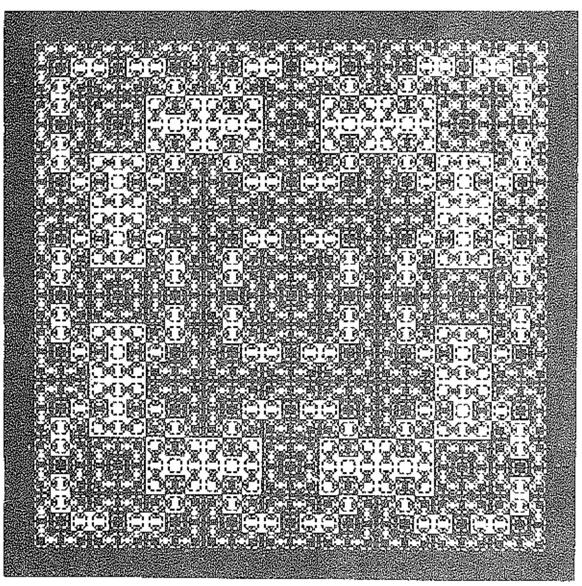
Picture 24



Picture 27



Picture 28



Picture 30

Reference (A Selection of the Author's Publications on the Subject)

A. In German:

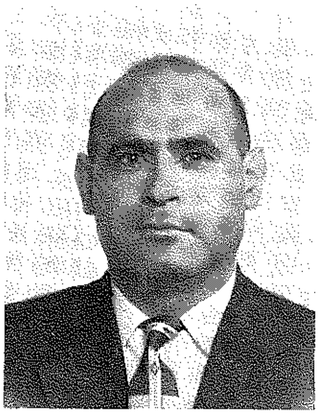
1. "Praxis der Mathematik:, 1969 Heft 3 pp. 61-70, and 1969 Heft 11 pp. 299-308.
2. "Kosmos", August 1971 pp. 346-350, with a colored picture.
3. "Welt der Schule, Ausgabe Hauptschule", Juli 1972 pp. 253-277.
4. "Bild der Wissenschaft",Oct. 1975 pp. 1440150, and Nov. 1975 pp.150-154.
5. "Bildnerische Erziehung", 1971 Heft 1 pp. 1-6.
6. "Zeitschrift für Kunstapädagogik",
7. "Die Realschule", 1973 Heft 2 pp. 42-47, 1973 Heft 8-9 pp. 303-308, 1974 Heft 10 pp. 323-329, 1975 Heft 12 pp. 397-403, 1978 Heft 5 pp. 239-252.
8. Messerer, Wilhelm: "Geometrische Raster für visuelle zeitliche Kunst-

werke. Figuren von Reinhard Lehnert." In: "Zeitschrift für Asthetik allgemeine Kunstwissenschaft",Bonn XXI/1 1976 pp. 130-138. -- A review of my publications on the theme, with 2 pictures. I cite: "It is today a downright burning problem how structure and concrete entirety can be united; that applies especially for art and science of art. The inner-stars have solved this problem in their partial way. Works of art whose bases they are would be performed in a certain way by by this solution. -- As structured such entireties are different from many figures of older times; but they are different above all by their transparence. With good reasons, Lehnert sees in it a special merit of his discovery, what is more: the 'basic idea of the inner-star' ...With an instrument that resumes in many a way what is scattered in our modern world, 'some work' could well be done." (pp. 136 - 137).

B. In English and in French.

1. "Mathematics Teaching" England, No. 55 (summer 1971), cover and pp. 36-43: "Layered Surface Design, its Pictures and Games"
2. "Mathematics Teachers Forum" England, Bulletin 51 (Sept./Oct/ 1973) pp. 6-12, and Bulletin 52 (Nov./Dec. 1973) pp. 10-12: "Geometrical Pictures, a Contribution to a Reform of Mathematics and Art Teaching".
3. "Engineering Design Graphics Journal" USA, Winter 1975 Vol. 39 No. 1 Series 116, cover and pp. 7-18. -- This article is a reprint of the article mentioned under No. 2.
4. "Mathematics in School" England, Jan. 1975, cover and pp. 16-19, and March 1975 pp. 18-20: "The 'Inner-Stars', '-Pictures' and '-Games', a Contribution".
5. "Mathematics Education, Journal of Japan Society of Mathematical Education" Japan, Nov. 1973 pp. 275-280: "The 'Inner-Stars', ...".
6. "Delta-K" Canada, Nov. 1974 pp. 16-20: "The 'Inner-Stars', ...".
7. "Mathématique et Pédagogie" Belgium, 1/2 (Mai-Juin 1975) pp. 77-90, and 1/3 (Sept. - Oct. 1975) pp. 119-128: "Les 'étoiles en couches', les 'images en couches' et les 'images mouvantes en couches', une contribution à la reforme de l'instruction géométrique et artistique".

Yaakov Arwas
Technion - Israel Institute of Technology
Visiting Professor of Design
Tufts University



Borah L. Kreimer
Northeastern University

ENGINEERING DECISION-MAKING WITH THE COMPUTER

Since the advent of the machine that we now know as the computer, its uses have been constantly explored. In the past there were many instances where it has been used more because of its glamour than its practicality -- it was the " in thing". It was used "to derive greater accuracy" to mathematically involved problems where accuracy was unnecessary. It was used to solve problems for the purpose of satisfying personal curiosities. Much of this continues, even now. However, other than this "fun", a great number of practical applications can be, and have been, found if we understand the computer not to be a toy, but a physical tool which enables tedious solutions to analytical (mathematical) and/or graphical problems to be developed quickly and accurately.

Today, the computer is used in engineering to solve repetitive problems involving mathematics; with the plotter, various graphical presentations are being made. The time and cost involved in these graphical computer activities are, for the most part, prohibitive, especially where orthographic drawings are concerned. This can easily be understood since working drawings are usually made only once and thus it is easier and quicker, as well as less expensive to perform the task "long hand". Corrections are accomplished quicker by the draftsman than by the computer since data must be programmed, fed to the machine, necessary corrections made and the process repeated before the drawing is available.

Although Engineering Design has always been a part of Engineering studies, it was concerned with the analytical rather than the creative aspects. (The term "analytical analysis" usually relates to "mathematical analysis"). Design, however, must also concern itself with other considerations such as Aesthetics and Human Factors. To make decisions in these areas of design it often becomes necessary to have a series of layouts from which the designer may choose the one that is believed to best suit the particular situation.

The preparation of material that may be necessary for a subjectively oriented decision may be long and tedious in the making. Should this preparation be programmed so that the computer would present us with the required material, much time can be saved and many more choices placed at our disposal. In fact, using some of the basic principles of Descriptive Geometry, standard programs can be developed so that only necessary data would have to be added for purposes of making a decision in a particular situation. Some of these basic principles for which standard programs may be developed are for solutions to determine true lengths of lines, angles between intersecting or skewed lines, normal view of a plane, angle between planes, etc.. Since one can develop programs to plot a variety of standard geometric shapes and intersections of object, it is also possible to use many of our Descriptive Geometry problems for practical design purposes where mathematics is not a primary factor.

Let us examine two instances where computer output may be used to make non-mathematical decisions.

EXAMPLE 1

Assume that a new style of automobile is to be developed. One of the new features is to be the front seat. In considering the styling of the seat it is necessary to examine the positions of its two parts ----the seat and the back ---- in relationship with each other, with the ceiling of the car and also with the steering wheel. By developing a silhouette of an average person, according to anthropometric data, and a series of combinations of positions of the parts, it is possible to determine that which will probably be most comfortable for most people.

Since the designer wants to find the most suitable angle for the seat, it would be advantageous for him to analyze the various alternatives that could be made available to him. This could be accomplished by rotating the seat and its back-support about their common axis.

Both planes -- seat and back-support -- could be represented by their edge views in the form of line segments, as shown in Figure 1. Using a loop in the program for a circle, the computer could plot as many alternative positions as may be desired.

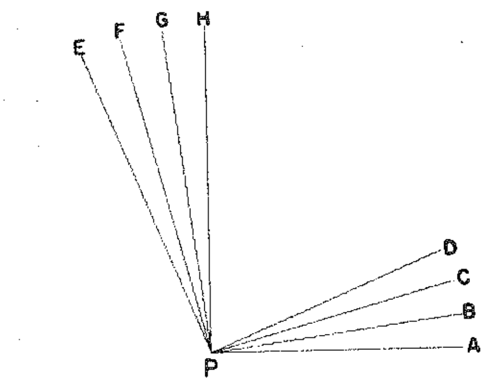


Figure 1. Positions of Seat And Back-Support

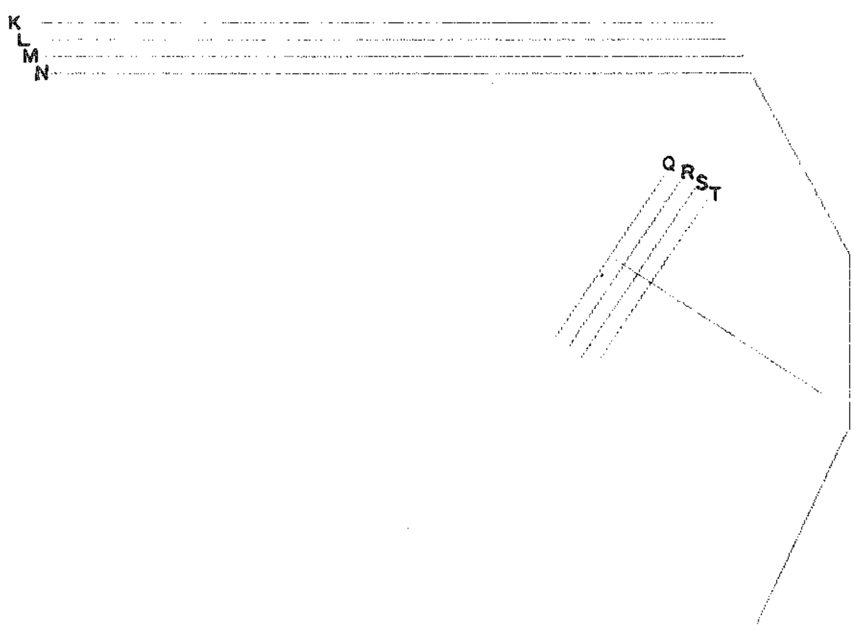


Figure 2. Positions Of The Car Roof And The Steering Wheel

In addition to the seat and its back-support, the designer may also want to see a variety of heights of the car ceiling and/or the steering wheel locations. A program for the translation of a line segment could have the computer plotter trace as many alternatives as may be desired for each of these items, as shown in Figure 2.

The designer may now want to see a particular combination of seat C, back-support G, roof N and steering wheel Q. All of these are to be with reference to point P in a given position. This would merely require the designer to introduce into his respective loops a logical IF statement such as, in Fortran

```
IF(I.NE.M)GØ  TØ N
```

with "M" being the integer number of the required position and "N" the integer number representing the end of the loop. Thus, the plotter would trace the combination required as shown in Figure 3. It is obvious that the designer may call for as many alternatives as he would want by changing the value for "M".

EXAMPLE 2

One of the standard problems that has been used in Descriptive Geometry required the student to find the angle between two parts of a windshield. This, of course, is a problem to find the angle between two intersecting planes. A practical purpose for the required objective was seldom -- if ever-- given. Some may have indicated the necessity for a special brace for the windshield parts to be held together in a given position. However, other objectives for consideration could be to determine the best angle between the planes for the purpose of better visibility, better aesthetic appearance, most comfort for the pilot and/or passenger, etc.. This may require the basic top and front views from which the choice of angles may be made to suit the needs of the designer. This information could also be used for analytical consideration as that concerning wind resistance.

Figure 4 illustrates the use of our windshield problem. The two front panels of the windshield are in alternate positions. The computer is programmed to produce an output giving the values of the angles for the various positions of the panels as shown in the table of Figure 5.

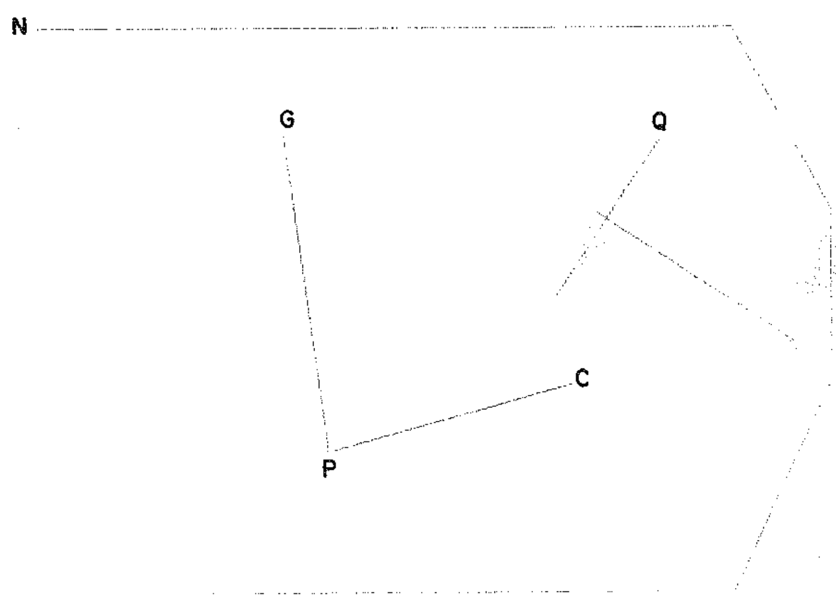


Figure 3. A Combination Of Specific Elements Of The Variables

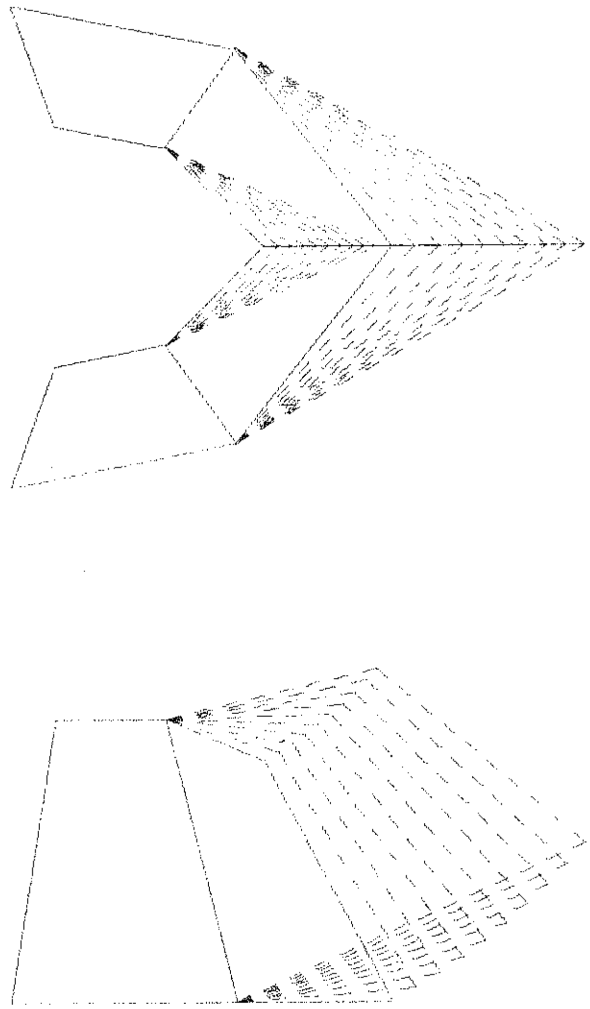


Figure 4.
Alternate Positions Of The Windshield Panels

SUMMARY

Both of the problems that were mentioned illustrate a use for Descriptive Geometry that has not previously been emphasized. Perhaps we felt that such objectives would require long and tedious study, as well as much work in pushing the pencil as often as may be necessary to graphically develop the many possibilities. Yet, once a program is made to call for the required graphical output, the designer may request any number of alternatives as he would want in order to arrive at his best decision.

Since engineers must make many decisions other than those based on mathematical analysis, they must have an understanding of the variety of tools available to them. Some of these tools are Engineering Graphics (including Descriptive Geometry) and the concept of Engineering Decision-Making along with programming for Computer-Graphics. A combination of these tools and the knowledge of how to put them together should, hopefully, provide better engineering decisions than in the past.

FOR I=	1			
ANGLE (RADIANS)=		1.7668709	ANGLE (DEGREES)=	101.2343300
FOR I=	2			
ANGLE (RADIANS)=		1.6278420	ANGLE (DEGREES)=	93.2685550
FOR I=	3			
ANGLE (RADIANS)=		1.5066398	ANGLE (DEGREES)=	86.3241750
FOR I=	4			
ANGLE (RADIANS)=		1.4010091	ANGLE (DEGREES)=	80.2719780
FOR I=	5			
ANGLE (RADIANS)=		1.3088294	ANGLE (DEGREES)=	74.9904610
FOR I=	6			
ANGLE (RADIANS)=		1.2282051	ANGLE (DEGREES)=	70.3710250
FOR I=	7			
ANGLE (RADIANS)=		1.1574914	ANGLE (DEGREES)=	66.3194290
FOR I=	8			
ANGLE (RADIANS)=		1.0952855	ANGLE (DEGREES)=	62.7552910
FOR I=	9			
ANGLE (RADIANS)=		1.0404019	ANGLE (DEGREES)=	59.6106900

Figure 5. Table Of Angle Values

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ENGINEERING GRAPHICS AT NATIONAL TAIWAN UNIVERSITY

The engineering profession in Taiwan, Republic of China considers engineering graphics an important part of the educational process for engineering students in certain disciplines. In the College of Engineering of the National Taiwan University, engineering students in the Departments of Civil Engineering, Chemical Engineering, Mechanical Engineering, and Naval Architecture are required to take graphics courses.

The Department of Mechanical Engineering requires the most coursework and three academic years are needed for the mechanical engineering student to complete the sequence of courses which totals eleven semester hours of credit. There is a two-semester sequence called Graphic Science I for first-year students. The same course title is used for both semesters even though two separate courses of one semester hour credit each are involved and classroom time is three hours per week. Second year students receive Graphic Science II during the fall semester and Mechanical Drawing during the spring semester. Both courses are two semester hours of credit each and classroom time for these courses is six hours per week. Seniors receive Machine Design Drawing which meets six hours per week. The same course title is used for both semesters with two semester hours of credit during the fall semester and three semester hours of credit during the spring semester.

The Departments of Civil Engineering and Chemical Engineering require the same course sequence snd credit hours as the first year students in the Department of Mechanical Engineering. The Department of Naval Architecture requires Graphic Science only in the first semester for the first year students. The course is one semester hour of credit. The second year students receive the same course, titled "Hull Form Calculation and Drawing", during both semesters. The course is two semester hours of credit each.

Engineering students who take graphics courses have had no mechanical drawing background before entering the university. Therefore, all students must start with the fundamentals of graphics. Since only students with good academic backgrounds are admitted into the engineering school, they have no problem learning all the aspects of engineering graphics.

The Graphic Science I course is devoted to descriptive geometry. By using projection theory, the illustrative method is used to show the point, line, plane, solid, shape and size relationships. The students are trained to imagine, analyze and visualize. When and if the need arises the students can use the principles learned previously to solve vector problems and to determine intersections and developments so that the objects can be described correctly. This course consists of one hour of lecture and two hours of laboratory per week.

The sophomore class is devoted to engineering graphics. In the beginning, the students are taught graphic language such as orthographic projection, pictorial drawings, auxiliary views, sectional views and dimensioning. The course also includes precision and tolerance, standard size parts and tools, gears and cams, welding and riveting, piping, structures, charts, graphs, and diagrams. In this year, the student attends two hours of lecture and four hours of laboratory per week. Problems are drawn both from the textbook and from applied blueprints. The students make freehand orthographic sketches and check by using freehand pictorials. They also practice by measuring actual objects with instruments and then drawing the objects. Gradually, the students are given more and more engineering application problems to make engineering drawings.

Sometimes students are given "ditto" sheets to practice how to read drawings, which works out very well. Although lecture time is at a minimum, these students can understand the graphical method very well due to their excellent learning ability. During the drawing exercises, the students work on the board for freehand sketch and instrument drawing. Instruction is provided in various drawing methods including pencil drawings, ink drawings, and tracings.

By the time they are seniors, the students already have had the basic courses in mechanics, mechanisms, materials science, and machine design and therefore they are required to do a graphic design starting with the conceptual design, then on to material selection, calculations, and final drawings. We have found that the students are very interested in this design project, and are motivated to learn more about engineering graphics and other subjects in order to accomplish the work.

Since there are approximately forty students in each class, it is impossible to provide individual instruction for the students. This problem is solved satisfactorily by a) emphasizing the important area in the description of drawing making and showing a practical example drawn in steps during the lecture hour, and b) helping individual students who have questions during the laboratory hours. We have found that creating detail and assembly drawings of actual objects helps the students a great deal in reading and making drawings. elected drawing problems are also used to discuss what should be done to make the drawing correct. This approach enables the students to reduce their possibility of making errors and to establish a good feeling for correct drawings.

The national standard of the Republic of China recognizes both first angle projection and third angle projection, which are also used by the International Organization for Standardization. Our students must work with both and understanding is not a problem. The metric system of measurements is the national standard, but instruction is given in the English system so that both systems are familiar to the student.

A faculty member of Graphic Science in our College of Engineering usually teaches two or three classes each semester. The teacher gets help from two or three teaching assistants in the laboratory and also for grading student work. Two of the textbooks used are as follows:

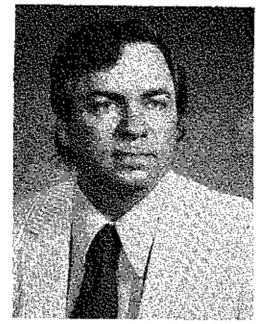
a. Engineering Drawing and Graphic Technology, by T.E. French and C.J.Vierck.

b. Engineering Graphics, by F.E. Giesecke, A. Mitchell, H.C. Spencer, I.L. Hill and R.O. Loving.

To sum it up, our objectives are to teach our students to understand and to apply the principles of projection, to read drawings, to visualize lines and objects in space, to analyze and to solve graphical problems, to design by making detail and assembly drawings, and to utilize graphical methods properly in the solution of engineering problems in surveying, structures, engineering mechanics, mechanisms, machine design, etc.

Most of the graduates from our university take jobs in industry or with consulting firms. Feedback from these graduates indicates that they can generally utilize what they learned in college. They also feel that their on-board experience is very useful for their jobs. They are evaluated highly by their superiors in their ability to read drawings, analyze graphical problems and make machine design drawings. Based upon the above, we feel that our graphics courses very adequately prepare our students to meet their job requirements in industry.

PUZZLE CORNER



Robert P. Kelso
Puzzle Editor

There are two graphics, Figures 1 and 2, by Prof. Abe Rotenberg of the University of Melbourne, which are solutions to the SPRING '77 puzzle and have not been published.

The problem was to find a view in which two skew lines would appear equal in length. b_1-c_1, and d_1-e_1 are the given lines and he begins by drawing a_1-b_1 parallel and equal to d_1-e_1 and operating from there. Similar approaches were taken by several others.

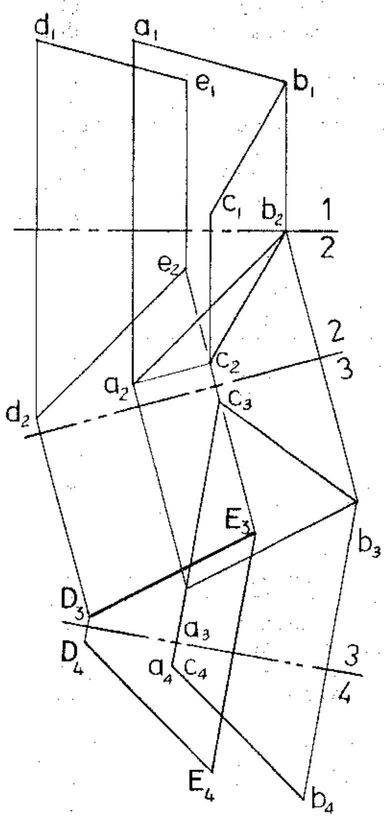


Figure 1

Along with the solutions above, Rotenberg enclosed a general solution in which all cases of arbitrary-skew-lines-appearing-equal may be determined. This is an extremely interesting and challenging problem and has become the new Corner puzzle.

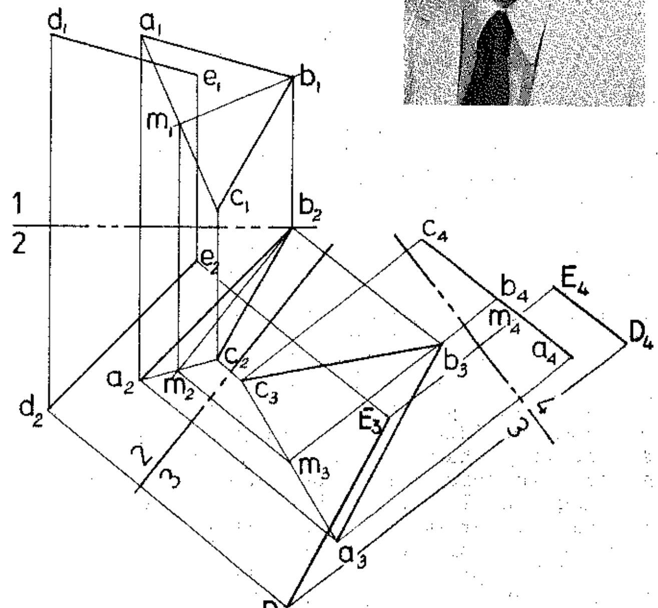


Figure 2

FALL '78 PUZZLE

Given: two skew lines of arbitrary orientation in adjacent orthographic views.

Find: the general condition* which will yield all-views-of-the-two-lines-in-which-they-appear-equal-in-length.

*This is a geometric configuration oriented in space such that the elements of the figure represent lines-of-sight, all of which will yield the given lines as appearing parallel.

I guarantee that lack of responses to the new puzzle will not be because it is too easy!

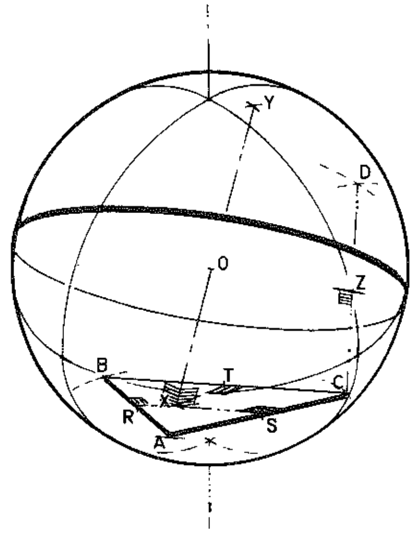
As for the Spring '78 puzzle, the responses were underwhelming. Perhaps it was not as challenging as it appeared at first blush. In any event one solution is suggested here. It relies on the principle that the perpendicular bisector of a chord will pass through the center of the circle (sphere) (Figures 3 and 4).

SPRING '78 PUZZLE

Given: an oblique triangular limited plane, and point not in plane, in any two successive orthographic views.

Find: two orthographic views that would define the diameter and center location of the sphere whose surface passes through each plane vertex and also passes through the non-planar point.

ABC and D are the given points. RX, SX, and TX are perpendicular bisectors. XY is perpendicular to ABC. A plane is perpendicular to CD at midpoint Z. The sphere radius is equal to the TL of either AO, BO, or CO - all of which are equal. Note this problem may be solved without using auxiliaries - just the two principal views.



PICTORIAL

Figure 4

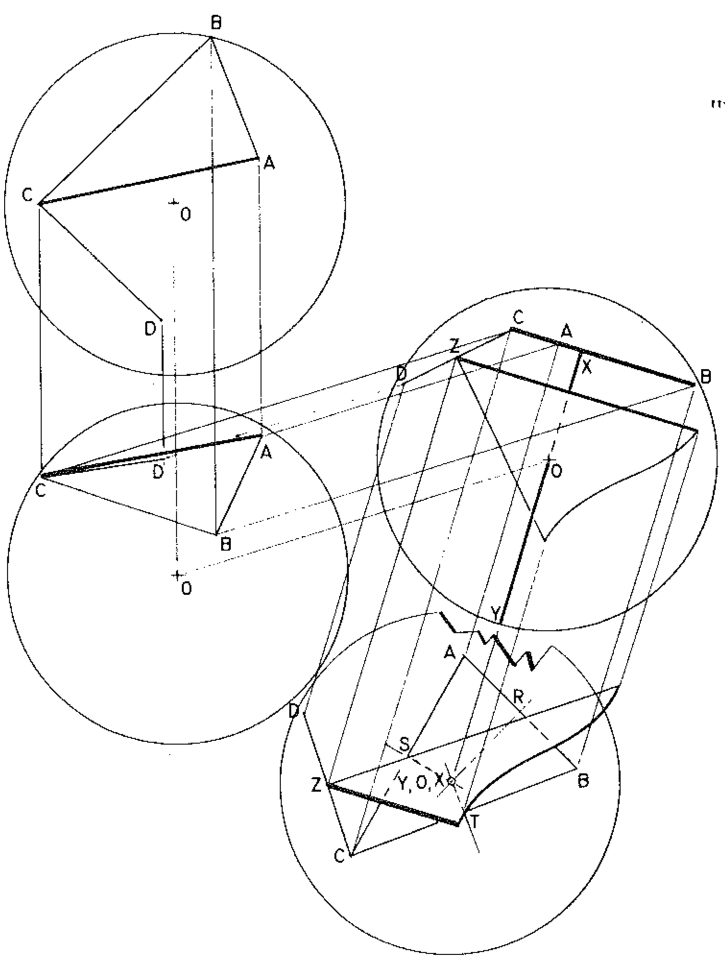


Figure 3

This is a good issue in which to run a "filler". Your ideas are solicited on these also. Call this one

"Visualization Questions from the Final Exam".

(Circle True (T) or False (F)

1. T F If any two lines are, respectively, on perpendicular planes and appear perpendicular in a given view, then at least one of the lines must appear TL in the given view.

2. T F If a skew plane forms a 30^o angle with a frontal plane, then the lines appearing TL on the skew plane in any orthographic projection adjacent to the front view will appear to make a 30^o angle with the edge view of the frontal plane.

3. T F Any two non-parallel skew lines may be viewed such that they will appear perpendicular in an elevation view.

4. T F The true angles formed by any skew line intersecting with any two skew planes will be seen in the view which shows both planes as an edge.

5. T F Two principal planes may be seen together as an edges view in a third successive auxiliary projection.

6. T F If parallel lines in one plane are parallel to parallel lines in another plane, then the planes must be parallel.

See 'ya at the Mid-Winter meeting!

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Suite 400, One Dupont Circle, Washington, D.C. 20036
202/293-7080

INDIVIDUAL MEMBERSHIP APPLICATION

VALID BETWEEN JUNE 1978 AND JUNE 1979 ONLY

Date ______________

I, ______________________ (signature), hereby apply for membership in the American Society for Engineering Education, and enclose $ ________

ıs my annual membership dues for the year. $5.50 and $1.50 of this amount are for a year's subscription to *Engineering Education* and *Engineering Education lews* respectively. The undersigned member of ASEE stands as my sponsor. (If ASEE sponsor is not readily available, application may be submitted to ASEE leadquarters for continuing action.)

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ᴾlease complete the application form below, hand-lettering or typing all entries. Enter one letter or number per block, eaving a blank box for normal separation of words. Use standard abbreviations where possible.

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OVER PLEASE

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(Enter your Divisions/Committees in order of preference) ☐☐ ☐☐ ☐☐ ☐☐ ☐☐ ☐☐

☐ Please check if you have chosen dues paying Division/Committee affiliations.

Date of Birth ☐☐☐☐ *(Month) (Year)*

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ASEE Divisions and Constituent Committees

DIVISIONS

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11 Agricultural Engineering
12 Architectural Engineering
13 Chemical Engineering
*14 Civil Engineering (Construction, Hydraulics, Sanitary, Soil Mechanics, Structural Surveying, Transportation) $2.00
15 Continuing Engineering Studies
16 Cooperative Education
*17 Educational Research & Methods $1.00
18 Electrical Engineering
19 Engineering Economy
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21 Graduate Studies
22 Industrial Engineering

**Include division dues with payment.*

Code

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*24 Computers in Education $1.00
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26 Mathematics
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*28 Mechanics $2.00
29 Mineral Engineering (Geology, Mining, Petroleum, Metals, Ceramics)
*30 Nuclear Engineering $2.00
31 Physics
32 Relations With Industry
33 Engineering Technology
34 Environmental Engineering

Code

35 Instrumentation
36 Engineering Libraries
37 International
50 Biomedical Engineering
57 Engineering Management
61 Experimentation and Laboratory-Oriented Studies (DELOS)

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54 Energy Conversion
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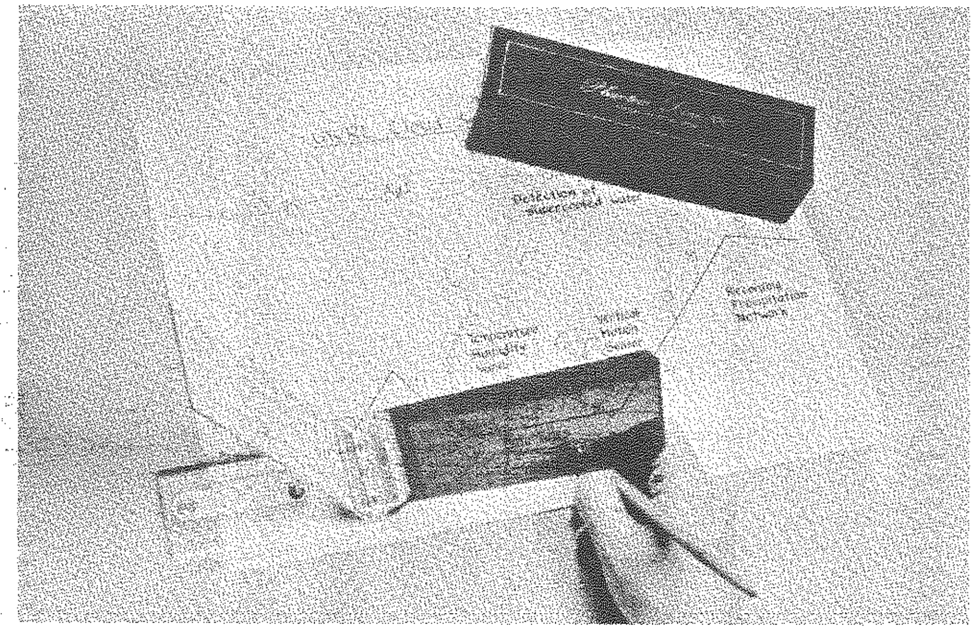

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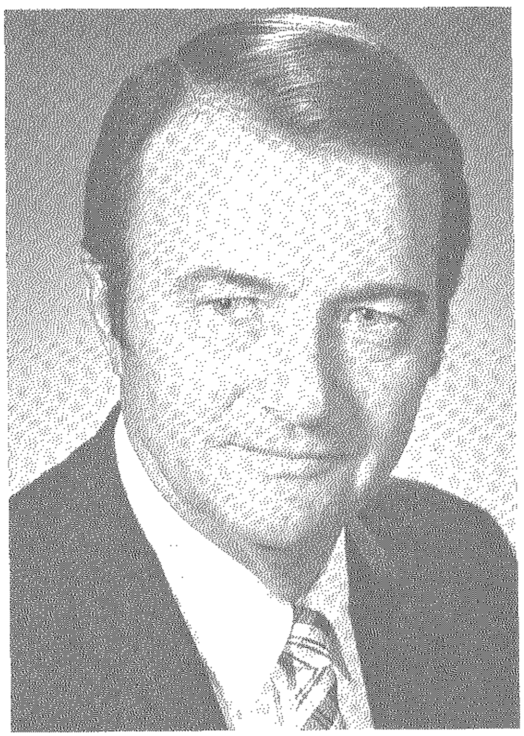

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