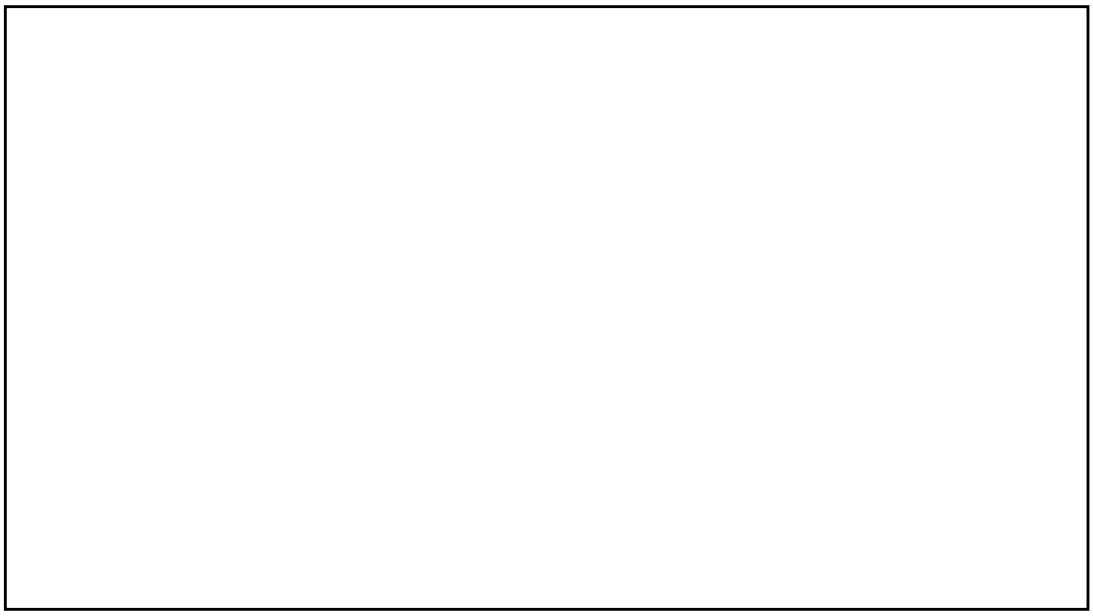

CS undergraduates— l to r, Scott Johnston '96 (not CS), Bryan Cantrill '96, Tim Brennan '97, Mike Shapiro '96 and Mike Cafarella '96—enjoying the evening reception at the October 19 IPP Symposium

conduit!

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Brown University

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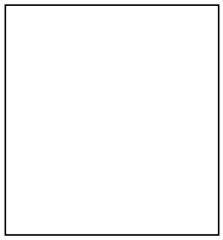

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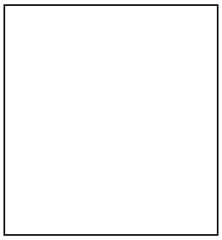
Editor-in-Chief



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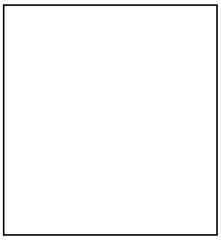

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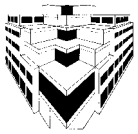

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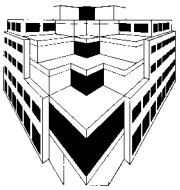
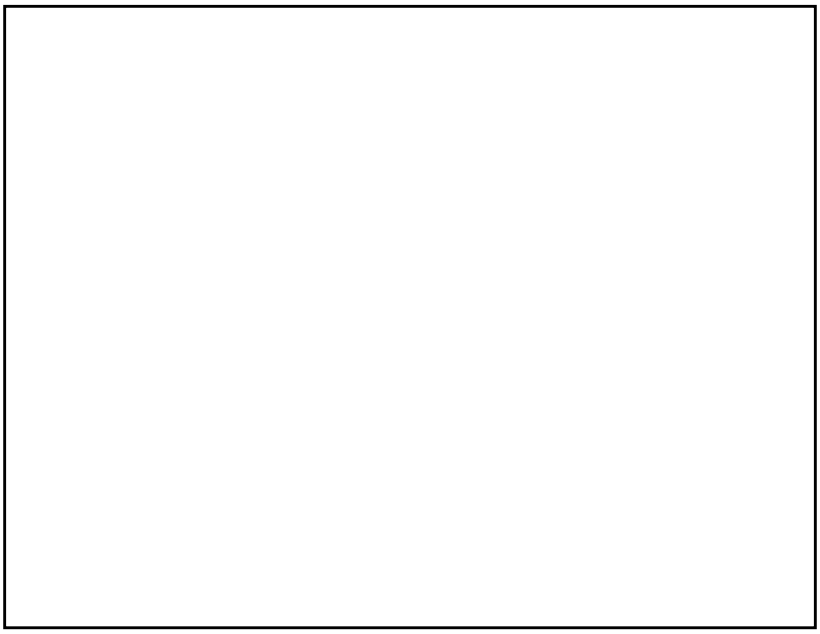


A quick calculation showed that I should be done in about 400 days or so. The solution was to use Quahog, a program created by our technical staff that takes jobs and distributes them to free machines around the department. The good news is that in the end Quahog worked just great, and finished it off in four days, running on an average of 100 machines at a time. (It was over a weekend early in the semester, so not that many students were hacking away.) The bad news was that there were two bugs, one in my program that caused it to infinite loop in very rare circumstances, and another in Quahog that in some cases would fail to kill a job when the "real'' user of a machine started to use it. Both bugs are now fixed, I am happy to report, but in the meantime one of the machines I managed to trash was one of those in the undergraduate teaching assistants' office. One thing I learned is that being chair of the department does not protect one from the fury of a ugrad trashed.

STOP PRESS!—two late-breaking developments—First, in the 20th Annual ACM Programming Contest preliminary round, the Brown team—consisting of Ed Bielawa, Mike Radwin and Sam Haffey—took second place and therefore advances to the semi-finals. Way to go, guys! Second, we just learned that John Savage has been elected a Fellow of the ACM "for fundamental contributions to theoretical computer science, information theory, and VLSI design, analysis and synthesis." John is now our fourth ACM Fellow—Congratulations, John!



Yi-Jing Lin after his thesis defense with Pascal Van Hentenryck and Leslie Kaelbling

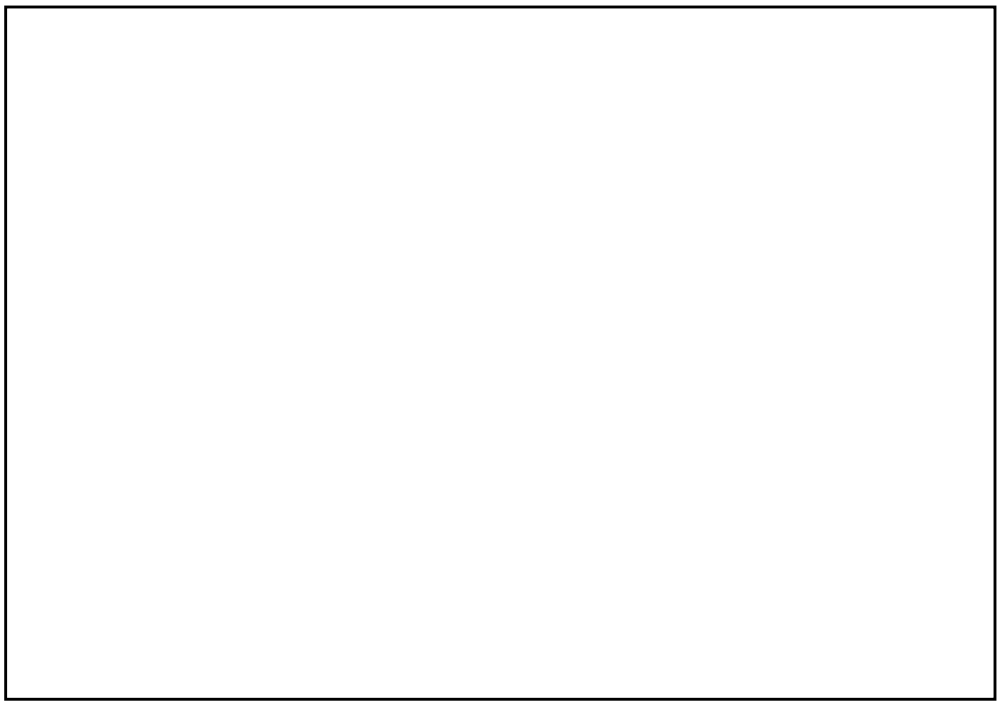
NEW IPP INTERN PROGRAM

Due to popular request, the Industrial Partners Program announces the introduction of its new ***Partners Intern Program (PIP)***. It will serve as a vehicle to bring together students seeking employment with IPP Partners seeking employees.

The Department is blessed with talented, well-educated students eager to apply creatively the knowledge they have acquired during their tenure in our degree programs. And our Partners have many challenging employment opportunities for able students. The role of PIP will be to facilitate matching opportunities with individuals. We anticipate holding a job fair, probably in February.

Watch for email announcements concerning this new program. In the meantime we invite inquiries—please correspond with Suzi at *sjh@cs.brown.edu*.

think we know why. Various net search engines let one do a keyword search for relevant web pages. For example, you can search for "multiprocessors" and get a listing of the URLs of tons of Web pages that somehow refer to multiprocessors. Well, though we may get hits from people looking for multiprocessor information, it seems that most of our hits are from a different audience. Thanks to the UTAs, our Web page starts off, 'Welcome to the home page for CS169. If you were trying to just read Dilbert or find some Dutch porno mpeg site, then click here because you're clearly lost.' So, if you do a net search using the keyword "porno," you get us.''



Area high school teachers at the third annual summer workshop learned about three-dimensional geometric modeling, computer graphics and animation. Unfortunately, van Dam's schedule precluded his attending many of the sessions, so a more available (but more reticent) replacement was created using the technology at hand

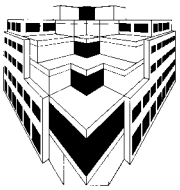
Recently two Brown undergraduates, CS major Bryan Cantrill and Engineering's Scott Johnston, were the topic of an article in the ***Providence Journal***'s business section about looking for, applying for and obtaining summer jobs over the net. The ***Journal*** clearly thought this was pretty neat, though the idea is probably not all that surprising to the readers of this news outlet. The article shows, though, that at least some CS students have a head for practical affairs. To quote:

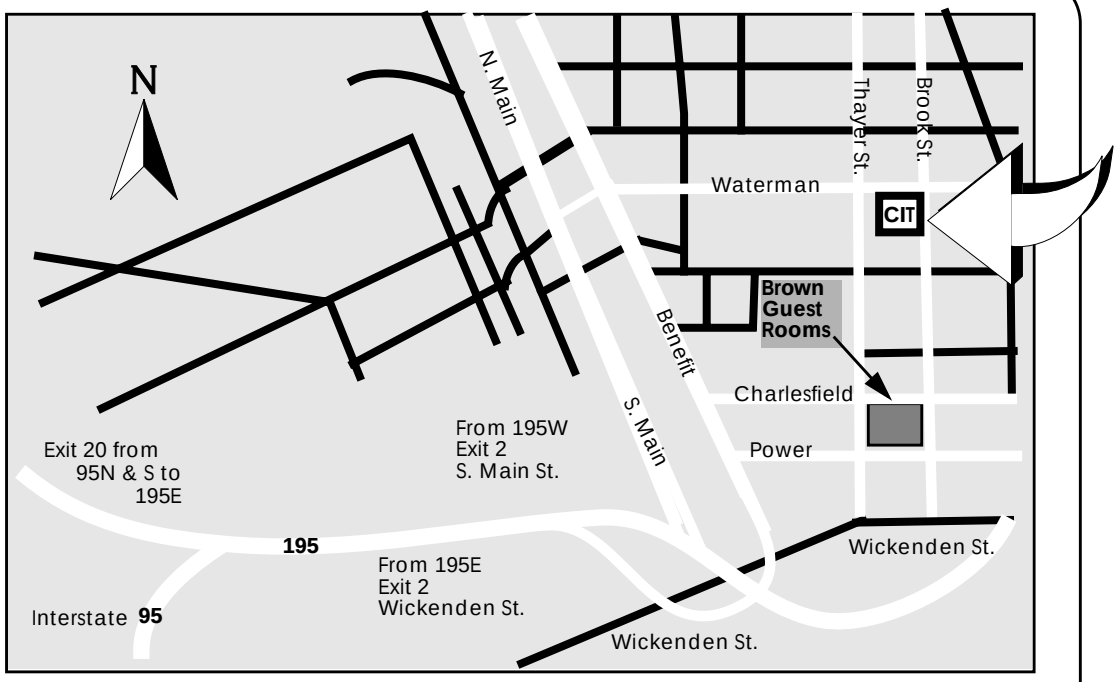
> "Cantrill—who researched companies, circulated his resume, entertained offers and negotiated his salary entirely via the Internet—conceded, 'There are some things you want on paper.'
>
> Like what?
>
> 'Like the final offer,' he said with a grin.''

We are very pleased that since the spring issue of ***conduit!*** four graduate students have successfully defended their doctoral dissertations: **P. Krishnan** has joined the Computing Systems Research Lab at AT&T Bell Labs in New Jersey; his topic was "Online Prediction Algorithms for Databases and Operating Systems;" **Yi-Jen Chiang**, "Dynamic and I/O-Efficient Algorithms for Computational Geometry and Graph Problems: Theoretical and Experimental Results," is doing a postdoc at SUNY in Stony Brook. **Bharathi Subramanian** will be working for Texas Instruments in Dallas; her topic was "Expressing and Optimizing Queries Over Lists and Trees;" and **Yi-Jing Lin** will be working for IBM at the T.J. Watson Research Center in New York; his topic was "Configuration Management in Terms of Logical Structures."

Lastly, when not writing ***conduit!*** columns, I have been doing some research. Recently I wanted to parse about 40 million words of ***Wall Street Journal*** text, which I have on line. As all good computer scientists should know, the typical context-free parsing algorithms take "*n*-cubed" time, where *n* is the number of words in the sentence. Some sentences can get quite long, and even with optimizations my algorithm takes a little less than a second per word on our Sparc 10s.

This three-dimensional model of an ant was created by Matt Brennan, a teacher of mathematics and physics at St. Andrews School in Barrington, and a participant in the computer graphics summer workshop

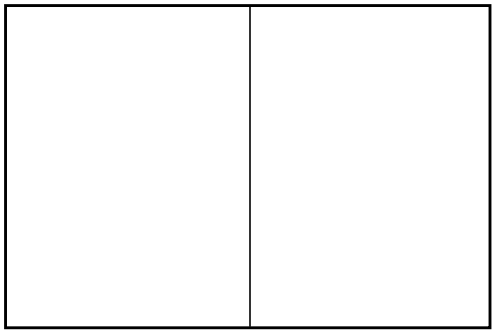




DIRECTIONS TO THE CIT BUILDING

- From I-95N or S, take Exit 20 to I-195E
- From I-195E take Exit 2, Wickenden St.
- Go LEFT on Wickenden, LEFT again at the 2nd light onto Brook St.
- The red-brick CIT Building is on the left at the intersection of Brook and Waterman (1st light).

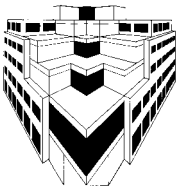
"Open Houses'' are held by all departments at Brown to show students what things are like for concentrators in that area of study. A few months ago a group of undergraduates decided to go to all of the open houses and report their observations in the ***Brown Daily Herald*** (May 2, 1995). The observations were couched as a series of "awards." Computer Science tied with five other departments for the "I Want to Stay Here a Fifth Year'' award for best open house. We also got the "TCI Press Award'' for best informational packet. (Congratulations should go to ***conduit!***'s intrepid editor Suzi, who is also responsible generally for departmental publications.) My favorite, however, was the fact that we were in a five-place tie with Neuroscience, History, Comparative Literature, and Biology for the "Best Use of UFS (University Food Services) Award''—"for having the exact same plate of cookies on the same little metal tray.''



Newly promoted faculty, Stan Zdonik (left) and Pascal Van Hentenryck

Some more serious, but no doubt equally reliable, polls have come out since our last issue, these ranking all the computer science departments/graduate programs in the country. The ***US News and World Report*** has Brown ranked in a four-way tie for 12th among graduate programs, while the National Academy of Science ranked us as 13th. What ticked me off, however, was that the ***New York Times*** article on the Academy's rankings only listed the top 12 CS departments!

The Computer Science Department is constantly adding World-Wide Web pages on departmental functions, people, etc. Recently Tom Doeppner, who teaches CS 169—our undergraduate operating systems course, and a good candidate for the toughest course at Brown—discovered that the CS 169 WWW page was visited more often than all of the rest of the department's Web pages put together. Like any good empirical scientist, Tom looked for an explanation of this fact, and his analysis will surely become a landmark in the area. To quote Tom, "We'd naturally assumed that this was because of the course's great reputation worldwide, but, after some research, we now



straints. There are two schedules, one for the 28 interns and another for the 54-58 residents. Each resident does a different rotation each block—some of which are four weeks, some six, and some eight. Some rotations are much harder than others, so it is important that each resident get a fair number of easy vs. hard rotations and have the hard ones spaced out to avoid as much burnout as possible. Some of the rotations are subspecialty consult services, and if a resident has done a particular one one year, it is better that they not repeat it the next. Residents can include all sorts of preferences such as when they want their vacations (which can only come out of some rotations and not others), which consult services they want to do, particular times when they need easier months (e.g. during interview season if they will be applying for a fellowship), which hospitals they want to work at, etc., etc. Not all requests are granted, but we certainly try to get as close as we can. Then there are constraints as to who can do hard rotations in the beginning of the year because at first we only trust third-year residents, and by early fall, only the best of the second years. Is there software that would be able to handle something like this, or do you have suggestions on how to go about creating such a system—realizing of course that I have not programmed in years and have limited free time? Are there any students who'd want to work on this as a project (maybe for an AI or constraints reasoning class)? I would appreciate any ideas you may have.

nicolaid@ohsu.edu

WARREN POTAS '70

Was just back to Brown for reunion—went really well, got to chat with avd etc. The point of this note is to shed light on an omission in the ***conduit!*** newsletter. I've not been to Brown since the new Computer Science building came into existence and had taken ***conduit!*** with me so I'd be able to locate the building. Lo and behold, though, ***conduit!*** omits any reference to a physical location for the building and includes ONLY virtual locator information. You might want to include information on physically finding the building for those alums who stagger back to campus after long intervals! How about street-corner address information or a thumbnail map?

adventure.man@glib.org

Besides the inset on the opposite page, a map and directions to the CIT are now available on the Web: http://www.cs.brown.edu/directions.html.—Ed.

FROM THE CHAIRMAN, Eugene Charniak

Eugene Charniak

The last time Pascal Van Hentenryck appeared in these pages was in fall, 1993, when he won an NSF National Young Investigator award for his work on constraint logic programming. I am happy to announce in this issue that he was promoted last July to Associate Professor (with tenure). Within the department Pascal is classified as a "systems and applications'' person (as opposed to a "theory'' or "artificial intelligence'' person), but his research relates to many areas. A few years ago at the national AI conference I mentioned to a colleague that there were three of us in AI at Brown. His response was, "Let me see ... well, there's Van Hentenryck ...''.

Also, Stan Zdonik has been promoted from Associate Professor to Professor. While to the best of my knowledge nobody has taken Stan for an artificial intelligence researcher, he has recently been significantly extending his reach. He is known, of course, for his work on object-oriented databases, an area in which he has been a pioneer. Lately he has also been working on mobile computing. In particular, he is interested in the case in which many mobile computers, e.g., ones in cars, need the same information, e.g., a map. This topic is very *au courant* and has attracted attention. If you wonder how this is connected to object-oriented databases, all I can say is that it made sense when Stan explained it to me.

Another pleasant development since the most recent ***conduit!*** was the creation of the Center for Geometric Computing, as described in the lead article in this issue. Brown has long been a hotbed of geometric computing research. The creation of the Center and the award of several significant grants to Franco Preparata and Roberto Tamassia confirm this fact, while giving enhanced visibility to the effort. Speaking personally, I particularly like the general focus of the research effort and the general hypothesis behind it. The implicit claim of the Center's researchers is that when theoretical results in our field do not eventually transfer to the practitioners, the remedy is more theory, not less, but theory informed by practice.

JOHN CRAWFORD '75

In response to Andy van Dam's delighted congratulations on winning the highly prestigious Eckert-Mauchly award, John Crawford wrote:

I worked for avd as an undergraduate on his LSD compiler research project, my junior and senior years, including the summers. Slave labor, as I recall, chained to my ascii cruiser. It was a great experience, and I am grateful for the opportunity. Andy was one of the two people I thanked at my acceptance speech for this award—I appreciated his energy and enthusiasm and thanked him for getting me off to a great start in computer science through his innovative curriculum (we were reading research articles hot off the press—no textbooks), and for the opportunty to work on a research project as an undergrad. I 'had to' go to ISCA95 in Santa Margherita Ligare on the Italian Riviera to receive the award (the 1996 winner gets the prize in Philadelphia...) and took my family with to share the excitement.

john_h_crawford@ccm.sc.intel.com

Intel Fellow John Crawford '75 receives the prestigious Eckert-Mauchly award from James Smith of the University of Wisconsin, co-chair of the conference

Awarded by the ACM and IEEE, the Eckert-Mauchly award recognizes an individual each year for technical contributions to computer and digital systems architecture. John Crawford, an Intel Fellow and director of Microsprocessor Architecture, received this award for his pioneering work over two decades in microprocessor design and architecture—Ed.

ROBERT GOLDMAN Ph.D. '91

I've been working at Honeywell Technology Center for about two and a half years now and find the work very interesting. I'm not, regrettably, doing anything with NLP right now, but am doing some very fun work on manufacturing scheduling via constraint satisfaction and on planning under uncertainty. Mark Boddy, in the next office down from me, has been here for five or so years. He helped me find my roost here and having Mark as my neighbor has made for stimulating collaborations.

I just got married to Pam Hanson, someone I met up here. In attendance were Mark Boddy (msb), Keiji Kanazawa (kgk), Robert McCartney (rdm) and Kate Sanders (ks). I'm very happy living in Minneapolis, all in all: a good cultural and outdoors life is to be had here. And we have a different (and more favorable) view of global warming up here.

goldman@src.honeywell.com

SWAMI MANOHAR Ph.D. '89

Just read the Spring '95 ***conduit!*** and hence this mail. The first question that pops to my mind is, what is the ping-pong scene like these days, or has that seminar room been taken over for less serious business (like holding seminars)?

Have been here at the Indian Institute of Science for the past five years, moving from VLSI architectures (my Ph.D. area) to parallel architectures and algorithms for graphics and visualization. Graduating my first set of research students and setting up a VR lab for visualization applications are my current activities.

My wife Sathya and I have just celebrated the fifth birthday of our triplets. Best regards.

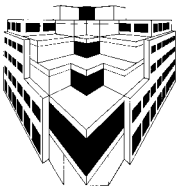
manohar@csa.iisc.ernet.in

CHRISTINA NICOLAIDES '88

Life has been going very well, notwithstanding the usual complaints about being way too busy. I'm finishing my second year of internal medicine residency at Oregon Health Sciences University, and I must say I am enjoying it much more than I expected. Portland is a fantastic place to live. The 36-hour shifts get to me at times, but such is the life of a resident, I suppose. CS people are about the only others who keep similar hours, so I suspect you can all relate.

I was recently chosen to stay on a fourth year to be Chief Resident. It's a great opportunity and should be a really rewarding year, but along with a lot of teaching and clinical responsibility comes some pretty awful administrative stuff—perhaps someone could help me brainstorm the following problem, or at least point me in the right direction. One of my responsibilities is to come up with the rotation schedule for all the residents. This may sound simple, but it's actually a very complex problem. Currently, the chiefs do the whole thing by hand and literally spend months working on it. I'm watching the current chiefs struggle with it now and keep saying to myself that there has to be a better way to do it by computer.

Optimally, I would like to have a system which would allow us to specify a long list of con-



ALUMNI EMAIL TO THE EDITOR

TODD APO '89

It's me . . . Todd . . . Yes, Todd Apo! Aloha from Hawaii. It's time for my three-year appearance, but since I can't make it out to Providence this time, I have to use email—I finally got an account on America Online and now have access to the world. It sure brings back the memories of sending email about CS11 and filling up the MOTD. It's amazing that it's been six years since graduation and three years has passed since I was last at Brown. Let me update you on what has happened since then. I had just finished law school and the bar exam when I was last in Providence. Jaime and I got engaged right on the steps of the Green. We were married in August 1994. I finished up my MBA in the fall and graduated in December 1992. I then started a clerkship with Justice Robert Klein at the Hawaii Supreme Court. After a year of clerking, I started as an associate at Ashford & Wriston. I have been working at A&W for almost two years. Those are the major highlights, but I am now applying for an Assistant Professor position at the Law School here at the University of Hawaii. It is a tenure-track position teaching first-year contracts. I am also hoping to work in the area of Native Hawaiian rights, which is a very hot topic right now. I have always hoped that I could get into teaching, though I had always thought about it at the high-school level. This position came up and I am very excited about it. I have been thinking more and more about those CS11 days. I enjoyed working with students, teaching, and getting people to understand and learn. I know I will take a lot of what I went through in CS11 into the classroom with me. I am looking forward to having a chance of getting back into education. Hope all is going well for the CS department. Aloha. 46-359 Haiku Road #C-10 Kaneohe, HI 96744. Mahalo — Todd. *TKAHawaii@aol.com*

MARC BROWN '80, Sc.M. '82, Ph.D. '87

It was nice to be part of your double-checking data about the UTA program. Schlepping for Andy, Sedge, and Gene was one of the highlights of my undergrad days. And I'm not alone in saying that the UTA program was a big part in making Brown Computer Science undergraduates a highly-sought-after commodity.

Reading each issue of ***conduit!*** never fails to bring back many more fond memories of the decade that I spent in the Department. It's hard, for me at least, to believe that in a few months it will be exactly ten years since mhb@cs.brown .edu became mhb@src.dec.com; my home page is http://www.research.digital.com/SRC/personal/Marc_Brown/home.html. Keep up the good work!

PS. pls ask kha to check this msg for typos, thinkos, and other Marcisms, just like old times....btw, I'm still waiting for a cover story about the ACSL (American Computer Science League), which I started that fall of '78 (the idea came to me while schmoozing with one of my graders, Allan Schwedock, during one of ec's lectures, in fact) and is still going strong. Last year, three teams from Bosnia came to our All-Star Contest in Houston with one of the teams winning the Intermediate Division and walking away with an IBM PC—but maybe I should be holding out for a cover story in the BAM!

TED CAMUS Ph.D. '94

It was nice seeing everyone in the department at Commencement. Reading the most recent (and excellent) issue of ***conduit!***, I thought I'd offer a contribution to your column. I of course defended in August '94, after having finished my dissertation during the summer at the Max-Planck Institute in Tuebingen, Germany, where my co-advisor Heinrich Buelthoff is now director (Tom Dean being my other co-advisor). (My dissertation topic of real-time motion detection for robotic vision applications is discussed in detail on my WWW page http://isd.cme.nist.gov/staff/camus/.)

After spending a month in Chicago, Santa Barbara and back home in Westford, Massachusetts, I began work here at NIST as a National Research Council Postdoctoral Research Associate. Best known for its measurement standards, NIST is the only government agency whose primary mission is to assist and deal directly with industry. I was very fortunate in finding a research group whose work description was virtually the abstract of my thesis. Although this is only a two-year position, in the past about 30 percent of NRC postdocs have become full-time staff at NIST.

tac@cme.nist.gov

Eugene Charniak.

Eugene gave several invited talks these last six months, some at universities (e.g., Cornell, where he gave two quite different talks, one to Computer Science and one to Cognitive Science), but more at conferences. In particular, he was an invited speaker at the Florida AI conference (FLAIRS), the IJCAI workshop on New Approaches to Learning for Natural Language Processing, and an invited talk for the full IJCAI (International Joint Conference on AI, held this year in Montreal).

Thomas Dean.

Tom was elected to the Board of Trustees of IJCAI (International Joint Conference on Artificial Intelligence). One of his duties is to serve as the program chair for IJCAI 1999, which will be held in Stockholm.

Maurice Herlihy.

Since the spring issue, Maurice has chaired the steering committee for the ACM Symposium on Principles of Distributed Computing as well as the ACM Doctoral Dissertation Award Committee. He is on the program committee for the Symposium on Parallel and Distributed Computing, 1995, and is on the editorial boards of the *SIAM Journal on Computing* and *ACM Transactions on Computer Systems.*

Paris Kanellakis.

Paris has joined the editorial board of the new journal *Constraints*. In May he gave an invited tutorial on constraint query languages at the 14th ACM Symposium on the Principles of Database Systems (PODS) in San Jose, California. In June he began serving as conference chair for ACM PODS.

Pascal Van Hentenryck.

Pascal was an invited speaker at Constraint Programming '95 in Marseilles (France), at INFORMS in New Orleans, and in Namur (Belgium) to honor French computer pioneer Henry Leroy. He also became an associate editor of *JAIR* (*Journal of Artificial Research*).

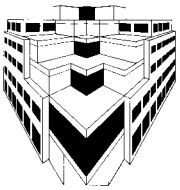
Roberto Tamassia.

In January Roberto gave an invited lecture at the University of Rome, and in March joined the editorial board of *Computational Geometry: Theory and Applications.* He is on the program committees of GD '95 (Symposium on Graph Drawing) and WADS '95 (Workshop on Algorithms and Data Structures). Last month he gave an invited talk at the International Workshop on Constraints for Graphics and Visualization in Cassis (Marseille), France.

Peter Wegner.

Peter lectured in England, Denmark, Estonia and Sweden this summer. He will be conference co-chairman of next year's European Conference on Object-Oriented Programming (ECOOP '96). Look for his paper on "Interactive Foundations of Object-Oriented Programming" in the October issue of *IEEE Computer.*

Interoperability symposium speakers: back row, l to r, Frank Manola, Josh Auerbach, Jim Kirkley, Richard Soley, Steve Reiss; middle row, l to r, Jeff Sutherland, Sandy Heiler, Shawn Woods, Peter Wegner; front row, l to r, Robert Duvall, James Baker, Brook Conner



of avd in witch's garb—begowned, behatted and drinking from a smoking pumpkin—be easily forgotten?); they provide an outlet for creativity and good fun as well as an opportunity for social interaction.

For CS4 professor John Savage, having UTAs means that students can complete many more projects of greater depth than they could otherwise. UTAs also provide considerable help during TA hours, answering questions during times when faculty and graduate students are not available. They evaluate assignments so they can be graded, and develop a climate in which the material is perceived as and thus becomes more accessible.

Peter Wegner, who teaches CS2, believes the UTA program builds a sense of collegiality and belonging and creates a synergy among students, thereby greatly enriching the learning experience. Of the 19 UTAs who supported CS2 last year, one third were not CS concentrators; everyone gains, Wegner feels, from the breadth of perspective non-CS-majors bring to the course. During the month-long final project each UTA works intensively with the students; most find this one of the most worthwhile aspects of the program. Since the prerequisites for being a CS2 UTA are low (completion of CS15), the course serves as a UTA training ground for other CS courses. An incidental benefit of being a CS2 UTA is to provide a non-technical topic of conversation in job interviews; students have been very successful in establishing rapport with interviewers who lack technical expertise but can acknowledge the value of their UTA experience. (One CS2 UTA recently received President Gregorian's award for the most successful job-getter in his year—he received seven job offers out of seven applications!).

In a recent Brown survey on undergraduate student employment, CS was one of the top three academic employers (with Engineering and Dean of the College) in the University. CS hires undergraduates at three times the rate of the university at large: with only three percent of the Brown faculty, CS provides nine percent of undergraduate jobs (indeed, due to some oddities in how the data were compiled, the number may be closer to 11-12%). Katrina Avery, CS department manager, points to the financial advantages of UTAs. "Since the UTA system is such a plus educationally, it's really nice that it's relatively cheap too, at least compared to the cost of a graduate TA. Though it's such a tremendous plus that faculty want more and more UTAs each year, and often it's been hard to find the money."

From its anomalous beginnings as the quirky brainchild of a single CS faculty member, the UTA program has achieved campus-wide recognition to the point where the office of the Dean of the College now offers support for training complete with an orientation session citing collaborative learning methods, tips and guidelines for each new batch of UTAs.

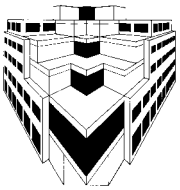
THE 15TH IPP SYMPOSIUM

Peter Wegner

Last April's IPP symposium on "Architectures for Interoperating Software Components" included an opening talk by Richard Soley who presented OMG's perspective on interoperability. Sandy Heiler and Frank Manola of GTE examined technical issues from the perspective of applications, while Josh Auerbach of IBM and Shawn Woods and James Kirkley of DEC presented the perspective of major computer companies, and Jeff Sutherland of Easel presented a business information system perspective. Steve Reiss of Brown discussed his research on interoperable environments, and three Brown graduate students discussed how interoperability issues impacted their research.

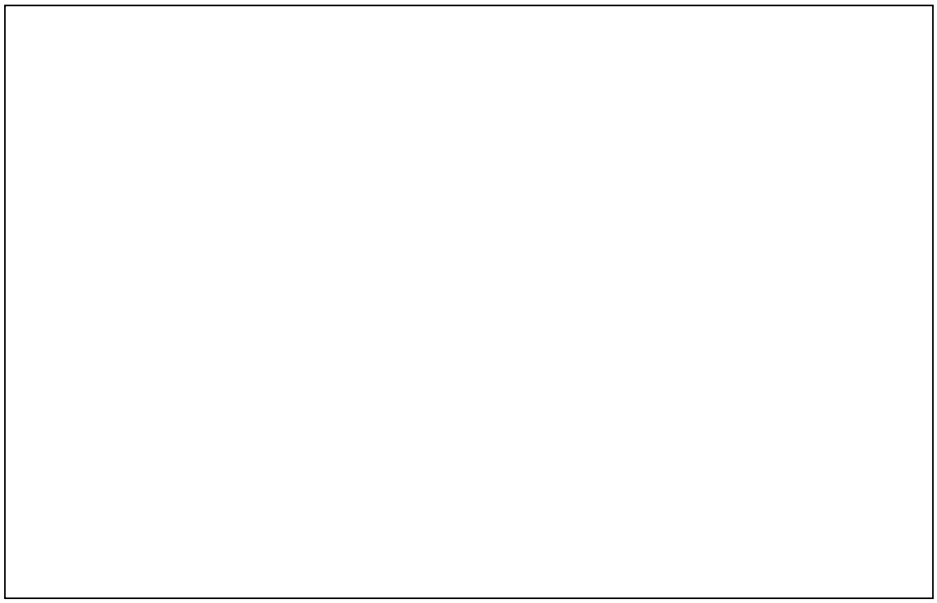
Interoperability is a leading-edge research topic that extends object-oriented programming techniques to very large applications. It was chosen as a topic for an IPP symposium because it bridges the interests of industry and universities.

The symposium featured worthwhile technical presentations of substantive systems, like the joint DEC/Microsoft work on COM and IBM's DSOM, as well as a lively discussion in the closing panel on the commercial prospects and technical foundations of interoperability. It covered a lot of ground in the time span of a single day. Three of the authors (Frank, Sandy, and Jeff) have written short articles on interoperability for the June issue of *Computing Surveys.*



number of our TAs go into academic and industrial teaching. The low UTA/student ratio (a little more than one UTA for every ten students) gives many benefits: as well as the obvious plus of one-on-one help for the students, faculty gain assistance in preparing and giving lectures, running help sessions and labs, and even determining course content and pedagogy. When a group of UTAs feels that a course 'needs help,' the constructive and detailed suggestions they give its professor are often heeded and put into effect.

The propriety of having undergraduates grade other undergraduates is sometimes questioned. "Naturally," says Eugene Charniak, chair of the CS department, "it is the faculty who are responsible for assigning grades, though we would all add, 'with the help of our UTAs.'" Defining the borderline between help and responsibility is discussed periodically at faculty meetings, where professors explain how they handle this for their particular courses. In CS169 Tom Doeppner, for instance, spot-checks all assignment and exam grading. He handles appeals of grades, which are very rare, by asking the UTAs to review their work and at the same time reviewing it himself; should he and his UTAs disagree, he of course changes the grade accordingly (but this hardly ever needs to be done).

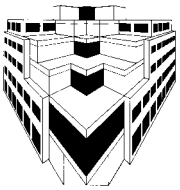


Faculty need lots of UTA support—CS15 UTAs chez van Dam

According to van Dam, the UTA program is popular because young people like to be involved, they learn a great deal, both technically and socially, and this kind of unique experience helps bolster a resume and grease the skids into graduate school—a genuine symbiosis. The UTA program is almost self-sustaining in that many UTAs sign on again and again; indeed, some find it the most memorable part of their Brown experience. Robert Duvall, who holds the current record of five semesters as a CS15 UTA, says "This enthusiasm is most people's experience, although some burn out after a single semester." Van Dam's 11th to 13th commandments define the credo of his TAs: Thou shalt not flake. Thou shalt not power trip. Thou shalt be proactive. "Even when you're working on the 12th iteration of the lecture slides and Andy again finds errors," Duvall says, "it's still worthwhile because you're doing it for the students, 150 of them. The TAs grow to fill the role; you need no predefined skills, you just give it your all and usually something really exciting happens."

Eugene Charniak was an early convert. "My first encounter with the UTA system was in my first semester at Brown, in 1978. I had been asked to handle CS51 (what is now CS15, the introductory CS course) while Andy was on sabbatical, and knowing nothing of its reputation I agreed. I had never programmed in the language the course used, and generally I felt pretty unprepared. Fortunately, however, I had Marc Brown (who went on to win the ACM Distinguished Dissertation award and is now at DEC SRC) as my head UTA, and he and his crew that semester really saved my anatomy. I've been a believer ever since."

Ann Nicholson, a former post-doc who taught in CS4 and is now at Monash University in Australia, was so impressed with the CS4 UTAs that she recently asked Robert Duvall how to start up a UTA program for her course at Monash. He estimated it would take as long as two to three years to build a pool of suitable students at a suitable level of excitement. An important facet of the CS program, in his opinion, is that students can TA as second-semester freshmen once they've taken CS15—if they were forced to wait until their junior year, say, they would quickly become swamped with other commitments and lose momentum. Skits that are at least mildly relevant to lecture material are part of the CS15 tradition (can the sight



Technology, Inc. We were very happy to introduce Dan, Mel and Ken to our faculty and students.

DEC has renewed its membership and has appointed Bruce Foster as its contact person. Bruce made his first visit to the Department in late September and spent a full day visiting with faculty members and students. We are most pleased to welcome Bruce as DEC's IPP representative.

IPP continues to grow in size. We are very pleased to have continuing memberships in our program for IBM T.J. Watson Research Laboratory, Bellcore, and Honeywell.

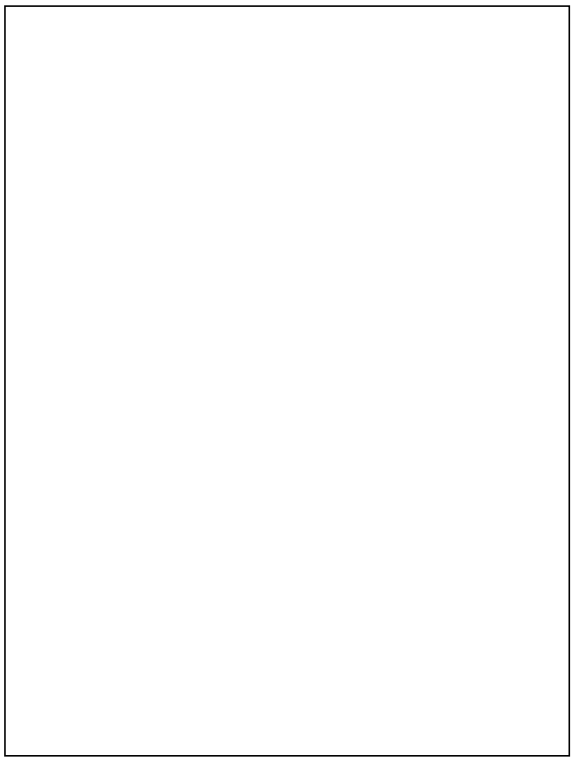
A special mention is in order concerning Suzi Howe. Suzi is the Manager of the Industrial Partners Program. Not only does she edit and publish ***conduit!,*** our departmental newsletter, but she also coordinates visits to campus by Partners, supervises the logistics for IPP symposia and generally facilitates communication for Partners. Her style and grace are reflected in every one of these important activities.

UNDERGRADUATE TA PROGRAM

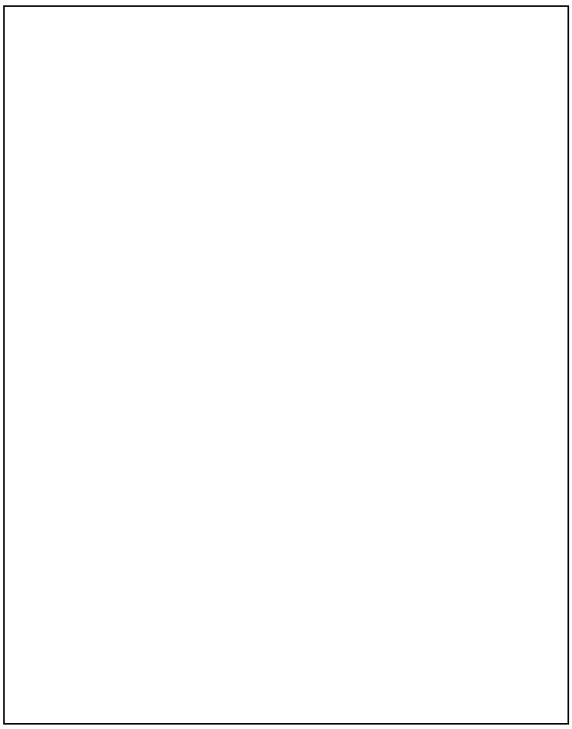
"Can undergraduates help teach other undergraduates?" To Andy van Dam, who initiated the CS Department's Undergraduate Teaching Assistant program in 1965, the answer is simple: "Certainly—who better than somebody who's just taken the course, understands what the learning difficulties are and has the right empathy? Besides, graduate students probably haven't taken the course and may well be more interested in their own research than in giving individualized help to undergraduates."

At the start of our UTA program, the whole idea of involving undergraduates in teaching and research was unheard of—at most, undergraduates were used as graders for calculus courses. "At the time, nobody considered this a reasonable thing to do and I took considerable flack for it during the first ten years," says van Dam. Now other schools routinely involve undergraduates in teaching, and our department's program involves approximately 120 undergraduates per year. The benefits are clear: the students get personal help from a peer to whom they can relate, and the UTAs gain a deeper knowledge of the material and learn about teaching—upon graduation a disproportionate

COMMENCEMENT '95



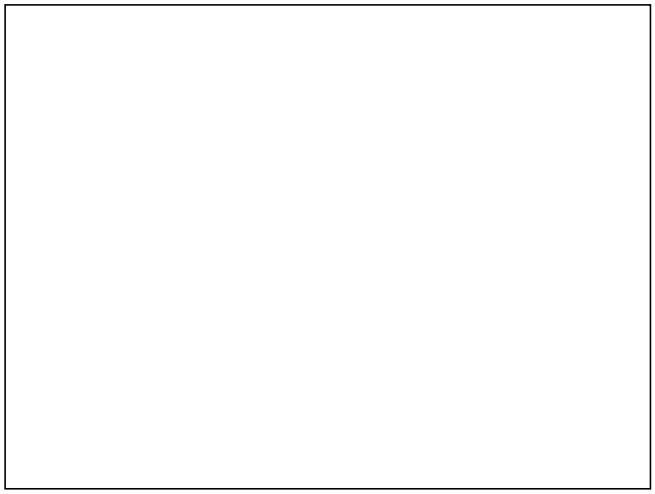
O tempora! O mores!



John Savage and granddaughter Emily Rudder, '17

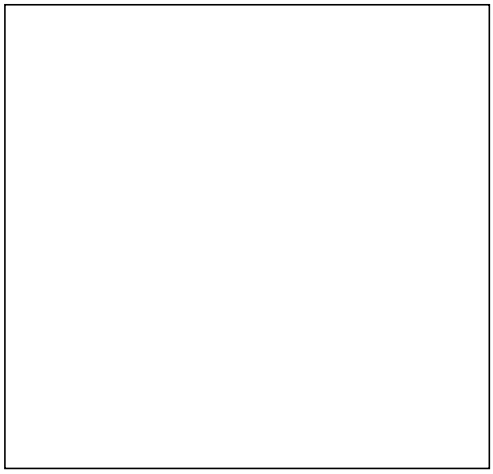
Peter Lauro of Brown's Development Office plays a large role in prospecting for new IPP Partners. Peter, whose responsibilities in Development include corporate and foundation giving, has not only provided the names of many potential Partners but has also visited them during his many travels.

In the last few months we have entertained and negotiated with many Partners and prospective Partners. In mid-May Ken Huebner of Ford Motor Company spent a very informative day here. Faculty and students turned out in large numbers to introduce Ken to the Department.



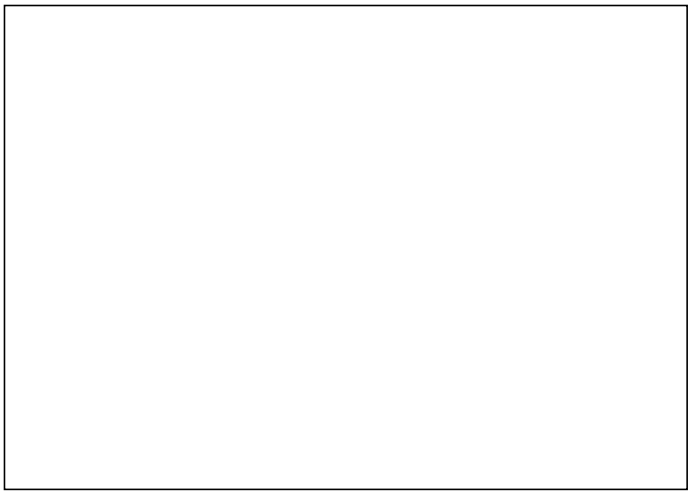
From Fleet Services Corporation: l to r, Diane Valerien, Diane DeCosta and Suzanne Morin

Early in June Electronic Book Technologies of Providence, a leader in electronic books, agreed to join IPP. Throughout the summer they availed themselves of one of the benefits of IPP membership, access, for a fee, to our celebrated instructional facility for training sessions. Also in early June we had a very pleasant visit from Emil Sarpa and John Hale of Sun Microsystems, one of our long-standing Partners. Emil continues to be one of IPP's biggest boosters, and Sun contributes not only the annual $25,000 Partners fee but also another $10,000 to a scholarship fund.



Emil Sarpa (l) and John Hale from Sun

June was a busy month. Peter Lauro and I also visited Dennis M. Rygwalski, Executive Vice President of Fleet Services Corporation of Providence, the computing arm of Fleet National Bank, at which time Dennis informed us that Fleet would join IPP. At the end of August we hosted Diane DeCosta, Human Resources Manager, Diane Valerien, Development Manager and Suzanne Morin, Application Manager, Training, who spent a day with us.



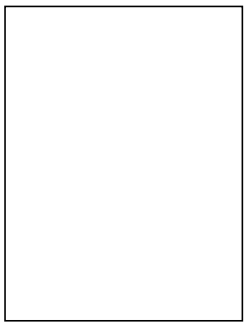
Citicorp visitors: l to r, Ken Randall, Dan Schutzer, Mel Takata

In late June we received a large delegation from GTech led by Roy Nicolosi, Vice President of Software. GTech of East Greenwich, RI, is the largest maker and installer of public lottery systems in the world, installing and running systems worldwide and in many of the fifty US states. Joining Roy were Steve Beason, Director of Product Development, Software, Steve Schottenfeld, Director of Communications, Software, Lisa Lavieri, Director of Product Services, Software, Michael Hutton, Software Consulting Engineer, Architecture Group, Brian Ruptash, Senior Software Consulting Engineer, Architecture Group, and Rick Bates, Manager, Human Resources. I'm happy to report that they had a most interesting and successful trip that resulted in their joining IPP.

Dan Schutzer, Mel Takata, and Ken Randall of Citibank, a prospect company, also spent a day with us in late June, the latter two traveling from Citicorp's California subsidiary, Transfer

Industrial Partners from GTech: l to r, Rick Bates, Lisa Lavieri, Steve Schottenfeld, Roy Nicolosi, Michael Hutton, Steve Beason. Faculty members Steve Reiss and John Savage back right

IPP EXPANDS



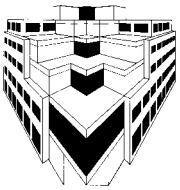
John Savage

Last spring, at the urging of Eugene Charniak, I resumed responsibility for the Department's Industrial Partners Program (IPP), which I had introduced in 1989 during my second term as Chairman. Eugene felt that the Program should be expanded, believing it more important than ever that we be well attuned to the interests of industry.

One of IPP's primary purposes is to provide opportunities for the Computer Science faculty and students to learn from our Partners. Our IPP symposia serve this purpose most admirably, and on many occasions our speakers have introduced provocative ideas. A symposium talk that stands out is that given last November in the Nexal Computing Symposium by James Gosling of Sun Microsystems on Java, his network-aware language, and Hot Java, his network browser. By this summer Java became a media hit. The ***New York Times*** did a feature story on Gosling in late September highlighting Java's revolutionary impact on network browsers such as Netscape. Network browsers have been good for viewing text, pictures and video as well as following links from one data source to another, but they lacked full programmability. Java now makes it possible not only to animate displays but also to let users interact with the browser.

Another IPP-related event that stands out in my memory is the licensing of Steve Reiss's FIELD system to the Digital Equipment Corporation in 1990. In our very first regular IPP symposium Steve described his work to an audience that included John Ellenberger of Digital. John later told his DEC colleagues about Steve's work at a time that Digital very much needed a competitive software development environment. When Chuck Piper led a team to Brown to speak to Steve and see his software demonstrated, he was so impressed that he immediately began negotiations to license the software. The success of FUSE, Digital's version of FIELD, is such that Brown has received many hundreds of thousands of dollars in royalties from Digital.

Expanding an IPP Program requires a great deal of prospecting, that is, identifying prospective Partners and introducing them to the Department. The bad news is that this takes a great deal of time; many unproductive leads must be pursued. The good news is that it is quite easy to impress prospective Partners; one need only introduce them to the faculty and students in the Department. In turn, the faculty are enthusiastic about IPP. They readily agree to speak to prospective Partners and they explain and demonstrate their terrific ideas with zest. Students are very enthusiastic as well; they realize that opportunities may arise through Partners to find that choice industrial position as well as to learn more about industrial priorities.



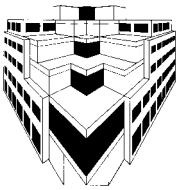
systems, for which Computational Geometry offers a wealth of stimulating and challenging questions.

The second concerns the visualization of conceptual structures, which is a key component of support tools for complex applications in science and engineering. Foremost among the visual representations used are drawings of graphs (i.e., networks of nodes connected by edges) and related combinatorial structures. Graph drawing studies the automatic generation of drawings of graphs and has important applications to many computer technologies in which a variety of diagrammatic representations are used. Examples include software engineering (call graphs, program nesting trees, object-oriented class hierarchies), databases (entity-relationship diagrams), business graphics (organization charts), information systems (dataflow diagrams), real-time systems (Petri nets, state-transition diagrams), decision support systems (PERT networks, activity trees), VLSI (circuit schematics), artificial intelligence (knowledge-representation diagrams), digital libraries (hypertext documents), and logic programming (SLD-trees). Further applications can be found in other science and engineering disciplines, such as medical science (concept lattices), biology (evolutionary trees), chemistry (molecular drawings), civil engineering (floorplan maps), and cartography (map schematics). The last few years have witnessed the establishment of a multidisciplinary research community around an annual symposium on graph drawing that attracts participants from all over the world and circulates about 1,000 copies of its proceedings.

A Voronoi diagram—a fundamental structure in computational geometry: the grey lines delimit the regions of the plane containing the points that are closest to one of the black sites

Construction of the Voronoi diagram. Each vertex of the diagram is the center of a circle through three sites. Even if all the sites have integer coordinates, the vertices of the Voronoi diagrams are rational numbers given by the ratio of two 3x3 determinants, and thus need high numerical precision in computations

Roberto's project on graph drawing has two main sponsors. The National Science Foundation is supporting theoretical investigations with a $225,000 single-PI grant from the Theory of Computation Program. The Advanced Technology Program on Component-Based Software of the National Institute of Standards and Technology has recently awarded a $2-million grant to support work on graph visualization technology by an industry/academia team that includes Roberto, Isabel Cruz (Tufts), Arunabha Sen (Arizona State), Ioannis Tollis (University of Texas at Dallas), and Brendan Madden, president of Tom Sawyer Software, a dynamic young company based in Berkeley, CA. Specific hard problems to be investigated are incremental layout maintenance, three-dimensional representations, and the layout of hypermedia documents.



of algorithms and algorithmic paradigms has been developed. Yet, despite this phenomenal development, the projected technology transfer has not materialized to the desired extent, causing considerable discomfort and frustration within the research community, since the need for such transfer persists unabated.

In our opinion, this disappointing evolution has been caused by some simplifying assumptions that are at the core of the discipline and have in a sense greatly aided its development. Such simplifying assumptions, originally deemed rather innocent, are:

- *Real-number arithmetic*. This choice (rather than that of integer arithmetic) is equivalent to an assumption of infinite precision, a far cry from ordinary computing experience. The problem is that both practice and careful analysis have shown that round-off errors give rise to not only (acceptable) approximate results, but also (unacceptable) topological inconsistencies (lack of robustness).

"The guiding principles of our research will be the pursuit of robustness and ease of programming.....Experimental verification will be an important component of our effort"

- *Unbounded random-access memory.* This assumption ignores the reality of the hierarchical organization of computer memories (cache, core, disk) and leads to algorithmic designs not closely attuned to existing computing systems. Correspondingly, algorithmic analysis is blindly aimed at asymptotic performance and therefore, rather than acting as a powerful guiding criterion, becomes an end in itself, frequently with misleading consequences.
- *Unbounded parallelism.* This assumption, in the context of parallel algorithms, contemplates the use of as many (rather simple) processors as demanded by the problem size. Of course, this is at glaring variance with today's technology and market, where parallel machines consist of relatively few very powerful processing nodes.

These issues were prominent in our research agenda when we became aware of a request for proposals in various strategic areas including Computational Geometry issued by the Department of Defense under the sponsorship of the Army Research Office (ARO) (MURI '95 BAA). The scope of the research effort was such that it could not be carried out exclusively with personnel at Brown, so that we chose to involve colleagues at Johns Hopkins (S. Rao Kosaraju and Mike T. Goodrich) and Duke (Jeff Vitter and Pankaj Agarwal), with whom we had a long-standing professional affinity and a substantive record of past collaborative research. The innovative approach presented in our proposal was favorably received by the sponsoring agency, and our project was approved for funding, with Brown University as prime contractor and Franco as project coordinator (Principal Investigator).

With this turn of events, an exciting new research chapter opens up for us, our colleagues, and our students, in the form of a five-year, $4.5-million endeavor designed to renovate the methodologies of Computational Geometry, develop new algorithms, and lay the foundations of a modern software library analogous to corresponding initiatives in the field of numerical computing. To be effective, the proposed renovation of Computational Geometry must be accomplished within the context of today's complex technology and computing environments. The guiding principles of our research will be the pursuit of robustness and ease of programming, which are keys to the targeted technology transfer. Experimental verification will be an important component of our effort.

We expect to establish a substantial visitor program (Giuseppe Liotta, from the University of Rome, is already on campus and Olivier Devillers of INRIA, France, will visit us in January), intended to promote interaction with prominent researchers sharing our objectives. To enhance the external visibility of the project, President Gregorian has just approved the establishment of a "Center for Geometric Computing" within the Department of Computer Science at Brown, with membership extended to our collaborators at the two sister institutions.

The Center will also be the home of two related projects of ours. The first is a project in parallel computing, funded by a $283,000 NSF grant to Franco, aimed at the realization of parallel computation on technologically current parallel

conduit!

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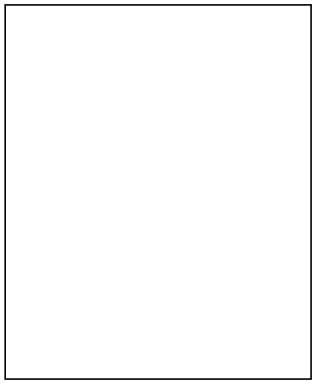
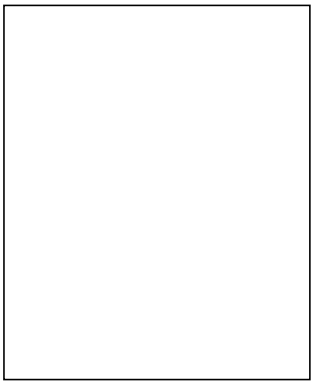
Brown University

NEW CENTER FOR GEOMETRIC COMPUTING



Franco Preparata



Roberto Tamassia

Geometric problems are as old as civilization itself. In early agricultural societies, the desire to measure land for taxation purposes gave rise to geometric thinking. In classical times, geometry grew beyond its utilitarian motivation to become the paradigm of mathematical thinking. Euclid, in addition to his monumental contribution of the axiomatic approach, according to which all properties of geometric objects are derivable from a given set of postulates, introduced the so-called *Euclidean construction method*, a schema bearing all the traits of modern algorithmic thinking, since any geometric construction is a terminating sequence of well-defined operations (primitives). Until recent times, the constructive approach was out of favor with mathematicians, who preferred the existential viewpoint. Yet geometry, which is so deeply rooted in intuition and, in different degrees, appeals to every human being, continued to be a generous source of problems in a vast variety of application areas dealing with representation and construction of geometric objects and environments, such as geography, architecture, mechanical engineering, etc.

Such pervasive interest in geometric problems led naturally to their solution by means of computers, once these versatile tools became available in the second half of this century. Such activity, while essentially *ad hoc* and without a stated objective of efficiency, acted as the incubation bed of Computational Geometry as we know it today. Although several geometric algorithms had previously appeared in the literature, it was only in 1975 that Computational Geometry officially became an identifiable area of algorithmic research. The denotation had been used before with different connotations (perceptrons, spline theory, computer-aided theorem proving); however, in a relatively short time its popularity as a research area grew so remarkably that no doubt persists today as to its meaning.

Computational Geometry was designated as the algorithmic study of geometric problems and involved the elucidation of structural properties leading to algorithmic efficiency (and sometimes "optimality"). It was intended as a powerful aid in a number of applications involving a physical environment, such as robotics, computer-aided design and manufacturing, geographic information systems, computer graphics, etc., so that its original mission involved a concrete transfer of technology from academic research to the industrial environment.

> *"it was only in 1975 that Computational Geometry officially became an identifiable area of algorithmic research"*

In the subsequent 20 years, Computational Geometry has flourished beyond the most optimistic expectations. Today a vast community of researchers exists throughout the world, a number of technical journals are devoted to the discipline, several textbooks have appeared, formal courses have been established in a large number of universities, and an impressive body