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Volume 86, No. 1

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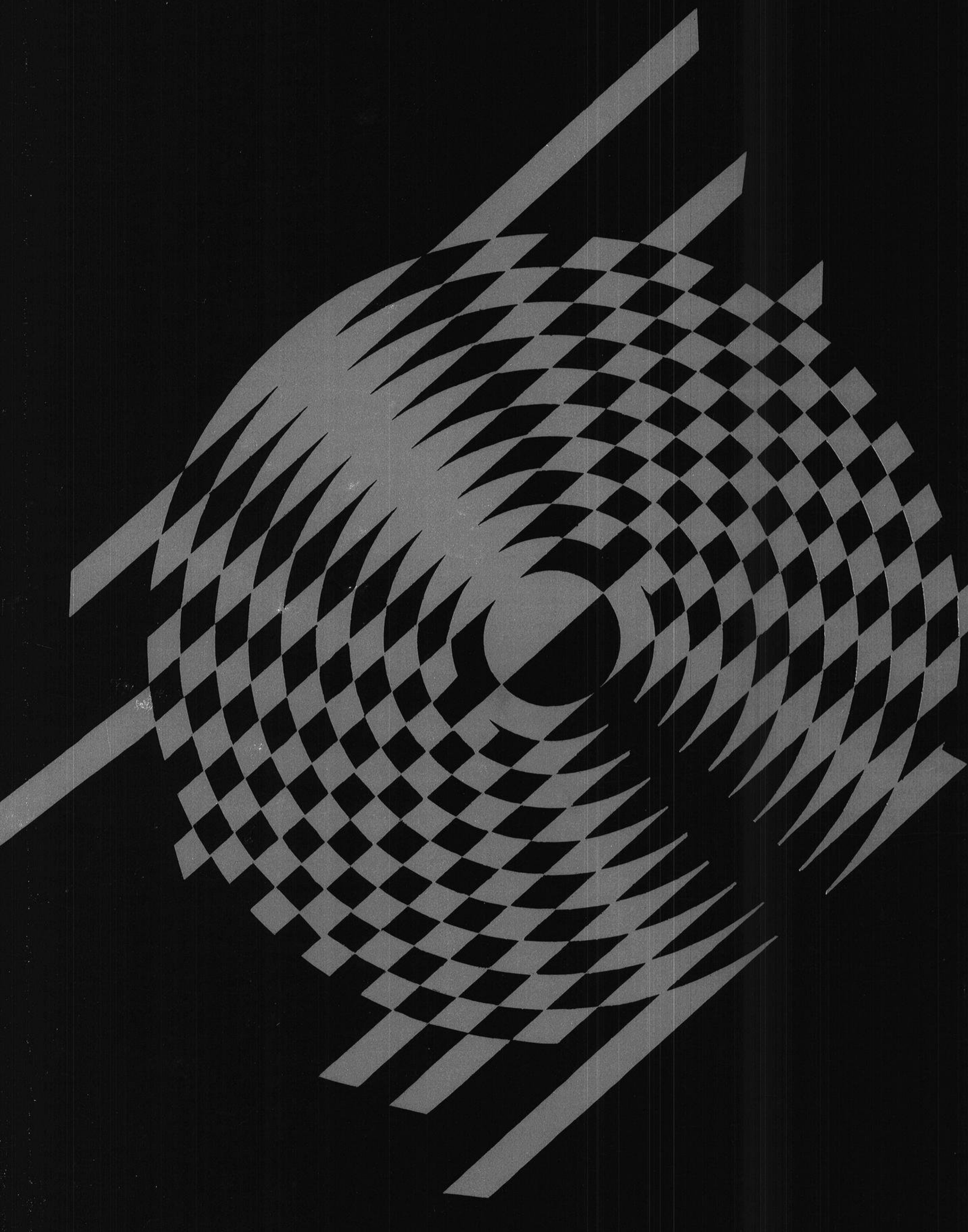
# wisconsin engineer



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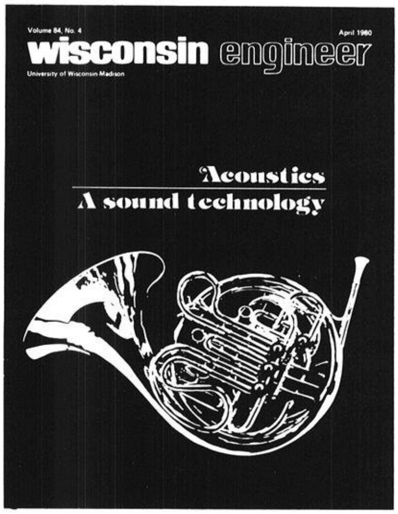
wisconsin engineer

PUBLISHED BY THE ENGINEERING STUDENTS OF THE UNIVERSITY OF WISCONSIN-MADISON, OCTOBER, 1981

## FEATURES






*page 6*

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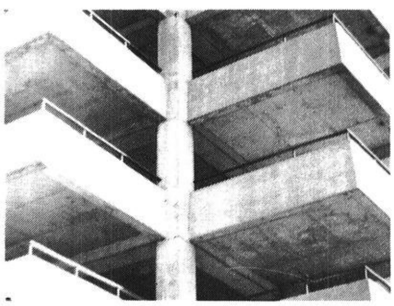

*page 21*

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# Editorial

There is excitement in the air. The feeling of starting off fresh has accompanied the beginning of the new school year.

The staff of the Wisconsin Engineer feels this is especially true for us. The results of staff recruitment in September proved to be very successful. People who would like to work on the W.E. are always welcome, and I think the staff thus far is exceptional. Everything adds up to the fact that the W.E. is *going places.*

Appropriately enough, this is the theme for the first issue of the 1981-82 school year. We have a collection of articles that will take you places in every sense of the word. A photo essay tour of the campus area will help you to see the same old things in a new light. The report on the Engineering College Magazine Association convention in Raleigh, North Carolina, will tell you about an organization that supports what we do on the magazine and also keeps us solvent! Suggestions on dressing for an interview are presented to help you get somewhere as the step into the real world draws closer. Exercising the mind is always beneficial, and Mind Games will give you a real workout, intellectually speaking of course.

Lastly, but most importantly, W.E. introduces you to the Man-of-the-Eighties, John G. Bollinger, the new Dean of the College of Engineering. The informative article about Dean Bollinger will tell you some of his background and show that we, the engineering students of UW-Madison, are really going places with this man at the helm. An interesting sidenote is that Dean Bollinger was Associate Editor of the Wisconsin Engineer when he was working on his undergraduate engineering degree here in 1956. I can see the headlines now . . . "ASSOCIATE EDITOR OF W.E. MAKES DEAN." Seriously, the staff of W.E. would like to extend an especially warm welcome to Dean Bollinger. As the new editor of the Wisconsin Engineer, I'd like to dedicate this first issue of 1981-82 to the new Dean, John G. Bollinger.

Joan Heitkamper
Editor

# Wisconsin Gains on Purdue

by Becky Geimer

*Cooperation and competition can go hand in hand as Becky and other staff members of the Wisconsin Engineer learned when they went south for the ECMA convention. Becky is majoring in Communicative Disorders and is managing editor of W.E.*

On April 9th through the 11th of this year, college students from all over the United States were united in Raleigh, North Carolina. The event which brought these students together was the 1981 ECMA Convention.

ECMA (Engineering College Magazines Associated) is an organization of college engineering publications across the nation. At present there are 37 member schools and 15 nonmember schools of the organization. It was founded in 1920 largely through the efforts of Mr. W. B. Littell of the New York firm Littell-Murray-Barnhill.

Littell-Murray-Barnhill is the advertising representative for ECMA. They solicit and distribute all national advertising for the organization.

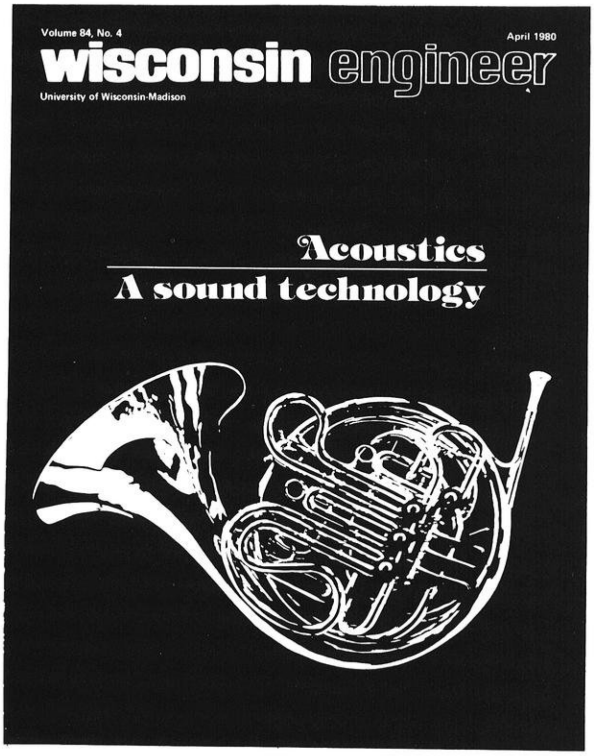
The aims of ECMA are to promote the improvement of engineering college journalism, to standardize size and format, and to simplify the soliciting and distribution of national advertising.

Each year ECMA holds a convention to which members of the organization send representatives. The program of the convention includes a review of the year's activities, study and discussion of the problems inherent in the publication of engineering college magazines, as well as discussions and demonstrations of ways of improving these magazines.

Hosted by the *Southern Engineer*, the 1981 ECMA Convention was a great success. It provided an opportunity to meet new people, share ideas, and gain more knowledge. Workshops were held on various topics ranging from photography to fund-raising. Luncheons, banquets, and a pig roast provided ample nourishment for all who attended. Business was discussed, problems were solved, and awards were presented.

Awards are distributed at each convention to acknowledge and stimulate excellence in the publication of engineering college magazines. This year the *Wisconsin Engineer* received seven awards out of an eleven possible categories. Among these awards were *2nd* place for Best Layout — All Issues and *3rd* place for Best Single Cover.

Next year's ECMA convention will be held on April 2nd and 3rd in West Lafayette, Indiana. The host will be the *Purdue Engineer*. The *Wisconsin Engineer* hopes to be well represented. □




*Prize winning cover of the Wisconsin Engineer, April 1980*

# Meet the Dean

**by John Wengler**

*A product of Wilmette, Illinois, John is a sophomore in Civil Engineering. As a writer and associate editor he contributes a lot to the making of the* Wisconsin Engineer.


*Dean John G. Bollinger*

The story of Dean John G. Bollinger is the tale of the Wisconsin engineer himself. Bollinger now sits at the helm of the college where he earned both his Bachelor's Degree and Ph.D. His years in Madison as a student, professor, researcher, and administrator have been marked by his energetic devotion to the betterment of our College of Engineering.

John Bollinger was born May 28, 1935, in Grand Forks, North Dakota. His father, a UW-Education graduate, was a professor at the University of North Dakota.The family moved to Long Island in 1937 when Professor Bollinger accepted a new position in New York.

In 1953, Bollinger came to Madison as a Mechanical Engineering undergraduate. Asked why he left the East to study in Madison, Bollinger told the *Wisconsin Engineer*: "When I was a junior in high school, a friend of mine and I took my old Henry J, put a mattress in the back (the back seat could fold down into a bed), and decided to go around the country camping and looking at college campuses. It was our excuse for our big trek around the country. And so, we took off for about six weeks: through the East, the Mid-west, then through Canada, Montreal, and down through Boston. We each chose a school. Cornell was one. I was interested in Princeton. But I liked Wisconsin. It had a sailing team, it was pretty, a good school, and lastly, but not unimportantly, my father had graduated from here in the 20's."

As a student, John Bollinger was active on campus. He was a member of the Theta Chi fraternity, the General Chairman of the Engineering Exposition of 1955-56, and the President of the student chapter of ASME. Bollinger was also a member of the UW Marching Band and served one year as the Vice-Commodore of the Hoofer Sailing Club.

During Bollinger's sophomore and junior years, he contributed articles to the *Wisconsin Engineer* and was elected Associate Editor-In-Chief his senior year. The articles he contributed reflected his interest in automated controls and the day's newest technologies: the Boeing 707 (back then it was new), helicopter technology, and the handling of radioactive materials. "I was interested in automatic controls even as a student," Bollinger remembers, "but in the 50's, we didn't have a lot of courses in these fields which were just emerging. A few courses were available for graduate students, but nothing for the undergrad. So I did some of these things on the side. All my articles were about emerging technologies, and they all tied into using automatic controls.

"After finishing an article," Bollinger continued, "I'd turn around and make a speech out of it for an ASME competition. I always liked to kill more than one bird with one stone."

Following his graduation in 1957, Bollinger was awarded a graduate fellowship at Cornell University, and it was there he earned his Master's Degree. After returning to Madison, Bollinger earned his Ph.D. in 1961. His thesis was titled, "A Computer Study of Nonlinear Geared Torsional Systems."

Bollinger has continually been involved with both education and research at the University of Wisconsin. During his senior year, he was a TA for Drawing and Descriptive Geometry. Bollinger's initial appointment to the University was as an instructor in 1960; the next year he was made an assistant professor. Bollinger became a full professor in 1968. From 1975 to 1979, he served as the Chairman of the Department of Mechanical Engineering.

Bollinger developed and taught many of the Mechanical Engineering courses in automated controls and computer design. An avid sailor, Bollinger also developed ME 240, "The History and Science of Sailing," in 1974.

Thirty-one Master's students and sixteen Ph.D. students have been supervised by Bollinger in the past years. Neil Duffy, now a member of the Mechanical Engineering Department, was supervised by Bollinger during his graduate work. "I remember going into his office feeling worried and down about a project," Duffy recalled, "and the next thing I knew, not knowing what hit me, I was coming out of Bollinger's office feeling great. He was always optimistic, looking ahead and seeing success."

Presently, Duffy and Bollinger are co-advising nine graduate students studying guidance systems for industrial robots.

Bollinger's research interests include the computer analysis of the dynamic behavior of machine drive systems, environmental noise control, position control for automatic welding, and many other fields of study.

CAMPUS NEW

*compiled by Dick Peterson, m'57 and Larry Barr, m'57*

Ron Schroeder

John Bollinger

NEW EDITORS, BUSINESS MANAGER ELECTED

The board of directors of The Wisconsin Engineering Journal Association elected the officers who will guide the *Wisconsin Engineer* through the next year.

As announced by board chairman Wayne K. Neill, Ron Schroeder, m'57, will succeed present editor Bob Hentges, and Bob Walter, met'57, will take over the post of Business Manager, now held by Barclay Gilpin. In addition, John Bollinger, m'57, will work with Schroeder as Associate Editor.

These new officers will officially assume their responsibilities for the May issue of the Engineer, although they will be broken in on next month's Engineer. [illegible]



Robert Walter, [illegible] Manager

[illegible]

John Bollinger, Associate Editor

[illegible] of the editorial staff [illegible] Assistant Editor. He worked previously on the article staff as a sophomore.

John at present has the responsibilities of General Chairman of the 1956 Engineering Exposition. He also is a member of Polygon Board, ASME, Tau Beta Pi and Pi Tau Sigma.

He is a mechanical engineer from Manhasset, New York.

1956 EXPOSITION NEWS

[illegible], *Publicity Manager*

This will be the final report [illegible] before Exposition [illegible]

*A page out of Dean Bollinger's student history.*

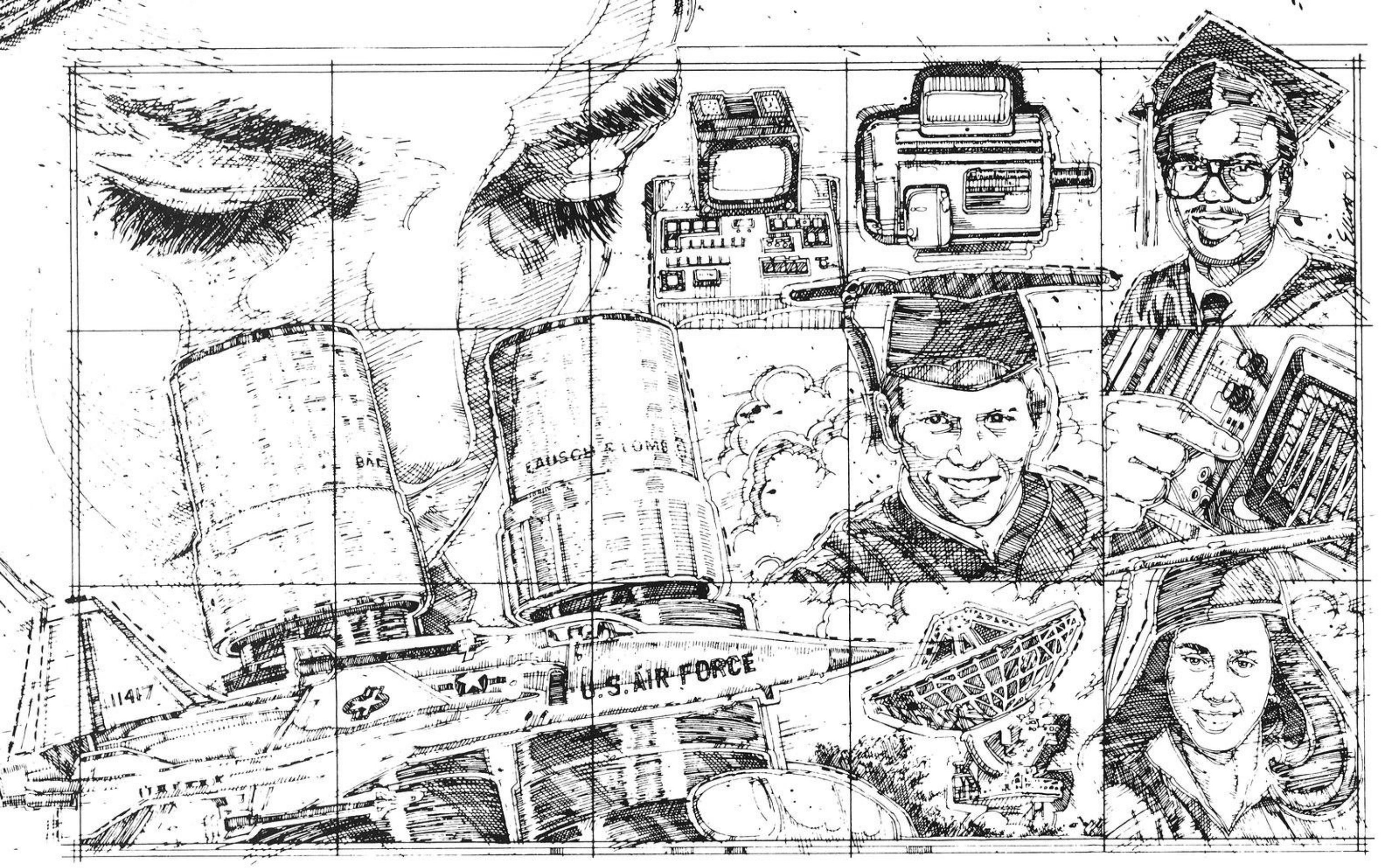
"Bollinger has worked on industrial robotics and noise control in the industrial workplace —subjects on which he has published or delivered well over 100 articles, invited lectures, and papers. He is the co-author of a textbook on automated controls (which is used on campus) and is author of two book chapters on shock and vibration. He has been a consultant to thirty-two companies, supervised fifty-two research projects, and holds eight U.S. patents."** In 1973, he was appointed the Bascom Professor of Mechanical Engineering, an honorary award for outstanding researchers in the university.

Bollinger spent fifteen months as a Fulbright Post-doctoral Fellow at the Institute for Machine Tools, Aachen, Germany, in 1962. He was awarded a Fulbright Inter-country Award in 1963 and again in 1980. Last year, Bollinger was a visiting Fulbright Professor at the Cransfield Institute of Technology in England, and spent the month of June as a visiting professor at the University of Stutgart, Germany.

Bollinger and his wife Heidelore have three children: William, Kristin, and Pamela. William is a commercial fisherman in Alaska, Kristin is a junior here at the UW, and Pamela is a high school student who also plans to attend this university. Bollinger's interests include his Thunderbird, travel and sailing.

Neil Duffy, his friend and colleague, says Bollinger "lives on a very high plane, but he's a very earthy guy. A great combination." Bollinger has done so much for this college, he is truly the Wisconsin engineer. The College of Engineering is fortunate to have such a dean. Bollinger can serve as an inspiration for both students and faculty alike in continuing the traditions of the University of Wisconsin. □

***Perspective*, College of Engineering, Fall 1981.

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# The Dean's Perspective

**compiled by John Wengler**

The changing of the guard in the dean's office has passed unseen by most students. The appointment of Dean John G. Bollinger marks the beginning of an administration facing new budget cuts and educational transitions into the computer age.

Dean Bollinger discussed with the *Wisconsin Engineer* the college's education system and its ability to prepare the student for his career in industry. We believe that the dean's perspective will be of value to students. The following are Bollinger's comments on issues important to students interested in the quality of their education.

**Computers and Education**

Although no new computer course credits will be required for graduation, students can expect to use more computer methods in their engineering courses. For example, Drawing and Descriptive Geometry will be taught with a new computer terminal system in the General Engineering building.

"I started my career teaching this course," Bollinger remarks, "and now this subject is being taught with a computer. The student learns the same basics of geometry and trigonometry; and on the terminal, he can rotate views and look at all sides for silly mistakes. It all happens so much faster than by a pencil, it's incredible.

"In the future, it won't be efficient to draw plans manually and utilize the data required in the design of complex structures. Visualize the ability to conceive a solid shape on the terminal, and then once having the plan in the computer, manufacture that part with machinery programmed with your data."

Dean Bollinger foresees that "all freshmen who arrive on this campus will eventually begin to visualize things with a computer data base." Programs like Descriptive Geometry will prepare the student to enter the world of industry, which already depends heavily on computer design.

**The State of the College**

"In the early seventies," Bollinger explains, "we went through a period when technology was not very popular. We had very low enrollments. Those were times when the faculty had time to spend with their students and also to sit down and think about their research, and this shows. If you look at our records, immediately following the period of low enrollments, our research just sky-rocketed. What was happening was that the researchers were doing

*Dean Bollinger forsees that "all freshmen who arrive on this campus will eventually begin to visualize things with a computer data base."*

interesting, creative things that have really paid off in world-wide expertise, respect, and funding for the faculty. Our proof of productivity is right there.

"Now, by looking at those same records, we see that our enrollments have nearly doubled in the past decade. In the same period, the college has also doubled its research programs. We have not been allowed to hire more faculty; this means there are people working a lot harder in our system. What we have done is increased the utilization of our research facilities and increased the class sizes. There was no alternative.

"With the higher enrollments, we got into a situation where it was physically impossible for our professors to handle any more students. It was frustrating to the professors to take on what they did, because they knew some students were not comprehending the material with such large class sizes. When the student complains about the overcrowded classrooms, he only perceives what is happening directly around him. The student will still graduate and feel satisfied with his education, but the faculty feels the increment of change: the pressures of past and present. The instructor perceives the quality deterioration because he can't do things the way he did in the past.

"We couldn't go on cranking the system up like this. Finally we said, 'This is a professional program, and if we are to maintain it, we must design the system for capacity. We must also design a method of controlling student flow in and student flow out.' Like a bathtub, if the faucet is bigger than the drain, the tub will overflow. We now have controls of student inflow at two levels: the new pre-engineering classification system for a student's first two years, and now-higher grade point average requirements for students to enter and remain in the College of Engineering.

"We have invented many ways of substituting new things for old. When I was department chairman of Mechanical Engineering, I went down to Professor Bill Feiereisen's office and asked, 'Bill, how are we going to spend less money preparing to teach the ME 370 thermal lab?' We worked out a plan and received some money for Professor Feiereisen to make video-tapes to prepare the student for

*"I think independent learning . . . is much more thorough than being led through a problem by anybody. The student's understanding and retention will be greater, and the student will be prouder of himself."*

lab. The tapes cover the instrumentation and operation details and set the student up to run the experiment. The TA then has more time to prepare the experiment while his students watch the tape, and he will also have more time to answer questions.

"A couple of weeks ago," Dean Bolliger contined, "I went down to Professor Feiereisen again and asked how the quality of instruction in ME 370 compared to five years ago. Bill replied that it was 'immensely better.' We have found with this program we can produce a higher amount of credits per TA assignment. Now that I can see in perspective, I think this type of program is worth it."

A number of faculty have begun experimenting by putting homework assignments on videotape to augment their lectures. "The idea is that if the student has the answer to the problem, he will try to work it through. If he doesn't get the right answer, he can go to the tape that explains the solution. I think independent learning, where you force yourself to a comprehension, is much more thorough than being led through a problem by anybody. The student's understanding and retention will be greater, and the student will be prouder of himself. It's a question of how much time he is willing to spend massaging his own intellect and work the problem correctly.

"We've probably got as good a videotape program system available for instruction as any engineering college in the country, and we could make much more use of it. So maybe if we fire up all these things, we can handle sixty plus students in our lectures."

### Budget Cuts

"We will do more careful accounting and planning than was necessary before. We run on a very tight margin. Last month we thought our system was in pretty fair shape, but there was another budget cut, and that really hurt.

"We have got a lot of what some people would call luxuries: a counselor program where students can go for advice, a fantastic minorities program, and a terrific videotape system, to name a few. These programs all require people; and these are the people who support a massive educational system. If we have to do without these programs, our whole system will degenerate very rapidly.

"As long as they stop taking money away from us, we think the system is getting into equilibrium. Now we have to be creative. To do that, we will have to have the support of industry, and that's what we're working on."

### The College and Industry

To initiate a direct relationship with industry, the College of Engineering has set up an Industrial Liason Council, a group of company presidents and top industrial leaders from Wisconsin and large firms around the country. The council will meet in Madison several times a year to discuss the state of the college, its enrollments, finances, and progress in research.

"Industry likes to be efficient, knowing the job is being done right. I'd like to show them evidence that our college is running efficiently. They can help us as advisors because they are so good at making judgements on productivity."

The council will be able to gain technological support from the College of Engineering and its research programs. Industry will also benefit when it is able to hire graduating engineers who have seen computer-aided design in their labs, who've seen new kinds of electronic measuring equipment, and other new technologies. "If the university can stay in the technological forefront by doing research and really advancing in ideas, the people coming out of the college can make a substantial input of new ideas and methods when they enter industry.

"We have some of the country's finest basic and applied research programs here in our College. Many people do not realize the fact that our total research expenditures exceed our instrumental budget. These programs are run by outstanding faculty who are international leaders in their fields. One of my major problems now is maintaining an environment (salary, space, facilities) which will support our faculty here at Wisconsin.

### The Future of the College

"Our hope is that we can continue to see the College of Engineering grow in its traditions and to continue to be as good and as well thought of, as it has been in the past. We are entering a new era when it's going to take a creative approach to solve our problems. We're going to try and find the solutions, and that's a challenge I believe I'll enjoy." □

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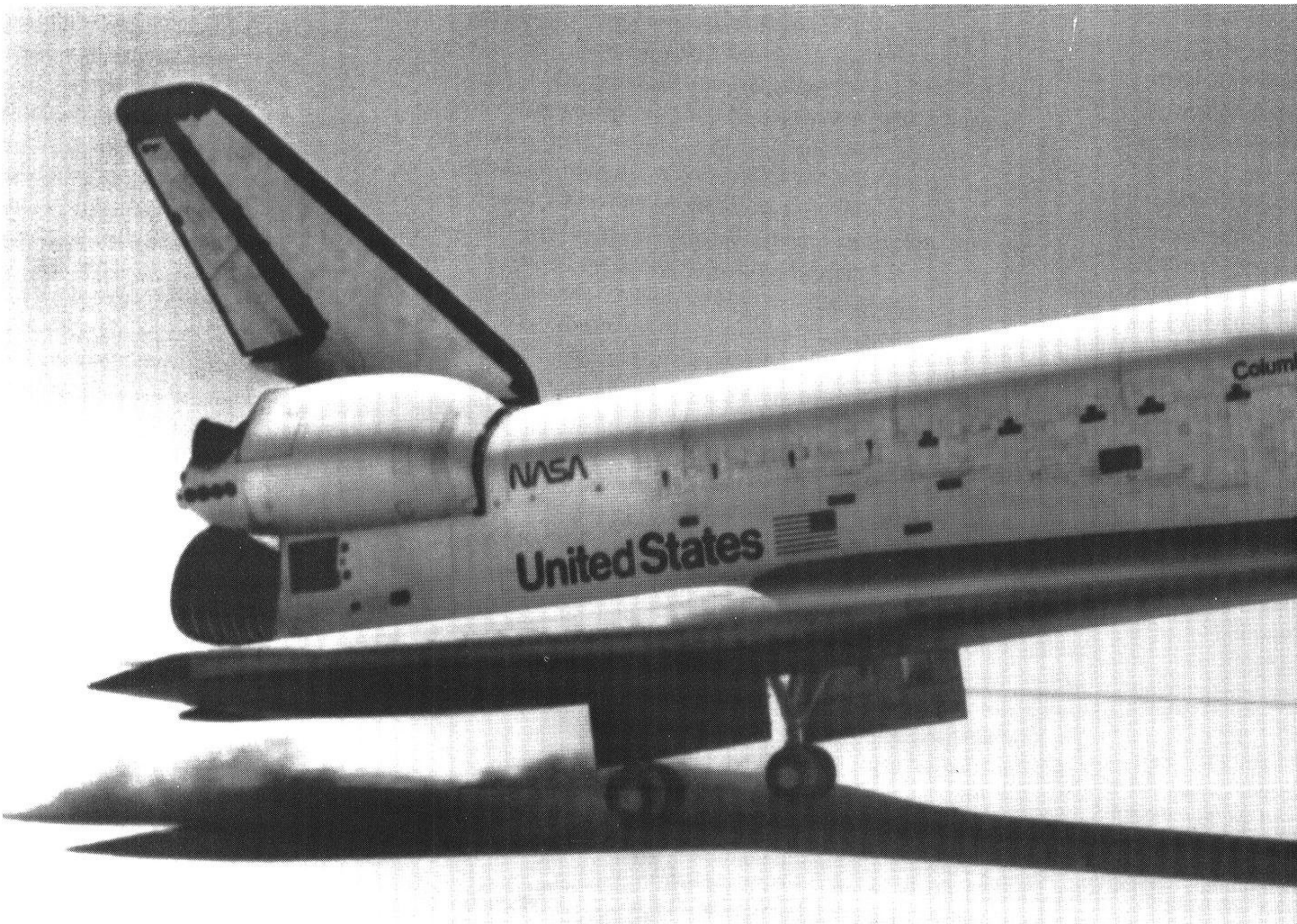

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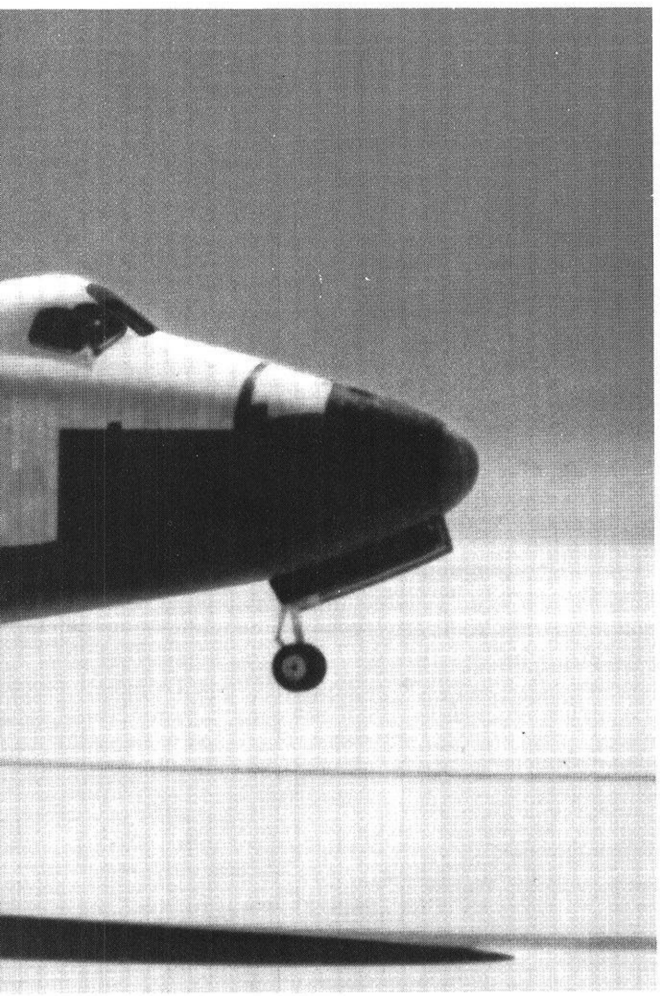

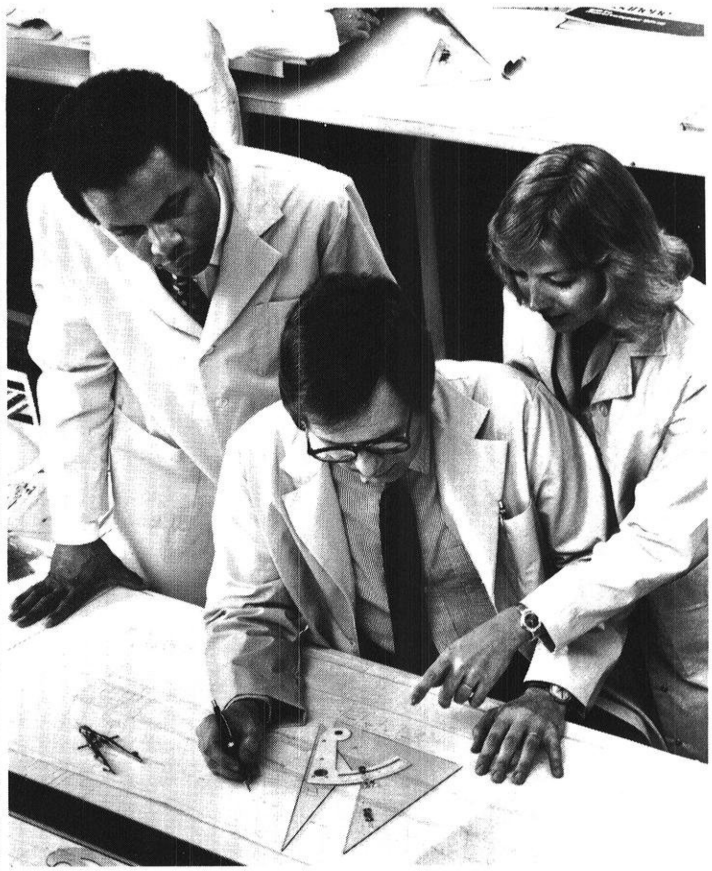

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# The Blue and Gray

**by Will Kenlaw**

*The former editor of the* Wisconsin Engineer *and a senior in Industrial Engineering, Will is about to step into the real (professional) world. The past few summers he has worked with IBM in Milwaukee and thus has firsthand knowledge of options available for interview dress.*

It could be a scene from the battle of Gettysburg—blue coats to one side, gray coats to the other, and a sea of alternating shades in-between. But this is not a battle scene. It's that well-known yet sorely dreaded task called interviewing: that quest for the gold after four years of college (four and a half in engineering). The scene is the waiting area in the Engineering Placement office.

Why blue and gray? It's simple. Engineering is a traditionally conservative profession. Conservative means wingtips, short hair, and *quiet* neckties. Interviewers call it "fitting the bill," creating that ever important first impression. For this purpose, shades of blue and gray are perfect. They are subtle and unassuming. This is important because the business world stresses conformity in dress. Interviewing is not the time to exhibit non-conformist tendencies. In short, mavericks aren't admitted into the business world dressed as mavericks. Therefore, packaging is important.

First, there is the suit to consider, and most importantly, the color. Color establishes mood. When it comes to establishing mood, there's nothing simple about gray. The choice of shades is endless. There's dark gray, medium gray, steel gray, army gray, and even corporate gray. On the other hand, the color blue *means* navy. Other than adding pinstripes or cuffs, there's really no getting around it. A navy suit is a necessity.

Then there are fabrics. In this day and age, the variety, again, is virtually endless, but only a few are practical. There are a few rules of thumb to follow. Wool is always good. It is durable, wearable, and wrinkles less than other fabrics. Unfortunately, pure wool is seasonally inflexible. A pure wool suit is simply too warm for at least half the year. On the other hand, there is polyester. It's wearable, lighter in weight, and usually less expensive. It does, however, lack the important quality—durability. Polyester shows wear-and-tear fast, and it frays easily. Also, only the more expensive polyester suits will match wool in appearance.

The most practical fabric is a polyester-wool blend. It combines the best features of both fabrics. Fifty-five to seventy percent wool is generally a good margin. Best of all, the wool blend is a price performer. It provides quality at an affordable price.

What is a good first impression worth? It varies. What one spends for a good suit depends on two factors: budget and personal taste. Prices range from $100 to $400+. Outside of this range lies the cheap and the extravagant; within it lies J.C. Penney's to Brooks Brothers. A good suit can definitely be obtained at the lower end of this price range, but shopping skill is required. End of season sales are the best bet.

The cost of a suit is merely a subtotal of the cost of a complete ensemble. Finishing touches add to the cost. These touches include shirts, neckties, and shoes. A white shirt is best for most purposes. It is also the best to wear to *get* the job. The necktie is possibly the most significant component. Neckties are an American status symbol, and can be used to add a tasteful dash of color. An additional tie or two adds new dimensions to a suit, especially a vested suit. Last but not least are comfortable, good-looking, yet conservative shoes. Wingtips aren't an absolute necessity, but they are traditional and comfortable.

Back in the interview waiting area, looking good is feeling good. But looking appropriate is far far better. These are a few tips to help the novice as well as the experienced interviewer achieve that appearance. The goal is, of course, a secured job and the wealth and future which accompany it. Good luck. □

# Luis Castellanos mines copper with software.

Most copper is found deep underground. But the Bell System's 100 million miles of copper cable have tons of it above and below ground. That copper provides vital circuit paths to transmit customer voice, data and video signals for today's Information Age needs.

And Luis Castellanos, seven years out of undergraduate school, supervises one of the groups that helps Bell System companies "mine" all that copper. He works with one of the largest computer hardware and software systems in the world—the Trunks Integrated Record Keeping System (TIRKS). Every day it "mines" the vast Bell network for available circuits and equipment. As a result of efficient use of network facilities, the Bell System saves millions by eliminating the need for certain capital expenditures.

Plus, there's more to TIRKS than "mining copper." It also configures circuits and assigns components needed for each circuit path. That allows Bell companies to respond faster to customer requests for complex services like video and data transmission. Employees are more productive too, because TIRKS helps them set up circuits and forecast facility needs.

Before TIRKS was available, keeping track of communications circuits and facilities required enormous amounts of paperwork and manual calculation. Every day, the average Bell System company handles orders involving 1500 circuits and up to 7500 individual components associated with them. Each detail has to be specified and accounted for.

Now, thanks to people like Luis, TIRKS keeps track of all that information instantaneously using computers. Information is up-to-date. It's instantly available. And it's more accurate.

According to computer scientists like Luis, the benefits from TIRKS are just beginning. He believes that, as more computer hardware and software systems like TIRKS interact, new benefits for customers may be possible, as well as additional productivity increases for employees.

Luis joined Bell Labs with a B.S. in computer science from Pratt Institute. Under a company-sponsored graduate study program, he attended Stevens Institute of Technology for his M.S. in computer science. At the same time, he worked part-time assuming responsibility for a large piece of TIRKS software. Working with design teams, he gained valuable insight from experienced members. Now, his technical performance has earned him a promotion to supervisor.

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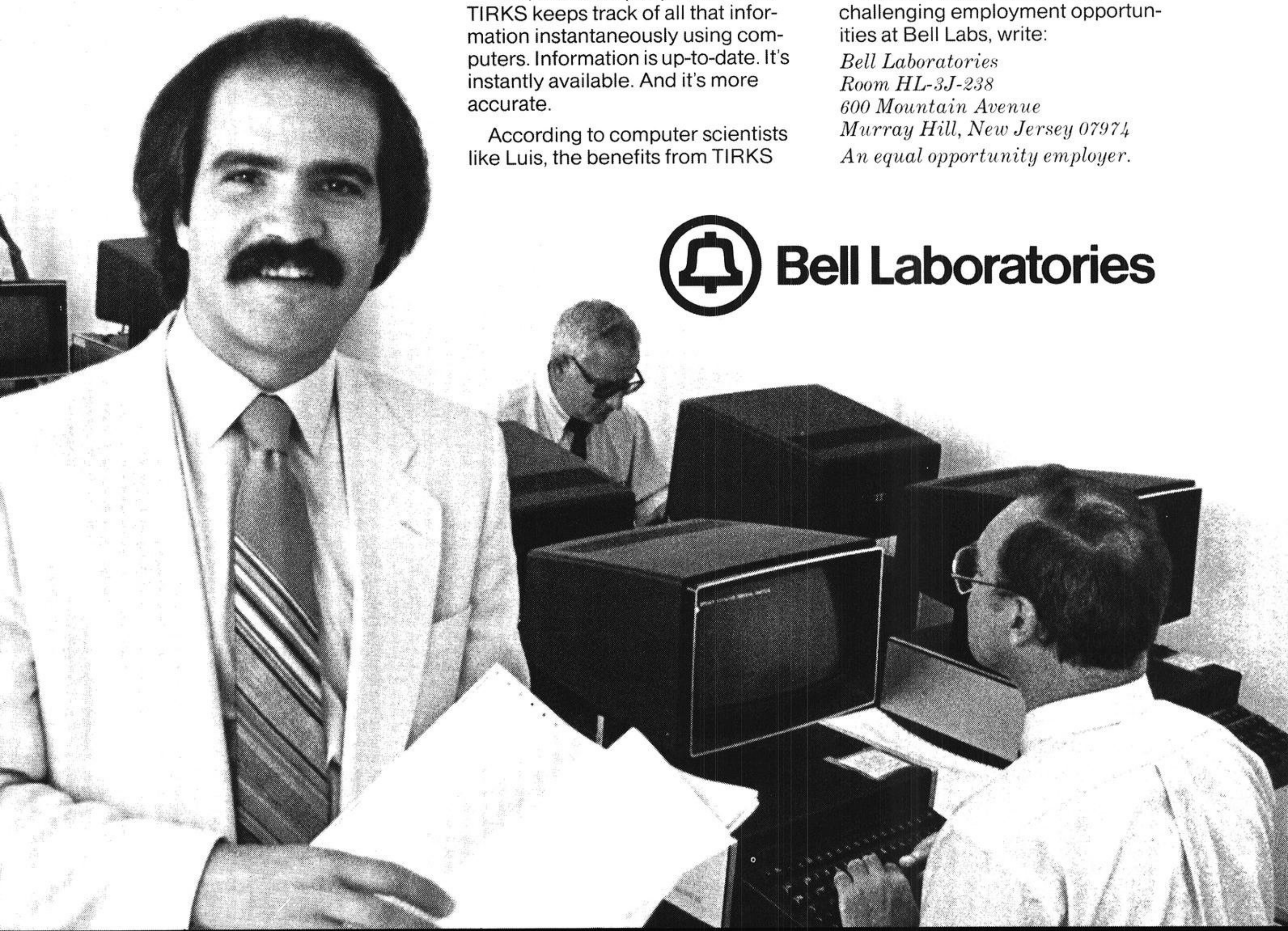

# Clothes Do Make the Woman (Engineer)

**by Joan Heitkemper**

*Joan, a senior in Civil Engineering, is an officer of ASCE in addition to being editor-in-chief of the Wisconsin Engineer. She consulted a number of women in the professional world to determine some groundrules concerning appropriate interview attire for women in engineering.*

Interviewing season is here, a time for choices and decisions. Unfortunately, in the area of interview dress, men and women are not created equal. For women, there are many more variables in finding that professional-looking appearance.

The name of the game is flow. From head to toe, you don't want to stop the interviewer's eyes. If there is something about your appearance that captures the interviewer's attention, it must inevitably take away from the focus on you as a potential job candidate.

The following is a comprehensive list of recommendations and suggestions on each aspect of the interview dress for women. Some recommendations may appear as hard-nosed conservatism. However, the old cliche, 'if you want to be in the game, you have to play by the rules,' really applies here.

To start at the top, hair should be clean and arranged in a simple style. No wild combs or brightly colored barrettes. If your hair has a tendency to fall in your eyes, it should be held by gold or silver barrettes. When it comes to makeup, try to be as unobtrusive as possible. It should enhance your facial features while remaining low-key. Wearing perfume is optional. If you choose to do so, make sure it is light and airy. Do not put it on immediately before the interview.

As the title of the article suggests, what a woman wears to an interview is an important indicator of how she will fit into the professional world. Solid color suits are in; dresses and slacks definitely out. Great care must be taken in choosing and buying a suit. A 100% wool jacket and skirt is the best buy in terms of wearability and durability. If this is out of your price range, try to get at least a 50% wool blend. Corduroy suits are not appropriate. They tend to look cheap, wrinkle easily, and do not move with the body. Classic styling is the key in looking for a suit. The skirt should be a simple A-line and fall to mid-knee or slightly below. It is also nice if the skirt is lined. That bothersome question, "Is my slip showing?" will never come up. In terms of color, blue or gray suits are the most respected. However, burgundy or dark brown are also acceptable. To complement the suit, look for a tailored blouse. Keep in mind, however, that blouses open at the neck do not make it. There are many varieties in styles, some with bowties or stand-up collars. It isn't difficult to look like a woman and a professional at the same time. (For spring interviews many of the above recommendations still apply. However, the fabric of the suit should be a heavy linen or have that quality. Anything with cotton will wrinkle easily.)

After you've chosen a suit, select stockings and shoes. Stockings should usually be a slightly darker shade of the suit color. 'Suntan' in the fall and winter looks out of place. For a burgundy suit, coffee-colored stockings are best. Shearness is also a good quality to look for in stockings. It is a good idea to take an extra pair along just in case a snag or run appears. Shoes for the interview should be as conservative as the rest of the outfit. Closed-toe is a must. Pumps or slingbacks are the most professional shoe. High, skinny heels should be avoided if dignity is to be maintained. A shoe that matches the color of outfit is not really necessary, but it is preferred. If your budget is limited to one pair of shoes, dark brown is a wear-with-everything color, and therefore the best buy.

To complete the ensemble, a few pieces of simple, classic jewelry could be added. Bracelets or earrings that dangle are distracting and could ruin the whole effect you have achieved so far.

Prices for an interview outfit vary depending on quality and the time of year you go shopping. Sales can be a life-saver as far as budget is concerned; keep your eyes and ears open.

There are rules for dressing for an interview. It is definitely not a game of chance. You have many decisions to make. In the end, knowing your outward appearance is appropriate can give you the confidence to concentrate on the interview itself. □

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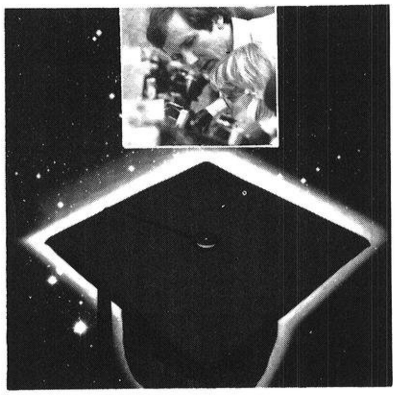

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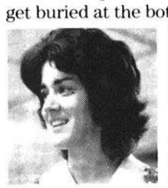

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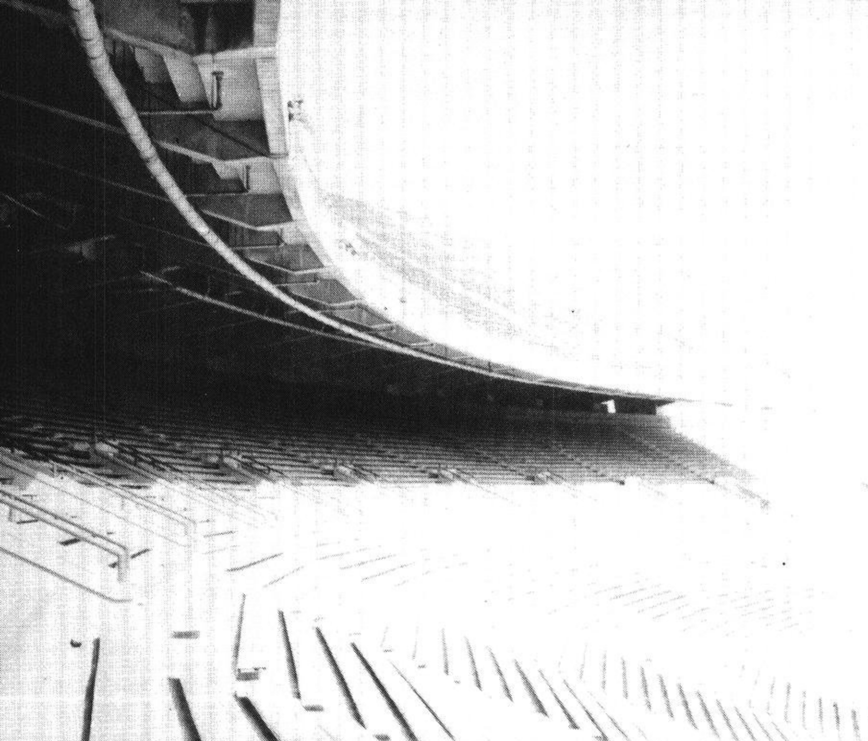
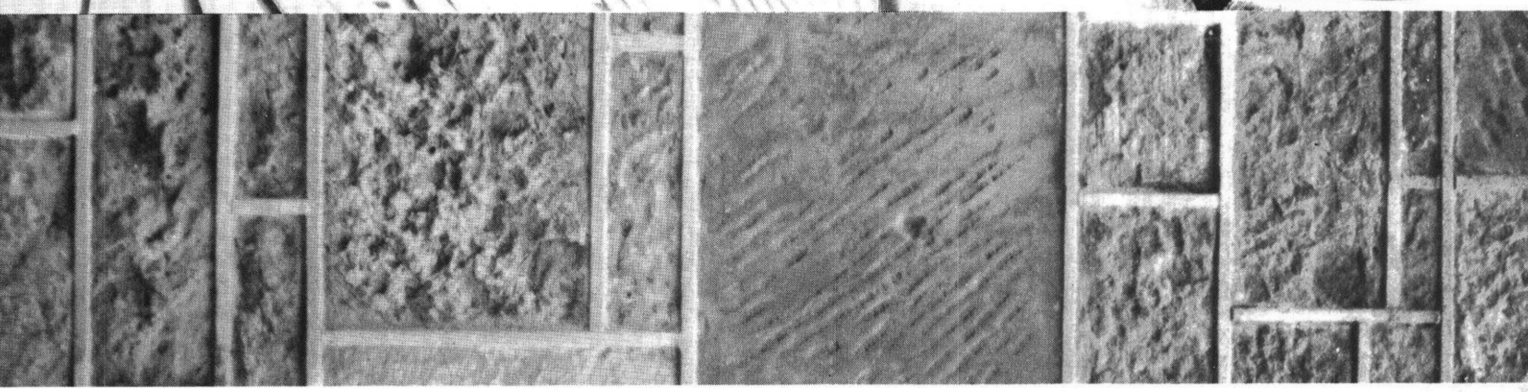
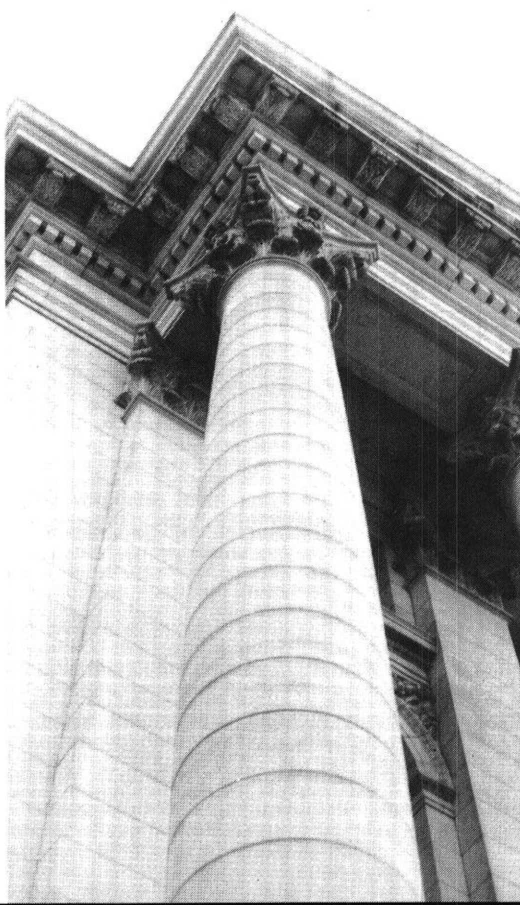


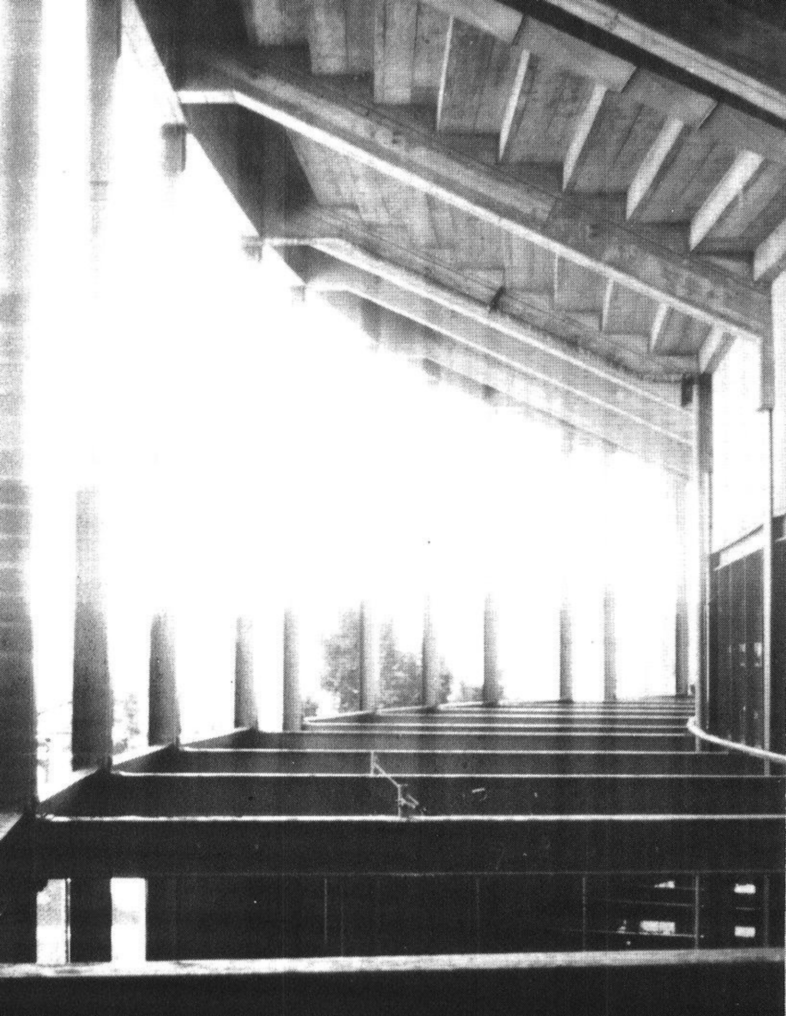
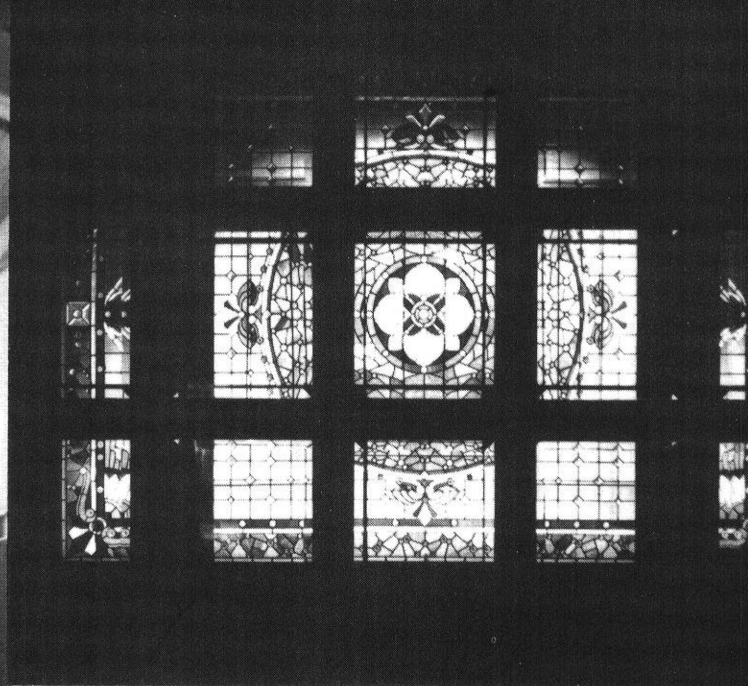


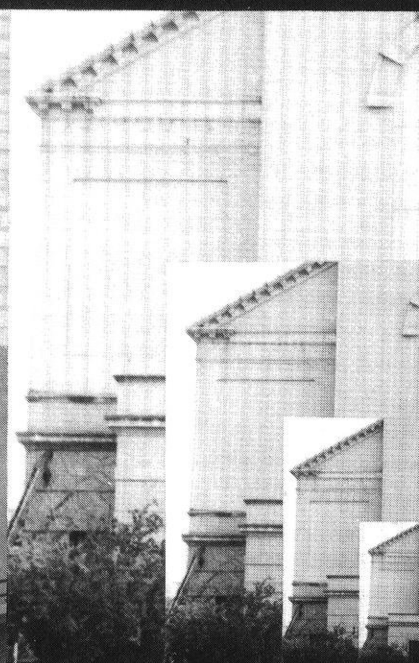
**Eighteen Frames of Madison**

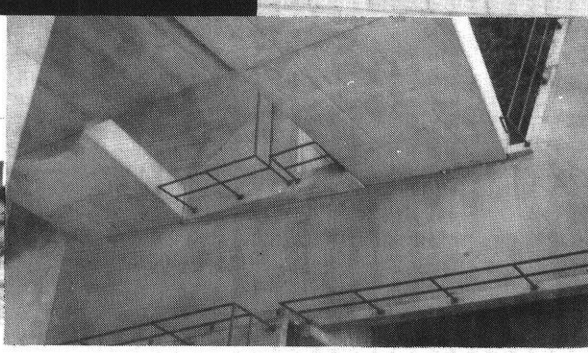
1.) *Camp Randall Stadium*
2.) *Ag Hall*
3.) *North Hall*
4.) *State Historical Society*
5.) *Law School*
6.) *Camp Randall Stadium*
7.) *Science Hall*
8.) *First Wisconsin Bank*
9.) *Stadium ramps*
10.) *Humanities Building*
11.) *Children's Hospital*
12.) *UW Heating Station*
13.) *Humanities Bridge*
14.) *Adams Hall*
15.) *Camp Randall Stadium*
16.) *Vilas Hall (riot-proof architecture)*
17.) *UW Fieldhouse*
18.) *Memorial Union Terrace*

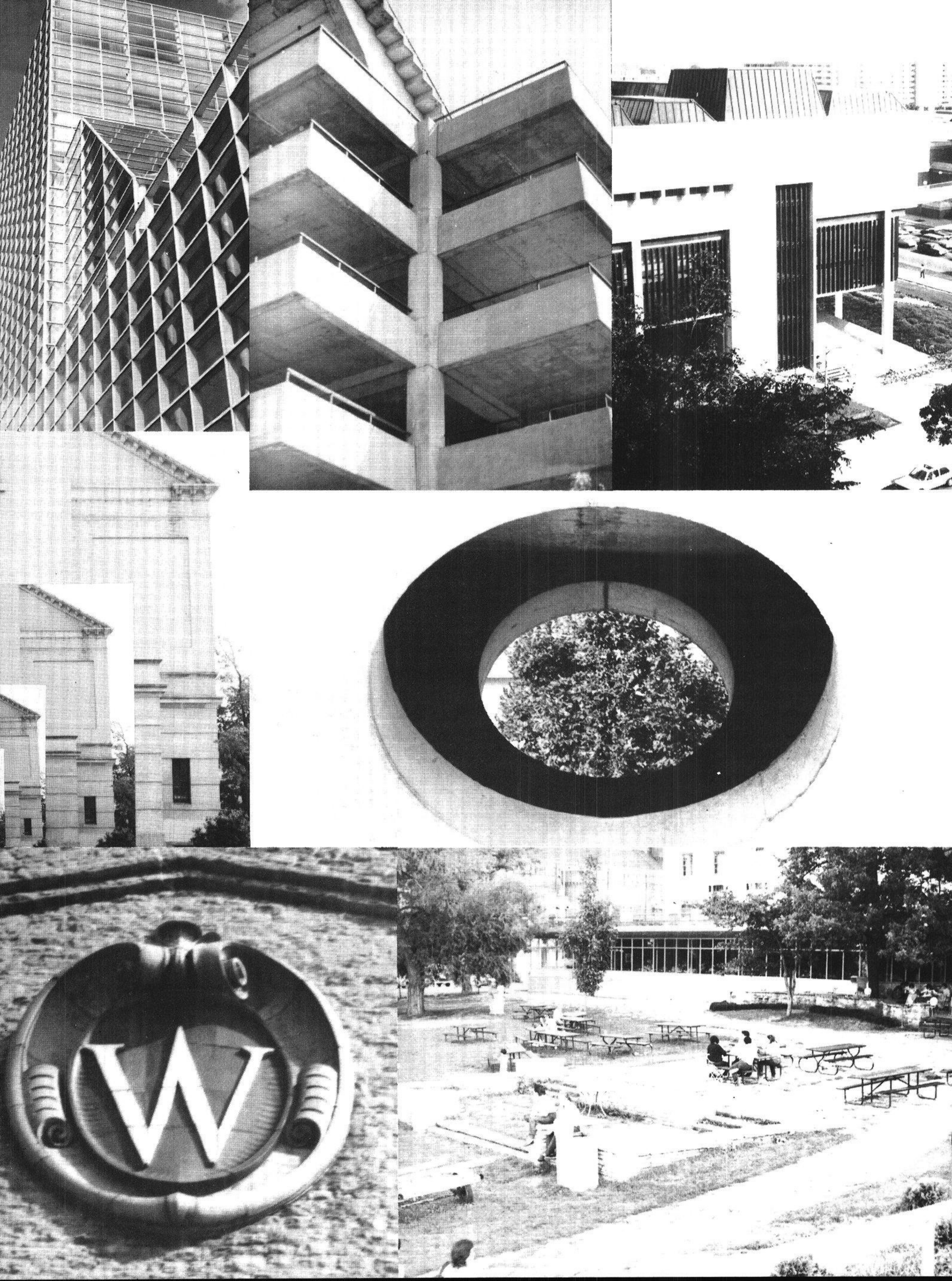
*Photos*
*#1, 2, 4, 6, 8, 9, 14, 15, and 17 by Karen Biesmann*
*#3, 5, 7, 10, 11, 12, 13, 16, and 18 by Robert Jones*





ADAMS HALL




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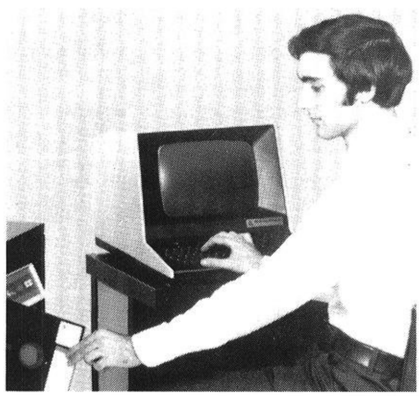

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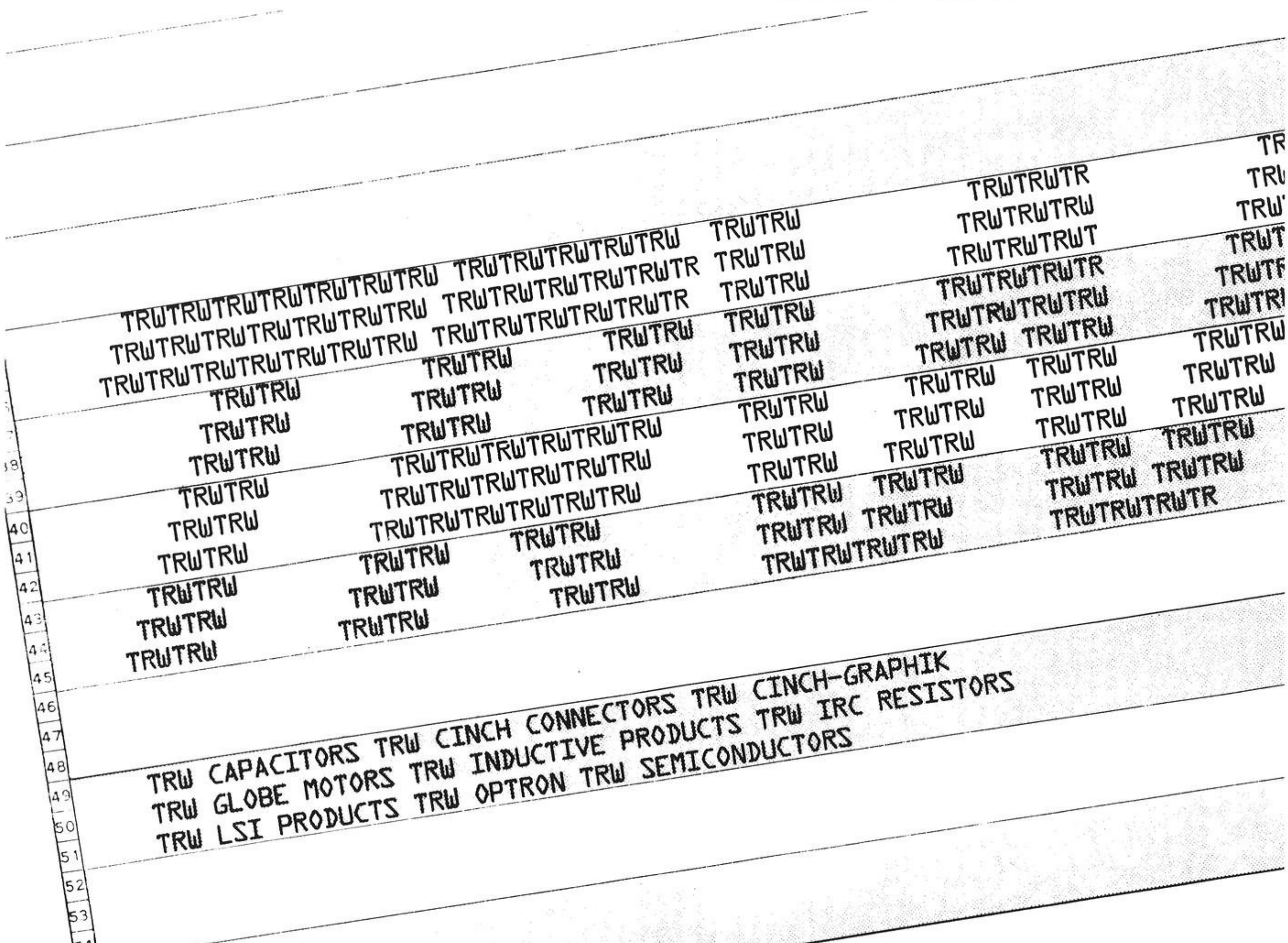


# Mind Games

**by Eric Loucks**

*Eric Loucks is not a mathematical theoretician, rather, he is a Fluid Mechanics teaching assistant in the Civil Engineering Department who feels that mathematics and statistics have more to offer than most people think.*

In 1729, a 22 year old student from Switzerland named Leonhard Euler undertook the pursuit of a continuous function that satisifed the difference equation, $f(x+1) = xf(x)$. In other words a function that would give meaning to x! for non-integer values of x. Euler's solution is an intriguing function that is encountered again and again in engineering and applied mathematics. It is now known as the gamma function, written $\Gamma(x)$. The gamma function draws much of its importance from the fact that many 'special functions' can be written in terms of gamma functions. In particular, this can be done for the exponential, circular and hyperbolic functions. Despite the usefulness of these functions in solving differential equations, there is no known differential equation that is satisfied by the gamma function. Properties like this make the gamma function one of the most mysterious elements of applied mathematics. Personally, my favorite mystery is the occurrence of the gamma function in Poisson statistics, but first let's investigate the function itself.

The gamma function was given its modern definition by Legendre in 1809. He defined it as

$$\Gamma(x) = \int_0^{\infty} u^{x-1} e^{-u} \, du$$

x may be any complex number except a negative integer and u is a dummy variable of sorts. It is readily seen that if x is a positive integer, the integral can be solved by repeated integration by parts to yield $\Gamma(x) = (x-1)!$. A person whose strong suit is integration might recognize that the function is also integrable if $x = ½$. A substitution of $u = t^2$ followed by squaring the integrand and reinterpreting it in polar coordinates leads to the interesting result of $\Gamma(½) = \sqrt{\pi}$. This was the earliest evidence of a connection between e and $\pi$, which had been sought since the early 1600's. Another approach to the same result involves the power series expansion of $\sin(\pi x)$ which, in infinite product notation, is

$$\sin(\pi x) = \pi x \cdot \prod_{n=1}^{\infty} \left(1 - \frac{x^2}{n^2}\right)$$

Euler's original definition of the gamma function was a similar product written

$$\Gamma(x) = \frac{1}{x} \cdot \prod_{1}^{\infty} \left( \frac{(1 + (\frac{1}{n}))^x}{1 + (\frac{x}{n})} \right)$$

Using this definition, one finds

$$\Gamma(x) \cdot \Gamma(-x) = \frac{1}{x^2} \cdot \prod_{1}^{\infty} \left( \frac{1}{1 - (\frac{x}{n})^2} \right)$$

Comparison of this to the expansion of the sine function leads to

$$\sin(\pi x) = \frac{\pi}{x\,\Gamma(x) \cdot \Gamma(-x)}$$

$$= \frac{\pi}{\Gamma(x) \cdot \Gamma(1-x)}$$

The relationship can be tested with $x = ½$. Also, substitution of $x = ½$ into Euler's infinite product and squaring the result will produce the same approximation for $\pi$ that was first proposed by John Wallis in 1656.

I'm sure many statisticians have wondered how the number $\pi$ made its way into the equations for many statistical distributions. It appears in the density function of the normal (the equation of the 'bell' curve) and chi square distributions and in one parameter of the extreme value type I (Gumbel) distribution. The reason is rooted in the Poisson process, a random process with many engineering applications. A Poisson process is any physical mechanism that generates a sequence of events and satisfies the three Poisson assumptions. Usually, the 'events' are distributed through time.

Examples include floods, structural overloads, and demands on facilities (like fire departments). The three Poisson assumptions are:

(1)The probability of an event occurring in *any short* time period $t_i$ is given by $\lambda t_i$.

(2)The probability of two events occurring during this short time, $t_i$ is very small compared to $\lambda t_i$.

(3)The number of events occurring in some long period of time is independent of the number of events in any other non-overlapping time period. (This is called the memoryless property).

Poisson processes can be described using the Poisson statistical distribution. This is a function used to compute the probability of k Poisson events occurring in some time period t. The function is written

$$p(k) = \frac{(\lambda t)^k e^{-\lambda t}}{k!}$$

The distribution's parameter, $\lambda$ is known as the arrival rate. It is the average number of events per unit of time.

A popular application of the Poisson distribution is the estimation of waiting time. A weak, but fun, example involves the time spent waiting to see a busy academic advisor. The Poisson event will be the admission of the next student in line into the advisor's office. Of course, this faculty member dispatches students in a manner that satisfies the Poisson assumptions. For example, to satisfy assumption (2), you would have to say that a student could not get through with the advisor in less time than the measurement unit of one minute. Also, it is assumed that this advisor has an average dispatch rate. If this was one student every 15 minutes, then, $\lambda = 1/15$ is the Poisson parameter. Now, suppose you and another student arrive at the same time and amazingly nobody else was waiting, what is the probability of your waiting longer than some amount of time T, by letting your classmate go first?

This is the probability that the advisor is unable to finish in T minutes, that is, no events during T.

$$p(0) = e^{-\lambda T}$$

If three of you showed up at once, the third student in line would want to know if the advisor could get through two students in a time period T. The probability that this won't happen is the probability that zero or one students are advised during T.

$$p(0) + p(1) = e^{-\lambda T} + \lambda T e^{-\lambda T}$$

In general the probability that the kth student will wait longer than T minutes to see this stochastic advisor is

$$p(k) = \sum_{n=0}^{k-1} \frac{(\lambda T)^n e^{-\lambda T}}{n!}$$

It follows that the wait will *not* exceed T if k or more events occur. The probability of this is obtained by summing the Poisson terms from k to infinity rather than zero to $k-1$. I'll call this p*(k), it's equal to $1.0 - p(k)$ and given by

$$p^*(k) = \sum_{n=k}^{\infty} \frac{(\lambda T)^n e^{-\lambda T}}{n!}$$

$$= \sum_{n=1}^{\infty} \frac{(\lambda T)^{n+(k-1)} e^{-\lambda T}}{(n-(k-1))!}$$

Sums like the one on the above right can be rewritten as definite integrals. This one is equivalent to

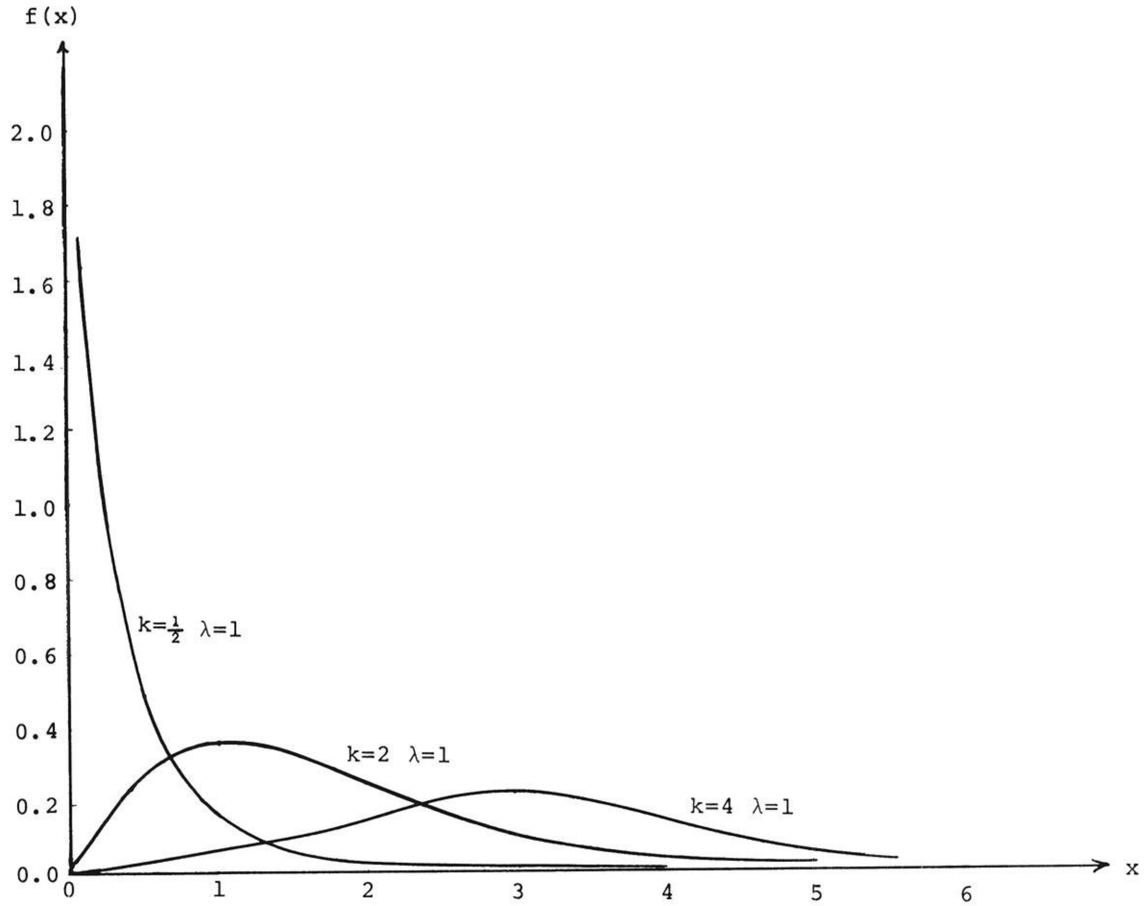
$$\int_0^T \lambda \frac{(\lambda t)^{k-1} e^{-\lambda t} dt}{(k-1)!} = \frac{\Gamma(k,T)}{\Gamma(k)}$$

This is the general probability function of the appropriately named gamma distribution. The two parameter function in the right hand numerator is called the incomplete gamma function.

In application there is no need to interpret the gamma distribution as the probability distribution of the waiting time until the kth Poisson event hence, the extension to include non-integer values of k by defining it using gamma functions. It is well suited to many kinds of engineering measurements and is not as difficult to use as it might appear.

A gamma distributed variable (T in the above) is always positive and skewed to the right. That is, the mode is less than the mean. The density function or bell curve of the gamma distribution has two vastly different shapes depending on whether k is greater than or less than one. When k is less than one the variance of the random variable is larger than the mean and the characteristics of the distribution are quite different from those of the gamma distribution with k greater than one. Engineering applications include analysis of drought duration using $k<1$ and column yield strength with $k>1$.

The importance of the gamma distribution goes way beyond its engineering applications though. It is of great statistical importance also. If $k=n/2$ and $\lambda = 1/2$ are used as parameters in the gamma distribution the chi square distribution is the result. As this n gets large the chi square distribution approximates the well known normal distribution. Both of these have a factor of $\pi$ in their probability functions. There are no less than four additional statistical distributions in common




Some gamma distributions

use that are derived from the gamma. It is the link to the normal distribution that allows one to approximate $\pi$ by dropping a straight pin on a hardwood floor. (The percent of the drops where the pin lines on a crack is about $\frac{\pi}{4}$ if you drop it often enough).

Despite all the relationships among natural processes, $\pi$, and e, there is still no known finite function that relates the two non-rational constants. Recent attempts to relate them have not brought us much closer than Euler's $\Gamma(\frac{1}{2})=\sqrt{\pi}$ though we do have the complex relation $e^{i\pi}=-1$, this is more of a definition of complex exponentiation than a relationship between $\pi$ and e.

The question of whether or not any relationship exists brings about an interesting, yet unresolved paradox. $\pi$ and e are thought to be non-repeating, non-ending decimal numbers. If this is a fact then somewhere in the endless string of digits of $\pi=3.14159265...$ there begins a sequence ...2718281828... that is unendingly identical to the digits of e. This has to be true because every possible sequence of digits will occur in an *infinite* string of non-repeating digits. It follows that the relationship $e=10^n\pi-k$ exists where, k is a constant consisting of $\pi$'s digits that occur before the 2718281828... string. (Incidently, this apparent repetition at the beginning of e is purely coincidental.)

Unfortunately for the purists who have already begun their letters of disgust, the reverse must also be true. That is, the digits of $\pi$ begin somewhere in the depths of e and continues on to infinity. But, if $\pi$ is contained in e and e is contained in $\pi$, then $\pi$ is contained in $\pi$ and therefore repeats. This completes the paradox which I believe, was orignally posed by Isaac Asimov. Asimov was also frustrated by the lack of a concrete relationship between $\pi$ and e that we've been so close to since 1729. His paradox might be the first step toward proving they can not be directly related in real space, but someone has to track down the faulty reasoning in the paradox first. □

# Polygon's Fall Picnic

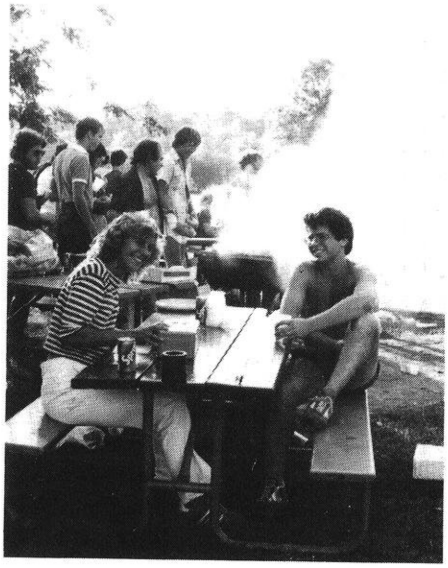
The Annual Polygon Engineering Picnic was an event true to Madison's cultural heritage. Under sunny skies, over 200 engineers converged upon Vilas Park to mercilessly consume 140 pounds of brats as well as an unlimited amount of soda and three barrels of beer. The gathering enjoyed playing volleyball, frisbee, football, and doing whatever engineers do at picnics.

Sponsored by Polygon Engineering Council, the picnic was a chance for students and faculty from all fields to get together. This is the main theme behind Polygon, to promote positive relations between faculty, students, and their societies throughout the campus.

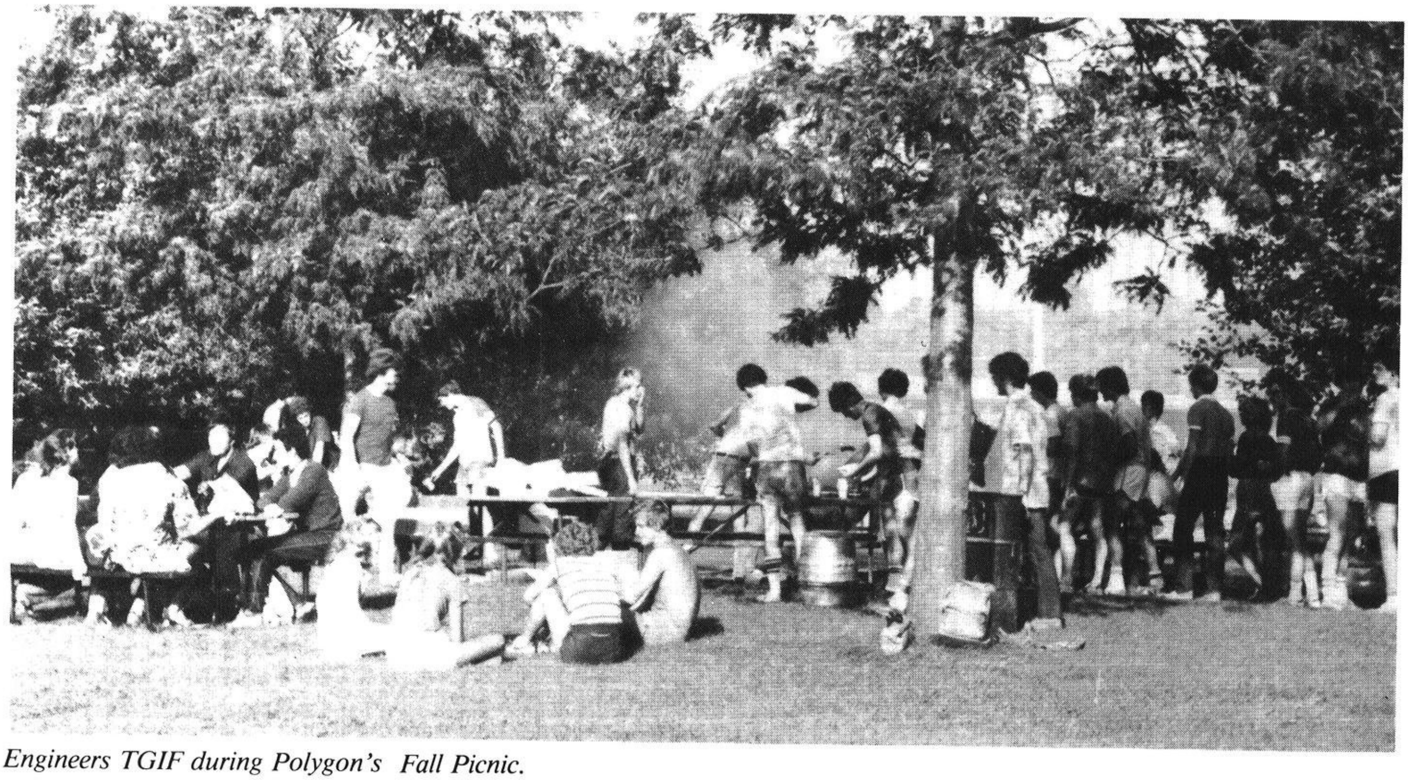
The Polygon Council is comprised of two representatives from each student engineering organization and other students interested in helping their campus. *The Exchange*, Polygon's monthly newsletter, provides students with information on up-coming events on campus.

Other Polygon activities include a service awards banquet honoring students who have made outstanding contributions to the campus. Each registration week, the council conducts a co-op book sale. The sale offers students the chance to make better deals by getting together directly.

Polygon thanks all those who attended the picnic, especially those who cooked and served the brats. All those who missed the picnic this year are invited to come next year. □



*Upperclasspeople discuss ticket sales.*



*Engineers TGIF during Polygon's Fall Picnic.*

# In electronics, Kodak isn't the first company that comes to mind. Yet.

Kodak is already one of the nation's top 30 companies when it comes to sales of electronics-related equipment. And its application of electronics technology is becoming more extensive every day.

Our steady growth and diversification mean we have more and more career opportunities for electrical/electronics engineers.

Opportunities such as developing and processing a state-of-the-art $I^2L$ integrated circuit to interface with the flash-charging system in Kodak Ektralite cameras. Using advanced analog and digital skills to design microprocessor systems in the Kodak Ektachem 400 analyzer for clinical chemistry. Or designing a machine or process control with hundreds of feedback loops, specially designed sensors and servos using microcomputers, microprocessors and programmable logic controllers.

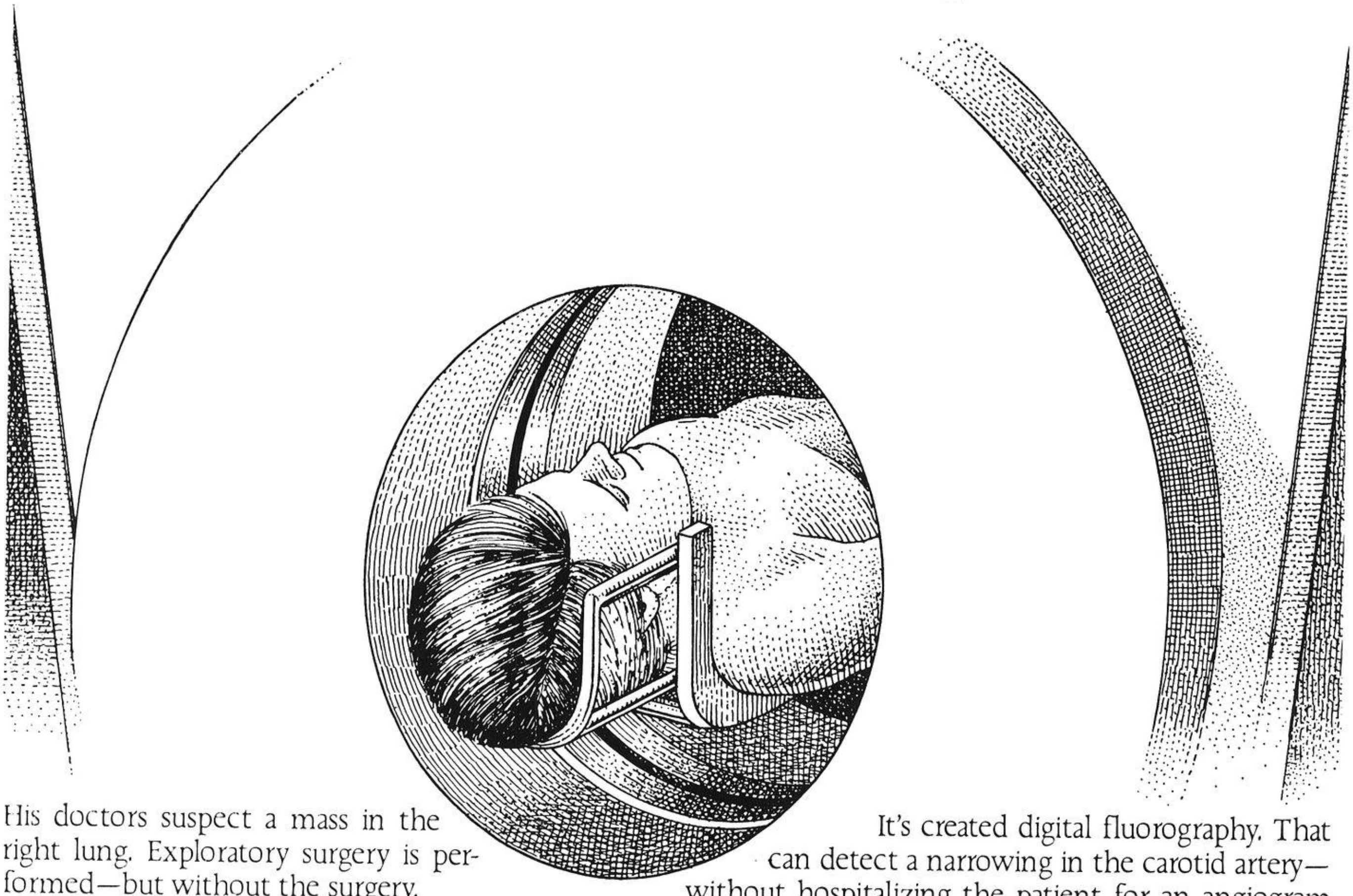
If opportunities like this come to mind when you think of your career, see a Kodak recruiter on your campus. Or send your resume to: Personnel Resources, Eastman Kodak Company, Rochester, N.Y. 14650.

Kodak

## Kodak. The right place. The right time.

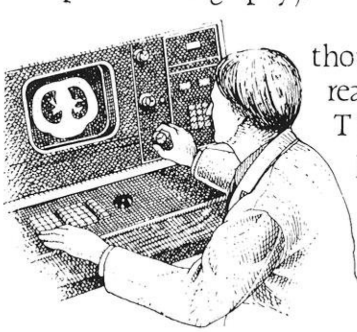
An equal opportunity employer manufacturing photographic products, fibers, plastics, chemicals, and electronic equipment. Plants in Rochester, N.Y.; Kingsport, Tenn.; Windsor, Colo.; Longview, Tex.; Columbia, S.C.; Batesville, Ark.; and a sales force all over the U.S.

# The silicon chip. It's replacing the scalpel.



His doctors suspect a mass in the right lung. Exploratory surgery is performed—but without the surgery.

This is made possible because of a major advance in radiology called the CT Scan (short for computed tomography).



The CT Scan provides thousands of digitized X-ray readings of a patient's body. Then, using a computer, it synthesizes the data into a series of cross-sectional or tomographic images—all within seconds.

The detail is incredible. Often a diagnosis can be arrived at immediately—so the patient is spared the knife.

But it's the heart of the computer that's the real miracle. The silicon chip.

The silicon chip is responsible for a new wave in microelectronics and a remarkable revolution in medical diagnostics.

It's created the digital ultrasound imager. That helps doctors visualize the womb of a pregnant woman with sound waves to monitor fetal development.

It's created digital fluorography. That can detect a narrowing in the carotid artery—without hospitalizing the patient for an angiogram.

General Electric is committed to finding new ways to make the computer chip serve. In medicine. And in other industries.

For instance, we're investing 100 million dollars in our new GE Microelectronics Center.

We've acquired INTERSIL, one of the leading designers of specialized computer chips. We've also acquired CALMA, a company which is using CAD/CAM technology to revitalize the American factory.

GE is even exploring new uses for microelectronics in satellite communications, radar and robotics.

Microelectronics is where the future is. A future that will need talent. Engineering talent.

If you'd like to know more about engineering opportunities at GE, check your Placement Office or write to: Engineering, Building 36-504, Schenectady, NY 12345.

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