NeXT on Campus™

Fall 1990

Multimedia authoring tools for humanities faculty

Speech recognition with Sphinx

Rethinking introductory computer science

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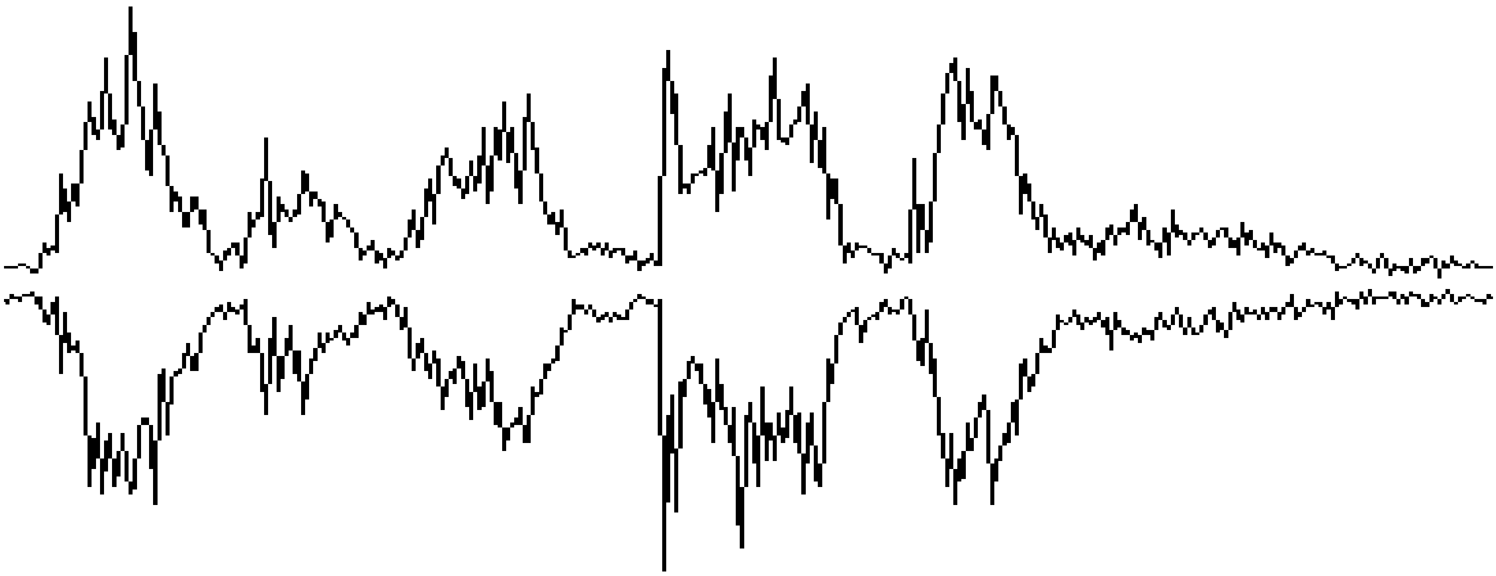
Gourmet: the supercalculator

Calculus meets the world of Mathematica®

Building an anatomical knowledge base



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September 1990

Dear friends,

Welcome to the second issue of NeXT on Campus, *a quarterly publication for our partners and colleagues in higher education. Since our premiere issue last May, we have heard from many of you; your ideas and comments have played a major role in shaping this issue.*

In addition to regular features about products and other resources, this issue includes articles focusing on ways NeXT™ technology is being used to rethink teaching in many disciplines ranging from calculus and psychology to art and computer science. Other project highlights include an anatomical knowledge base for medical research and multimedia authoring tools for humanities faculty. Richard Crandall's scientific computing column describes Gourmet*—a supercalculator that Crandall says, "eats other calculators for breakfast." This issue also contains a preview of NeXT's new product line for higher education.*

We hope you enjoy NeXT on Campus, *and we look forward to hearing from you. Please keep your comments, suggestions, and contributions coming to us at: next_on_campus@next.com*

Yours,

Dr. Ronald F.E. Weissman
Director of Higher Education
NeXT Computer, Inc.
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Fall 1990, Volume 2, Issue 1

NeXT on Campus

Table of Contents

Fall Feature

Liberal Arts Multimedia Exploration Project

Development tools for humanities faculty

"The biggest problem with introducing computers into the classroom has always been that faculty development environments have generally required faculty to become programmers," says Carol Lennox, director of academic computing and lecturer in mathematics and computer science at Mills College in Oakland, California. "For years, we've been buying hardware and software, introducing faculty members to these systems, and then watching them struggle and sacrifice their research time to create computerized learning materials. Of course, we want faculty to be the ultimate purveyors of what information technology is useful in the classroom—but we want them to be able to do it without having to become computer experts."

At last year's EDUCOM conference, Lennox found a system that she felt would allow faculty to create multimedia courseware that would not require learning multiple complex applications or programming environments. She and her colleagues viewed a demonstration of Imagine, Inc.'s MediaStation™—an application for creating rich multimedia environments of sight, sound, and text—running on a NeXT™ computer. "What we saw looked really knockout," says Lennox. "Good, high-resolution still and moving images. Exceptional sound quality. And, most significantly, a uniform interface for gathering these elements from perfectly ordinary sources—such as CDs, LPs, tapes, videotapes, live sound, and still pictures—all within a single, integrated environment that makes for a gentle learning curve.

"It was the first tool I had seen that allowed you to do sophisticated development in ways that didn't require programming expertise or support. We thought it could be a viable environment for faculty to build exploratory multimedia learning materials—particularly in the humanities—and wanted them to be able to try their hands at it."

The result was the Liberal Arts Multimedia Exploration Project, an idea organized by Lennox in conjunction with Barbara Morgan, director of advanced technology planning at the University of California at Berkeley and Gary Schlickeser, director of academic computing at Reed College. NeXT and Imagine provided tech-nical support.

Providing teachers with a forum for learning

After a call for proposals, the project organizers selected 15 humanities faculty from colleges and universities around the country to attend a week-long workshop at Mills College. "We did not require faculty to have development experience, or experience with a NeXT computer," says Lennox. "We were simply looking for intriguing projects and ideas."

At the workshop, participants spent a few hours familiarizing themselves with the fundamentals of the NeXT environment, and two days learning how to use Media-Station and input devices such as Digital Eye™ for still and live video, Digital Ears™ for CD-quality sound, and Abaton® and HSD scanners for printed material. For the rest of the week, they attended lectures and demonstrations, consulted on-site technical support staff, and used the NeXT computers and the image and sound digitizing equipment to create their own multimedia projects.

"I thought it was a fertile environment in which to learn and work," says participant Raymond Silverman, assista nt professor of art history at Michigan State University. "The technical and human resources available to us were superb, and the structure of the workshop allowed plenty of time to work with the specialists from Imagine and NeXT. There was also time to roam around and talk with fellow participants, to see what they were doing and to exchange ideas."

Helping students explore the history of African art

Silverman's project sprang from an interdisciplinary

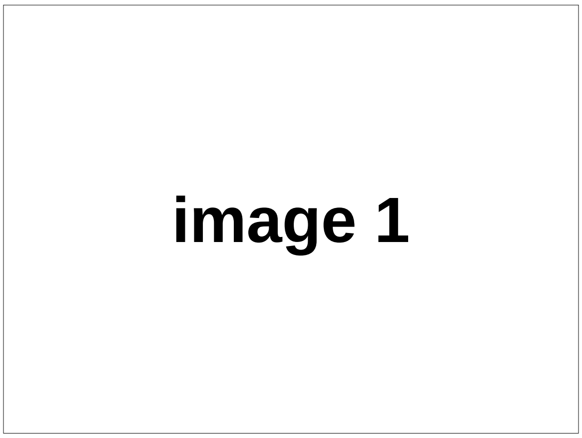
> *"Of course, we want faculty to be the ultimate purveyors of what information technology is useful in the classroom—but we want them to be able to do it without having to become computer experts."*

course he had been co-teaching at Michigan State on the cultural history of Africa. "I specialize in African aesthetic traditions, and I've studied brass casting technologies and the contexts in which brass is used in Africa. Over time I've gathered a lot of material in various forms—both moving and still video images, prints, slides, and audio cassette recordings of different sounds and music associated with brass casting. I wanted to bring all this material to the NeXT Computer and create a learning environment that students could work through and explore.

"The finished module will present the different contexts in which brass functions in West Africa. It will examine brass from an economic standpoint and from a cultural standpoint. The module will also look at how brass is actually manipulated; how people take the raw metal and fabricate it into different objects. We use video footage to show the wax casting process step-by-step, for example, then look at the people who actually work with the brass, including a biographical piece on the brass caster.

"Eventually, I want to create a number of these modules that can stand alone and deal with a specific subject, or be components of a larger system. I'd like to arrange things so threads can be cast from one module to another; so students, depending on what topic they're exploring, say brass-casting, might become interested in something else, say the clothing that someone's wearing, and they'll be able to click a button that will move them to a module on the use of textiles in West Africa.

"To allow students to explore and discover by asking their own questions—that's the great challenge, and that's why I'm excited about the potential of multimedia in education. As a teacher, I'm being pushed here to anticipate the questions that students will have when working with a system like this. What's going to pique their interest? What are they going to want to know more about? What sort of assumptions are they approaching the system with? The intellectual challenge for me is putting the words, sounds, and images together to create a useful pedagogical structure for these modules—and the NeXT Computer is a powerful medium for doing that."



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Bringing a dead language back to life

"To allow students to explore and discover by asking their own questions—that's the great challenge, and that's why I'm excited about the potential of multimedia in education."

The impetus for Owen Cramer's project came from a problem familiar to many teachers: fundamental knowledge to impart, and not much time to teach it. "I've been teaching Classical Greek for 25 years," says Crame r, professor of classics at Colorado College, "and students in the earliest stages are always troubled by several things. First, the strange alphabet: How can they possibly reproduce it? Second, what can they do about handwriting? The textbook, of course, shows neatly printed Greek letters, but learning how to handwrite is difficult. Then there are the odd sounds which one will tend to ignore later on, because, after all, it's a dead language. Nevertheless, there are interesting things to learn about what those sounds were like. Finally, we work in an intensive environment at Colorado College, and students are expected to get a good grasp of these alien letters and sounds by the second day of the course.

"I've often thought, well, what if there was a way that machines could help with that process? What I imagined doing with a computer was to display the handwritten letters, accompanied by the sounds that those letters make, syllable by syllable, spelling out the basic words of a lesson. What I succeeded in doing at Mills on the NeXT Computer was exactly that.

"I handwrote the words, then scanned them into MediaStation. I manipulated them and made them appear on the screen in syllable-sized chunks. For the sound, I recorded my own voice with a microphone plugged into the machine. The whole process was simple. It didn't take a sound studio. It didn't take a lot of fancy equipment. And I was pleased with the results.

Image 2

"Eventually, the completed module will let students browse through 12 sentences that present the whole alphabet—but in context. That's important to students studying a language that seems alien to them. They need to get an immediate sense that the phonetics of the language are not completely irrational. I am trying to present the sounds and the written letters in the most efficient way, so students can sit down and spend an hour or two at the computer and get pretty far along with learning how to say and write the words.

"I hadn't had any experience using the NeXT Computer. In fact, I had precious little experience using computers at all. The main advantage of the NeXT Computer is you don't have to be all that sophisticated to do things that are otherwise very sophisticated. Patching together animation, along with video, along with sound editing, along with computer programming, is not something I would have ever dreamed of attempting. The amount of learning I would have to do to accomplish that with separate systems is more than I would be willing to tackle. But the fact that, in just a week, MediaStation on the NeXT Computer allowed me to do as much as I did—especially starting from as low a level of computer competence as I had—well, I think that's extraordinary."

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"I am trying to present the sounds and the written letters in the most efficient way, so students can sit down and spend an hour or two at the computer and get pretty far along with learning how to say and write the words."

Simplifying the complexities of creating synthesized sound

Not everyone at the workshop was there to gain expertise using MediaStation. Anthony Holland, associate professor of music at Skidmore College, and his student, Jon Ryan, arrived at Mills with a project that they had been developing for several months using NeXT's Interface Builder™ and Music Kit™. Their project, an interactive tutorial for teaching the basics of sound creation using FM synthesis, is designed to overcome many of the problems of learning sound synthesis with conventional electronic keyboards.

"Creating sound by FM synthesis is a matter of defining many different parameters—attack time, modulator index, and carrier frequency—and that's difficult to learn on the average commercial synthesizer," says Ryan, a keyb oard player whose musical interests range from classical piano to rock and roll. "You might need to press six or seven buttons just to access the parameter you want to change, then press a few more buttons to change it, then press a few more to get to the next parameter—without getting any direct feedback as to what those changes actually sound like.

Image 3

"Our program will provide instructional text and show all the parameters on screen. The parameters will be connected to easy-to-use knobs and sliders. You will instantly hear the effect of changes you make. You will also see the changes in the sound envelope—the graphic representation of the sound form. It allows you to experiment more, and in a much easier way. In the process, it makes sound concepts much clearer and easier to grasp.

"Interface Builder and the NeXT Music Kit are powerful tools for creating applications like this. They let you build and connect all these premade graphic objects; then, based on those connections, they create a skeleton source code, which you can revise and modify to suit your specific purposes. It's a great shortcut instead of programming from scratch."

Eventually, Holland and Ryan plan to distribute their finished module over the Internet, and to create other tutorials that cover different realms of electronic music and sound theory.

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Dramatically reducing development time

Concludes workshop organizer Carol Lennox, "I think you can measure the success of this project—and of the NeXT development environment—by the fact that almost everyone was satisfied with their results. The pictures were sharp and crisp, the sounds were elegant, and the participants didn't have to learn ten different programs to actually use these sophisticated pieces of equipment.

"The most surprising thing was how much progress people made in such a short time. Most current models of faculty development maintain that it takes at least a year, and often two years, to create anything significant for the classroom. In fact, we planned this as a one-year project, and we're all planning to get back together in the summer of '91. But now, having gone through it, we sense that it's possible to condense the year-long process into three months—hold a two-week workshop at the beginning of the summer, then send people away to work on their own, and have them come back in mid- August with essentially finished projects that they can use in their classrooms in the fall.

"That's a pleasant surprise; we didn't expect it. We honestly feel that these new tools are so powerful that faculty could do significant development in a three-month period—and come up with some high-quality projects."

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University of British Columbia

Rethinking introductory computer science

First-year computer science classes traditionally focus on programming, and many incoming students who studied programming in high school are not challenged by introductory courses. More importantly, traditional programming courses often do not provide students with the theoretical foundation they need to continue their studies in computer science. But things are changing.

"There is a sense among computer science educators these days that something is seriously wrong," says Vincent Manis who teaches the introductory computer science course at the University of British Columbia. Seeking to overhaul the first-year course, Manis and his colleagues looked at a number of alternatives. They decided to model their curriculum on the one used by the Massachusetts Institute of Technology, which, says Manis, is based on significant issues in computer science rather than the raw skills of programming.

Manis's course focuses on four key areas:

- procedures, or rules, for data input, output, and manipulation
- objects used to model real-world problems
- relations between objects
- the computers themselves and how they work

"The focus isn't so much on how to give students the skills for using the computer," Manis explains. "It's much more conceptual."

After creating the curriculum, the university began searching for the computer that could deliver it. "We wrote a request for proposal that detailed our requirements—a box that could run the software we need, that could run UNIX, and that could provide good graphics," says Manis. "NeXT said they had everything we needed. In particular, they had tools like Interface Builder that would allow us to build up our lab equipment, which is all software, easily and effectively."

Image 4

The NeXT Computer has enabled instructors and students to build software tools quickly and easily. "We decided to start with one of the most imaginative tools we could think of," says Manis, "so we built a simple version of Interface Builder so students could get acquainted with the application. You can't build complete applications with our version, but you can set up a window with buttons, sliders, and features like those. Actually, I had a summer student work on it. He finished it in no time."

Manis and his colleagues decided to have students use Scheme, a simpler dialect of the Lisp programming language. They wanted students to build and explore tools for problem solving, and Scheme allows students to concentrate on the problems rather than language. "Say you're simulating the lineups in a record store to see how many cashiers you need so people don't have to wait in line too long. Obviously it's nice to have a display of that. But we don't want students to spend a lot of time programming the display. While they might learn some things about programming, they won't learn to think out and solve the problem we're trying to explore. With the NeXT Computer, we can give them a tool that does the artwork and have them concentrate on how to get a record store into the computer."

Manis also finds the NeXT Computer to be a wonderful environment for learning outside the classroom. He is using the NeXT Computer's Sound

Kit because “it’s not only fun, but attaching sounds to programs also helps students understand what’s going on.” Manis encourages students interested in other disciplines to use the NeXT Computer’s bundled software—for example, Music Kit or *Mathematica*®—in their student projects.

Manis compares the NeXT Computer to a university library. “Libraries don’t just have textbooks. They have other books students might be interested in reading that might have something relevant to what they’re studying. That’s an important part of education. Now, when a student says to us, ‘I am really interested in music and math,’ we can say, ‘take a look at Music Kit and *Mathematica*. It’s all there on the NeXT Computer, you can just play with it and see what you come up with.’ It’s really exciting.”

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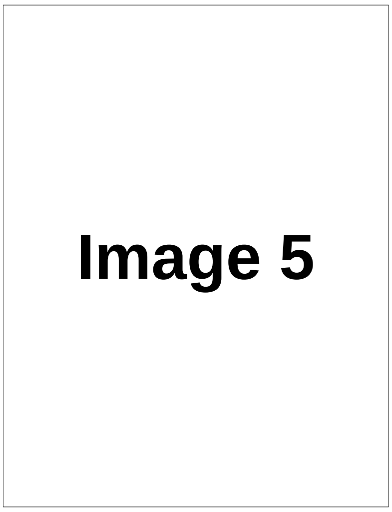
Academic Projects

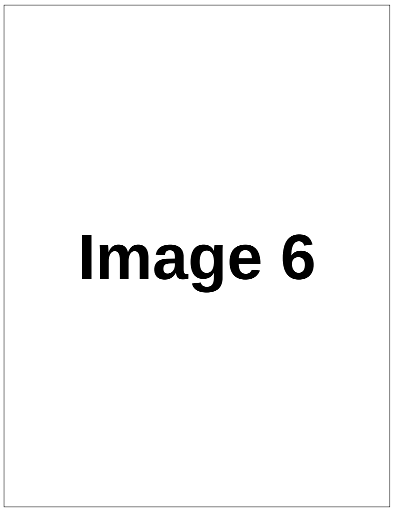
University of Washington

Building blocks to better medicine: developing a structural biology knowledge base

The practice of medicine depends on a comprehensive understanding of structural biology, which may be defined as the physical organization of the human body, ranging from gross anatomy to molecules. Advances in medical imaging and biotechnology have caused an explosion in structural information. Making this ever-increasing information available to the medical community in a useful, accessible manner is a difficult task.



Initial image



Final image with well-defined contour

Bill Barker and Jim Brinkley of the University of Washington Structural Informatics Group are using a network of NeXT and other computers to meet this challenge. Structural knowledge is more than the separate facts and figures about individuals commonly stored in databases. Instead, a knowledge base contains general information about entire classes of individuals. For example, a database might contain a 3D reconstruction of a kidney, whereas a knowledge base would describe both the expected shape and the range of variation for the class of all normal kidneys. A knowledge base of structural biology could therefore improve a physician’s (or a computer’s) diagnostic and treatment-planning capabilities by allowing application of general medical knowledge to specific patients.

The amount of structural information needed to create a knowledge base of human anatomy is too great for one research group to gather, so the university’s group is designing a framework to allow other research groups to build discrete portions of this knowledge base.

“We chose the NeXT Computer as our primary knowledge base-development platform because of its outstanding object-oriented programming environment, and because of the ease with which we’ll be able to build distributed, object-oriented knowledge-based systems to test our ideas,” explains Brinkley.

Via computer networks, the modules will be able to run on different computers in scattered locations worldwide. Groups of experts will work together to create larger systems than one group could create alone. "The design is that of a distributed system consisting of many independently developed modules running either on the same or different computers," says Brinkley.

Since the problem of representing structural knowledge is far from solved, Brinkley's group is concentrating on specific problems whose incremental solution will lead to better methods for representing that knowledge.

One such problem is finding specific biological objects in medical images. This occurs in many areas of medicine, from identification of cells on microscopic slides to extraction of organs in 3D image data. For ex- ample, physicians need to extract the kidney from computed tomography images of patients undergoing radiation treatment for cancer. Once the kidney is isolated, other computer programs can plan the treatment so minimal radiation reaches the kidney and maximal radiation reaches the tumor. Currently, experts trained in anatomy manually trace these structures in medical images. Because manual tracing takes a tremendous amount of time, Brinkley wrote an application that uses knowledge of anatomy to partially automate this process.

The application, SCANNER, takes a cross-sectional image of part of the human body, and isolates a structure such as a kidney within the image. With an initial starting point entered by the user, SCANNER retrieves a stored model representing spatial knowledge of both the expected shape and the range of variation for the class of all kidneys. This model then defines a region on the image within which the computer searches for the kidney borders. The model also defines a current "best guess" as to the contour of the kidney. As kidney borders are found, the search region shrinks and the "best guess" contour is adjusted until it matches the shape of the kidney in the image.

As an offshoot of the SCANNER project, the group created an object-oriented medical image processing framework that works as a front-end to other image processors. Brinkley credits the distributed object-oriented environment running on the NeXT Computer for making this task comparatively easy. Looking to the future, he says, "As our knowledge bases evolve, and as we work with other groups, we expect the NeXT Computer will continue to play a major role as an intelligent center of our knowledge-based systems."

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Images courtesy of Ira J. Kalet
Radiation Oncology Department
University of Washington

Academic Projects

University of Iowa

First-year calculus meets the real world

The University of Iowa has run calculus labs since the early 1970s. In the 1980s, the math department implemented a special accelerated calculus section in which students cover the content of three semesters in two.

"We wanted to revise our accelerated calculus curriculum to present calculus as the language of science and show students real-world ap-plications. We needed up-to-date scientific computing as part of that revision," says Keith Stroyan, professor of mathematics at the University of Iowa. After a comprehensive review of hardware and software, Stroyan decided on the NeXT Computer and *Mathematica*.

"NeXT offers great ease of use and *Mathematica* software with a 'notebook' front end, runs a UNIX® network, and has a host of bundled software," explains Stroyan.

Stroyan felt the NeXT Computer's built-in networking capabilities would make it easier to manage course files. "NeXT runs on a genuine Ethernet network. Also, NeXT delivers low overhead in terms of system programmer maintenance, and it looked like other UNIX workstations were going to be pretty high maintenance. Our network of 12 NeXT computers almost ran itself last semester."

Last year marked the introduction of the school's revised accelerated calculus class using NeXT computers and *Mathematica*. "It was a radical departure," says Stroyan. "For example, in the first week of class, we talk about epidemic models, which is really a system of differential equations."

Before advanced computers were available, an instructor would never have thought of mentioning differential equations on the first day of calculus. But the theories behind an epidemic model and how to interpret one are really not that difficult. “The students don’t have enough calculus to solve the differential equations, and this is where the computer takes over for us. *Mathematica* can solve the approximate equations and it draws graphs at the same time, so the students can see what the model predicts without having to struggle through the differential equations.” Students understand even more when they fill out the shell notebooks that Stroyan and his teaching assistants prepared.

The student notebooks are an integral part of this calculus curriculum, and the NeXT Computer’s large, high-resolution display makes the notebooks easier and more useful to work with than Stroyan had ever anticipated. “That’s because the NeXT Computer has higher screen resolution and is about four times the size of a Macintosh color screen. With the NeXT, you can lay out two notebooks side by side, compare them, and go back and forth. For doing this kind of work, the big, high-resolution screen is important.”

The NeXT Computer has enabled Stroyan to teach in ways that were not possible before. “The three-dimensional graphics are spectacular,” he says. “It’s hard to plot graphs of surfaces. Traditionally, we have only been able to plot simple, special-case equations. Now we can study and graph multivariable calculus in the first year. We also spend a lot of time studying dynamical systems, and there we make animations, or flows, that show how the solutions to these equations change in time. That’s something you can’t do with less advanced computers.”

Computing offers students a chance to experiment. It strengthens their understanding of the concepts by giving them a realm they can explore. Says Stroyan, “Last year we had a student who complained that this course was harder than the one he had in high school. But he pointed out that this course is the answer to the question, what good is it?”

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Image 7

Campus Profiles

Gustavus Adolphus College

Versatility in teaching and research

The faculty at Gustavus Adolphus College, a small liberal arts college in St. Peter, Minnesota, received a new teaching assistant recently: the NeXT Computer. Karl Knight, a professor of computer science, introduced the NeXT Computer to the college after selecting it as the platform for developing a course in artificial intelligence. After experimenting further with the computer, Knight and the college realized that Interface Builder, Objective-C®, the optical drive's storage capacity, and the variety of bundled software made it the best choice for other disciplines at the college as well.

Director of Academic Computing Dick Johnson explains, "When we looked at the NeXT Computer, it seemed ideal for math and other sciences, and also a good platform for the liberal arts. It's perfect for developing courseware."

Johnson's initial impressions are proving true. Faculty in psychology, political science, economics, physics, chemistry, philosophy, art, and music are finding NeXT computers excellent tools for developing courseware. With assistance from Knight and computer science student Scott Hess, several instructors are creating programs that solve a variety of teaching problems.

A psychological self-test on the NeXT Computer

Professor Dick Martin uses animation to give his sophomore psychology students a better understanding of basic developmental psychology principles. In Martin's program, a pendulum swings back and forth on the NeXT Computer screen, its trajectory dependent on three variables—weight of the ball and the height and length of the arc. The student must keep two variables constant while manipulating the third.

"The test was created by Swiss developmental psychologist Jean Piaget," Martin explains. "He used it to assess the cognitive development of his subjects. Piaget used balls and strings. The trouble is, balls and strings break and tangle.

"About 50 percent of our students find it a difficult task to work with the balls and strings," Martin says. Using the computer, students test themselves. "Now, when we discuss psychological assessment tests and the different stages of cognitive development in class, students have first-hand knowledge of the subject matter."

Making molecules come alive

Chemistry professor Larry Potts had a similar problem trying to communicate the intricacies of molecular vibration. "Many students don't have a good spatial concept," explains Potts. 'When you draw things on the blackboard, you're isolated in two dimensions. I was using ball and stick models in class, but with all the turning and twisting, they fall apart. The movements I'm trying to illustrate are actually difficult for molecules to do. Inverting, for example, involves a molecule moving through a center of symmetry and then coming out the opposite side of the center of symmetry. That's hard to show students."

With Karl Knight and Scott Hess, Potts is developing a program that models molecules' movements on the NeXT Computer. "I hadn't tried to model it on any other computer," Potts states, "partly because I'm not a good programmer. I think it could be done on other systems, but there are advantages to using the NeXT Computer. With Interface Builder, you can put together a program that is easy for students to use. With the speed of computing on the NeXT Computer and its ability to process graphics so clearly, it's a natural way to demonstrate these concepts."

NeXT opens new vistas in art

Visualizing form and movement is, of course, the artist's stock in trade. But young artists also need help acquiring these skills, according to art professor Stan Shetka.

"The basic concept of perspective is hard to understand, even for upper-level students," he says. Shetka plans to videotape and digitize images to help students understand the basics of drawing and sculpture. Once displayed on the screen, the images can then be isolated and broken down into their constituent parts. "The computer will act as a third eye for the students. I want to develop a program that uses the NeXT Computer and video to transform what they see into two- and three-dimensional formats."

Although computing is new to Shetka, he is excited about using a NeXT computer for his project. He just received a grant to work on his "World Art" project, which he envisions as a large-scale assemblage of materials from individuals—ranging from sounds and film clips to people's personal belongings—from around the globe. Shetka has allotted five acres of land to permanently exhibit what he collects. He is using the NeXT Computer to record images of each object and plans to experiment with its artistic placement in the total work on the computer screen. The computer's ample storage capability will allow him to do this as well as catalog information about each object used in the work. "Before I had the storage capacity of the NeXT Computer, and its ability to handle a variety of media, I didn't have any idea of how I was going to do this," Shetka says.

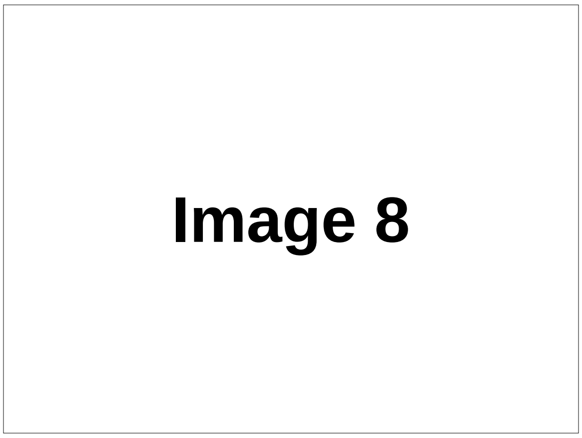
Multitasking boosts productivity for economist

The NeXT Computer's multitasking capabilities are a boon to writers like Paul Estenson, a professor of economics who is currently revising an intermediate-level macroeconomics textbook. He's using WriteNow®, Wingz™, Digital Webster™, and TopDraw™ software applications.

"The NeXT Computer is the workhorse for me," says Estenson. "I can go from computation to word processing and have the computation go on while I'm writing—and have it all on the screen at once. I'm also discovering how useful it is to easily move between applications. I can create a graph, pull it out of Wingz, and place it in my text without having to open one program and close another. It makes my work go much more quickly, and helps me keep my train of thought."

Exploring new frontiers

When mathematician and computer scientist Knight isn't helping his colleagues develop courseware, he's busy with his own research in artificial intelligence. Knight is attempting to adapt the Parallel Distributed Processing Group's Neural Network software to the NeXT Computer. "In a neural network," he explains, "you have a large number of processors working in parallel, interacting with each other. It's a model of computing more similar to the way the human mind works." Knight says parallel distributed processing could have uses in numerous disciplines including psychology, biology, cognitive science, and computer science. "The software that emulates a neural network on a computer works on many different systems," he says, "but it's geared toward a command-line environment, such as DOS or a UNIX shell. I want to keep the code, but rework it using Objective-C so it's easier to use. With the standard NeXT interface, you can manipulate it more easily, and NeXT's graphics will represent the information better."



Knight is satisfied with his choice of the NeXT Computer. He chose it, he says, because "it has the resources I need—UNIX in an easy-to-use environment, lots of useful utilities, and I was intrigued with the object-oriented approach that gives me an easy way to program.

"In a mouse-based environment, programming the user interface is usually difficult and time consuming," Knight explains. "With Interface Builder, you can set up the look and feel of an application with comparative ease. We've had success with it at Gustavus. The students learn how to use it quickly and they like that."

Academic computing director Johnson is pleased with the initial results of the college's commitment to NeXT. "We wanted to step into new frontiers," he states. "We evaluated and selected the NeXT Computer at 0.8 of the operating system and formed a good working relationship with NeXT. One of our goals is to get technology onto our campus as soon as possible, and give our students exposure to state-of-the-art equipment. By making a commitment to NeXT up front, we're getting that technology in people's hands faster, and our students benefit from that."

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Campus Profiles

Carnegie Mellon University

Breakthroughs in speech recognition and document management

The partnership between Carnegie Mellon University and NeXT began officially in the fall of 1985, when officials from both organizations met to discuss computing in higher education. “That was when NeXT decided to build the personal computer of the future, with a focus on higher education,” says William Arms, vice president for academic services and a member of the NeXT advisory board. “We were interested in their vision for the future, and they were interested in our Andrew distributed network.”

Technical cooperation between Carnegie Mellon and NeXT began when NeXT chose Mach—an advanced operating system developed by the university—for the NeXT Computer. The relationship continues today with cooperative research in voice recognition, a Carnegie Mellon researcher’s commercial document image management system, and a joint effort to establish a symbolic mathematics lab, among other projects.

Mach operating system developed for distributed networks

“When we began planning our network in the early ’80s, most operating systems were designed for workstations attached to timeshare computers,” says Arms. “Mach meets the needs for a new operating system intended for workstations operating on a distributed network. When the Mach team at Carnegie Mellon developed the Mach operating system, NeXT recognized its significance to the academic community. NeXT took CMU’s research, turned it into a turnkey product, and built it into the NeXT Computer.

The selection of Mach makes the NeXT Computer a perfect fit with Carnegie Mellon’s on-campus distributed network, called Andrew. “With Mach, the NeXT Computer has the development tools and systems programming architecture we needed to make it into a true Andrew client,” says Arms. The network today has 5,000 machines— NeXT computers, Macintosh® computers, IBM® PCs, and other UNIX workstations—that faculty members can use to access more than 100 gigabytes of library services, binary images of computer programs, and communication services stored on file servers.

Sphinx: voice recognition for the NeXT Computer

Members of the Carnegie Mellon computer science department have developed a large-vocabulary, speaker-independent, continuous speech recognition system for the NeXT Computer. Called Sphinx, the system offers two advancements over other speech recognition systems: It recognizes words spoken by any native speaker of American English without “training,” and it does not require the speaker to insert pauses between words.

“The NeXT Computer has three advantages for our work,” says Eric Thayer, research programmer in the computer sciences department. “First, the digital signal processor (DSP) makes it one of the few workstations equipped right off-the-shelf for speech recognition. Second, the optical disks enable you to store speech data in your own portable personal library so you don’t have to negotiate for centralized disk space. Finally, Interface Builder made building the user interface easier by an order of magnitude. I don’t think we would have attempted building the interface without the NeXT Computer. It would have taken too many resources.”

In the speech and natural language group, Alexander Rudnicky is using Sphinx to develop an understanding of the spoken language interface and multimodal input —a combination of keyboard, mouse, and voice. “What we find appealing about the NeXT Computer is that it provides an easy-to-work-with development platform for speech applications,” he says. “With most current speech systems, speech is all you get. With the NeXT Computer, I can pursue my interest in the spoken language interaction as one of several modalities—as an integral part of the computer interface.”

Image 9

Rudnicky and colleague Wayne Ward are working on two applications of Sphinx: Office Manager and the Air Travel Information System (ATIS). Office Manager incorporates a number of applications people use daily, including an appointment calendar, personal information database, voicemail, and a calculator. “Office Manager is built so all functions are accessible through different modalities: keyboard, mouse, or speech,” says Rudnicky. “Some of our work involves seeing the circumstances under which people decide to use one modality or another. Our goal is to understand the inherent cost to the individual—in terms of cognitive effort and time—of using the keyboard, mouse, or voice to perform different types of tasks.”

The ATIS project, sponsored by the Defense Advanced Research Project Agency (DARPA) speech and natural language program, studies the use of voice in a practical database retrieval task: planning air travel. “The system contains detailed airline schedules, so you can say ‘Show all flights between San Francisco and Pittsburgh that leave after 3:00 p.m.,’”says Rudnicky, “and a list of a ll flights meeting the criteria appears on screen. Our goal with ATIS is to understand how computers process spontaneous speech. That way, we can eliminate the need for the speaker to talk to the computer in specific, unnatural ways.”

Like Thayer, Rudnicky considers the integrated DSP the significant advantage for his work. “Having the DSP integrated into the computer is a logistical advantage—it eliminates the messiness associated with getting a signal into the machine and processing it. Also, we have found that the NeXTstep® object-oriented environment makes the development process fairly rapid.”

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Document image management

Document image management involves associating scanned images of documents with other computer files containing word processing, spreadsheets, or voice. For example, an executive might want to attach a voice file of dictated responses to a correspondence. An accounts payable manager might want to view invoice images and attach them to spreadsheet files.

Robert Thibadeau, director of the imaging systems laboratory in the School of Computer Science at Carnegie Mellon, has created a complete document image management program for the NeXT Computer. “Normally, a document imaging system would have an entry cost of $300,000. When I first saw a NeXT computer, I realized it had all the hardware ingredients for a complete document imaging system: a SCSI port for a scanner, optical disk storage, the DSP for high-speed digital resampling, adequate memory, and a multitasking operating system. I saw I could deliver a complete system simply by writing the software.”

Thibadeau was able to develop a demonstration version of his system, Visual Understanding System’s PaperSight™, in only two and one-half months. “If you know what you want to accomplish, the NeXT Computer is superior to any programming platform I’ve encountered,” says T hibadeau. “The reason is NeXTstep and object-oriented C.”

A document image management system needs two features: speed and flow. “The program has to be able to manipulate large quantities of data very fast,” says Thibadeau. “We achieved speed by using the DSP.” Work flow is the relationship between the document and other computer files. In the simplest systems, work flow is restricted to scanning, storing, and retrieving. In systems used by several people—for example, an accounts payable system—the work flow might involve scanning an in-

Image 10

voice, routing information about key accounts, and viewing spreadsheet files. “The paperwork actually organizes the other documents related to its flow,” he says. “PaperSight uses the NeXTstep environment so users can control the work flow by dragging icons directly over the document. For example, if they want to associate a spreadsheet with a scanned invoice document, they can drag the Wingz icon onto the document image."

Thibadeau is also using the NeXT Computer for prototyping and developing chips to handle simple image transformation. "Sometimes the scanned image on a page is skewed," he says. "Software solutions for document rescaling and warping are too slow to be practical. By implementing the solution in hardware, we'll be able to correct images 5 to 500 times faster than they would be in software."

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NeXT lab for instruction in symbolic mathematics

In fall 1990, Carnegie Mellon will make NeXT computers accessible to students for the first time, in its symbolic mathematics lab. "There has been a ground swell of need on campus for support of symbolic mathematics, and not just from the mathematics department," says Joan Mitche ll, director of academic computing and instructional technology. "The other departments interested in integrating symbolic mathematics into their curriculum include architecture, computer science, mechanical engineering, biology, and chemistry.

"We had been looking for some time for a platform that would provide symbolic mathematics support," she s ays. "We were attracted to the NeXT platform for three reasons: It comes bundled with *Mathematica*, it supports other applications students use—such as WriteNow and Digital Librarian™—and it provides a UNIX programming environment.

The symbolic mathematics lab will have 14 NeXT computers. "In the past, most clusters on campus were designed primarily for student walk-in use, with teaching as a side use," says Mitchell. "What excites us about the NeXT symbolic mathematics cluster is that it is designed primarily for teaching—it's a dedicated place where faculty can teach using *Mathematica*." This year, the symbolic mathematics lab will be used primarily for advanced courses. Later, its use might be extended to other courses, including lower level calculus.

"One way the value of the NeXT Computer becomes evident is in graph theory," says Bill Williams, c hairman of the mathematics department. "Until now, we had to assign small graphs for students to analyze because large graphs took too long to do by hand. This was limiting, because if a graph has only four vertices, the answer is so simple that it's difficult to show the relative advantages of different methods. Using a NeXT computer, you can show a graph with 60 vertices; the solution is not so obvious, and students can see the power of the different methods.

"The virtues of the NeXT Computer are its ease of use and that *Mathematica* software comes bundled with it," Williams says. "We could have used another workstation and implemented the software on the campus network, but at a great deal more expense."

During nonreserved hours, the NeXT lab will be open to students for wordprocessing, UNIX computing, and other tasks. "We see the campus cluster as being very much a part of our campus network," concludes Mitchell. "NeXT is working closely with us to make the cluster's integration into our campus network a reality."

Future plans: the NeXT Computer as a teaching tool

The university plans to use NeXT computers as teaching resources for many other courses, as well. "NeXTstep is the first object-oriented programming environment that I can imagine being used by faculty members who are part-time programmers," says Arms. The main reason is I nterface Builder. There are other appealing user interfaces, but they were designed originally for single-tasking computers, and have been improved gradually. The NeXTstep environment incorporates multitasking and virtual memory from the start.

A multi-faceted partnership

"We view our relationship with NeXT as a multi-faceted partnership," says Arms. "Fundamentally, Carnegie Mell on wants to be a leader in all aspects of computing. The only way a small university can achieve that goal is to be close to the leaders in industry. NeXT brings vision and leadership. It's in both of our best interests that we should work closely together."

AT NeXT, ENGINEERING NEVER RESTS.

We're never satisfied. Good is not good enough. Which is why—since we introduced the original NeXT Computer—we've worked diligently to make our computers faster. To make them even easier to use. To enhance our networking capabilities. To make certain that the leaders in the software industry are developing their best breakthrough applications on our platform—first.

In short, our goal is to offer you the best that technology has to offer—at an affordable price.

We have always looked to higher education for inspiration and advice. We've asked not only what you want in a computer but also what you've dreamed about having in a computer. We've listened. And we've learned.

Now, we'd like to introduce you to four new NeXT products: The NeXTstation™ Computer is the powerful computer you've asked for—at an exceptional price. The NeXTstation Color Computer offers everything that the NeXTstation does and runs 16-bit color. The NeXTcube™ provides expansion slots and several storage options, giving you maximum flexibility. And NeXTdimension™ is a state-of-the-art 32-bit color system that sets new standards for color computing.

They all offer the features that make NeXT computers revolutionary. They're the computers that you helped us create.

What makes a NeXT computer a NeXT computer

NeXTstep. NeXTstep is the software environment for the NeXT computers—it's both a development environment and a graphical user interface. As a development environment, NeXTstep makes it possible for people to design graphical user interface applications more quickly. As a user interface, NeXTstep makes it easy for people to learn to use a NeXT computer.

UNIX. NeXT computers run on the UNIX operating system (BSD 4.3), which offers true multitasking and powerful networking. These capabilities are enhanced by Mach and its advanced architecture.

Display PostScript®. Our use of this industry-standard page-description language assures that what you see on the screen is precisely what you'll get when you print.

DMA architecture. We used a DMA architecture similar to that of mainframe computers (which are known for their superior system throughput). The result is exceptional system throughput and performance.

Motorola 68040. Powered by the 68040 CPU, the NeXTstation and the NeXTcube process at up to 15 MIPS and 2 MFLOPS. They offer performance that's three to four times faster than that of our original NeXT Computer.

Motorola 56001 Digital Signal Processor. All NeXT computers come with a DSP, which makes them capable of generating CD-quality sound.

2.88 MB floppy disk drive. This drive gives you the ability to store twice as much as today's standard drives. It also reads from and writes to DOS-formatted disks, letting you easily transfer data between NeXT and other popular computers.

Ethernet. Every NeXT computer features both thin and twisted-pair Ethernet built right in, which makes it a snap to connect a NeXT computer to an Ethernet network.

A host of bundled applications. Every NeXT computer comes with a wealth of productivity software, including WriteNow, NeXTmail™, Digital Librarian™, *Mathematica*, and Webster's Ninth New Collegiate Dictionary® and Webster's Collegiate® Thesaurus on-line.

INTRODUCING FOUR BREAKTHRO

The best of both worlds

Power. Ease of use. One computer rarely offers both. If you want raw performance, you have to sacrifice ease of use. And if you want ease of use, you have to compromise on processing speed and performance.

No longer.

NeXT computers offer all the raw power of a workstation, but are as easy to use as a personal computer. They run UNIX, which gives you true multitasking and powerful networking. They can also run the X Windows™ system and offer MS-DOS® emulation through third-party solutions. They can help you to manage everything from large scientific data sets to a 400-page dissertation. They can be used in all disciplines—from engineering to English, physics to art history, mathematics to music, economics to biochemistry. They can help you in your research and your work, and they can help you do day-to-day tasks such as writing.

NeXTstation and NeXTstation Color: exceptional performance at exceptional prices

There are two NeXTstation computers: NeXTstation and NeXTstation Color. Both use the Motorola 68040 CPU. Both have a Motorola 56001 DSP. Both are exceptionally easy to learn and use. And both offer exceptional performance.

The NeXTstation includes 8 MB of main memory, and can accommodate up to 32 MB. It offers the latest in floppy disk technology; our 3.5-inch drive stores 2.88 megabytes of information, and can read from and write to 1.44 MB and 720 KB DOS-formatted disks. A 105 MB internal hard disk drive also comes with the computer, preinstalled with NeXT system software. A 340 MB hard disk is available as an option.

The NeXTstation Color Computer was engineered to handle the demands of today's—and tomorrow's—true-color applications. NeXTstation Color is a 16-bit-per-pixel color system that has 1.45 MB of dedicated video memory. This lets it display 4096 colors simultaneously on a NeXT MegaPixel Color Display. The large display, used with all NeXT color systems, has a resolution of 1120 x 832.

Introducing NeXTdimension: state-of-the-art 32-bit color

NeXTdimension is an accelerated 32-bit, true-color board that fits into a NeXTcube computer. NeXTdimension lets you display 16.7 million different colors on screen. Its RISC-based graphics coprocessor runs full-color PostScript® and is optimized for our coprocessing environment. This enables real-time performance for image processing and interactive 3D graphics. NeXTdimension also provides real-time compression and decompression, allowing you to store and play back still- and full-motion video.

NeXTdimension also provides video input and output to VCRs, laserdisc players, S-VHS, Hi-8, camcorders, and still-video cameras—without requiring additional boards, and is ideal for multimedia applications and high-end graphics.

The NeXTcube: ultimate flexibility

The NeXTcube is the NeXT computer for people who want the most configuration flexibility. You can equip it with between 8 MB and 64 MB of memory. You can choose from a wide variety of storage devices: 2.88 MB floppy disk drive, 256 MB optical disk drive, CD-ROM drive, and 105 MB, 340 MB, 660 MB, and 1.4 GB hard disk drives. There are also three NeXTbus™ expansion slots for third-party and NeXT boards, such as the NeXTdimension color board. The NeXTcube can also be configured as a server on a network.

NeXTstation

Motorola 68040 25 MHz
Motorola 56001 25 MHz DSP
15 MIPS, 2 MFLOPS
8 MB RAM, expandable to 32 MB
2.88 MB floppy disk drive
105 MB hard disk drive, 340 MB hard disk (optional)
Built-in thin and twisted-pair Ethernet

NeXTstation Color

16-bits-per-pixel color
Motorola 68040 25 MHz
Motorola 56001 25 MHz DSP
15 MIPS, 2 MFLOPS
8 MB RAM, expandable to 32 MB
2.88 MB floppy disk drive
105 MB hard disk drive, 340 MB hard disk (optional)
Built-in thin and twisted-pair Ethernet

UGHS FROM THE PEOPLE AT NeXT

NeXTstation: a scholar's workstation

For many faculty members, the NeXTstation will be the computer of choice. It can aid in everything from collecting data to analyzing information, from writing reports to modeling complex processes, from browsing through a life's work to sharing that work with others.

The NeXTstation is a rich multimedia platform that lets people enrich their work with music, sound, graphics, and text. It's ideal for illustrating lectures and course material. Digital Librarian—a versatile searching and indexing tool—can help you pinpoint information within that material, or within volumes of notes, reports, and other text files.

If you work with databases or crunch a lot of numbers, you'll be happy to know that the NeXTstation runs a wide variety of analysis products, such as SAS®, ORACLE®, SYBASE®, and Lotus Improv™—a revolutionary spreadsheet.

And when it comes to reports and articles, the NeXTstation will help you be clearly understood; you can easily incorporate graphics, charts, diagrams, and illustrations. For word processing, you can use programs such as WordPerfect®—the world's most popular word processing program—or for complex, book-length manuscripts, you can use FrameMaker, which even sets complex scientific equations.

A versatile computer for students

The NeXTstation can help students tackle everything from exercises in first-year calculus to researching and writing a senior thesis. It comes with WriteNow, a word processor, as well as an on-line dictionary and thesaurus, which makes it a helpful tool for writing everything from five-page papers to thousand-page dissertations. And virtually all of the leading companies in the software industry—Lotus, WordPerfect, Adobe, Ashton-Tate, and Frame—offer world-class applications that take advantage of the NeXTstation computer's unique capabilities.

When it comes to connecting to a network—to access a library catalog or to send electronic mail—students don't have to buy additional networking hardware. The NeXTstation features both thin and twisted-pair Ethernet, which make connecting to a network simple.

A lab computer for all seasons

The NeXTstation is extremely versatile. Its competitive price per seat makes it an ideal computer for labs and clusters.

Its UNIX environment makes it the ideal computer for general-purpose UNIX labs. And its integrated DSP makes it a logical choice for music composition and engineering work.

During the day, labs of NeXTstation computers can be used for everything from humanities instruction to scientific applications. And at night, a NeXTstation lab can be used for student and faculty computing—writing, editing, graphics, programming, data analysis, or even conversing with students and faculty at other campuses using electronic mail.

The NeXTstation provides a great object-oriented environment for teaching computer programming. It comes with *Mathematica*—a tool that faculty are using to teach everything from statistics and calculus to engineering. And because SAS is available on the platform, the NeXTstation is an inexpensive way to expand your use of SAS without having to increase your mainframe's capabilities.

The computers for the 1990s

These four new products take advantage of the latest processors, components, and technologies. They demonstrate NeXT's commitment to being an industry leader, and to providing our customers with the best technology has to offer.

For those of you who have been waiting for computers that are both powerful and easy to use, that offer exceptional performance at affordable prices, that run the latest and greatest software, and that were designed to last through the 1990s and beyond, we have only one thing left to say:

Your computer is here.

NeXTdimension

Intel i860 33 MHz RISC processor
Dedicated JPEG image compression processor
Real-time compression and decompression to hard disk
8 MB to 32 MB of main memory
4 MB VRAM

NeXTcube

Motorola 68040 25 Mhz
Motorola 56001 25 MHz DSP
15 MIPS, 2 MFLOPS
8 MB to 64 MB RAM
Built-in thin and twisted-pair Ethernet

A BREAKTHROUGH FROM LOTUS. FREE.

Lotus Improv

We're certainly not the only people dedicated to bringing you breakthrough products. Our third-party partners are working hard to make sure you see revolutionary software on our computer.

A special case in point: Lotus Development Corporation. The creators of Lotus 1-2-3® have reinvented the spreadsheet on our platform.

Improv is revolutionary because it lets you arrange and rearrange your data in countless ways—and gain insights from that data that you'd never be able to get from a traditional spreadsheet. That's because Improv isn't structured like a traditional spreadsheet. For starters, you enter formulas in plain English. You can use words such as "1st Quarter" or "Fiscal Year 90" or whatever you think best describes your data.

Plain English in a spreadsheet?

So instead of seeing formulas like "=BD2*BD3," you see "Dollar Volume =Tons*5.75," which makes it much easier to set up a spreadsheet—and substantially easier to understand it when you revisit it later.

And that's just the start. Lotus also lets you do something else revolutionary: flexible cross-tabulation. You can move your column and row headings from one part of the spreadsheet to another, even interchange them and without the slightest hesitation, the spreadsheet will automatically rearrange itself. Which lets you get completely different views of your data, and thus, reach more insightful conclusions.

Once you've reached those conclusions, Improv helps you present them with sophisticated presentation graphics—even 3D charts.

The benefits of registering your computer

We have a special offer for people who buy NeXT computers. For a limited time (through December 31, 1990), we'll send you a copy of Lotus Improv—free—once you register your NeXT computer.

How to learn more

Simply visit your campus computer store and ask for a demonstration.

If you'd like a brochure that describes our new products, or if you'd like the location and telephone number of your nearest NeXT reseller, please give us a call.

1-800-848-NeXT

News & Events

Campus consultants: who are they?

The Campus Consultant program was created to support NeXT's campus partners. The program's mission is to provide services such as technical support and product demonstrations.

Selected jointly by campus computing support organizations and NeXT staff, the Campus Consultant works closely with local NeXT representatives to augment the support available on campus. The Campus Consultant may have the following responsibilities:

- assist academic project development
- help support and manage the installed base of NeXT technology
- provide support to the bookstore or campus computing center
- participate in technology fairs and conferences
- develop software for campus projects
- support the local NeXT user group

Currently there are 70 Campus Consultants throughout the United States and Canada. NeXT is pleased to expand its relationship with colleges and universities with the Campus Consultant program. To find out who your local Campus Consultant is, call 1-800-848-NeXT.

NeXT gets set for EDUCOM'90

"A Conference on Information Technology in Higher Education," EDUCOM'90 will be held October 14-17, hosted by the Georgia Institute of Technology. EDUCOM is one of the important events of the year for colleges and universities concerned with integrating computing into their curriculums. An attendance of 4,000 is expected.

Now in its twenty-sixth year, EDUCOM is a forum for leaders in higher education to present up-to-date issues affecting computing policies, communications and networking, instruction, research, and development. Keynote speakers include Robert Allen, chairman and chief executive of AT&T, Jimmy Carter, former president of the United States, and Steven Jobs, president and founder of NeXT Computer, Inc.

NeXT will host a booth and a hospitality suite to provide attendees the opportunity to view demonstrations of NeXT's new products, including NeXTstation, NeXTstation color, NeXTcube, NeXTdimension, and Release 2.0. The booth will feature hardware and software third-party products, including applications for wordprocessing, databases, spreadsheets, and drawing. NeXT will also showcase applications created by faculty for the NeXT computers.

For more information, write to EDUCOM'90, P.O. Box 364, Princeton, NJ 08540. For more information about NeXT at EDUCOM'90, contact your local NeXT representative.

NeXT at NACS

The National Association of College Stores (NACS) hosted its first Campus Computer Resellers Conference at the Fairmont Hotel in Dallas, Texas, on August 1-4. The conference was designed by campus resellers to enable universities involved with technology distribution to better fulfill their institution's future computing needs. The four-day program focused on up-to-date issues and implementation of campus reselling activities. More than 400 campus resellers representing 300 universities attended the conference.

As one of several computer hardware vendors in attendance, NeXT conducted four breakout sessions to discuss its campus resale program. NeXT also hosted a hospitality suite to provide a forum for NeXT representatives to meet with customers to better understand their concerns and issues.

NeXT's Director of Higher Education, Ronald Weissman, conducted seminars on "The Future of the Scholar's Workstation," and on "Challenges for Higher Education in the 1990s." The latter focused on the pressures facing colleges and universities and the implications for computing support groups.

The *Gourmet* project: adventures in supercalculator design

by Richard E. Crandall
Director, Scientific Computation Group
NeXT Computer, Inc.

Whereas we hear a great deal about supercomputing, the notion of *supercalculating*, as I describe it presently, has not even begun to enjoy its rightful vogue. The historical explanation for this disparity is simple: Supercalculator design as I intend it requires a profound user interface. Supercomputing machines have been around for decades, while only recently have sophisticated workstation platforms—like NeXTstep—appeared on the scene. With a sufficiently powerful—and sufficiently friendly—window environment, it is possible to design supercalculator applications. With this in mind I embarked on the *Gourmet* project, the idea being to create an experimental supercalculator, meaning:

Supercalculator: a practical calculator that covers a super-wide calculating spectrum, from numbers to symbols to equations to graphics.

Certainly much can be said for technological innovations such as Hewlett-Packard® hand-held scientific calculators. But these machines, by their very design and physical autonomy, lack at least three primary advantages: interprocess activity, large dynamic data storage, and state-of-the-art graphics. In the *Gourmet* project, I endeavored, with the inestimable aid of NeXTstep, to overcome, rather than circumvent, these limitations.

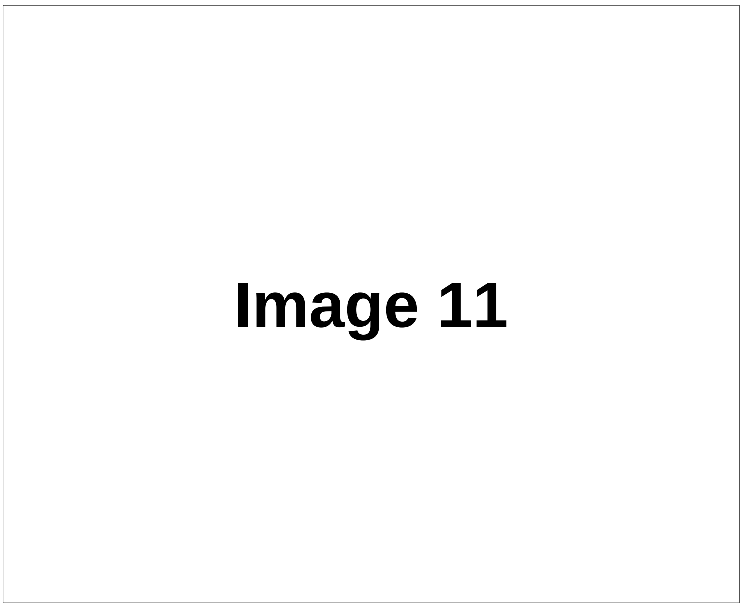
Gourmet can grapple with certain problems that reside beyond the reach of traditional calculators. For example, *Gourmet* can be used to do sophisticated Fourier analysis on large signal or image files. One may perform arbitrary-precision number theory, such as investigations of factoring and prime numbers. Another example might be complex analysis, involving say a key property of the Riemann Zeta function. In particular, *Gourmet* provides immediate access to most of the special functions of mathematics and physics.

Gourmet runs a *Mathematica* kernel behind the scenes. One important feature of the application is that the intricacies of *Mathematica* syntax are essentially hidden from the user.

The name "Gourmet" derives from a crude yet effective metaphor. Supercomputers are certainly awesome, being applied these days to such deep problems as the design of medicines at the molecular level, or detective work concerning the structure of remote galaxies, or prediction of the quantum meanderings of gluons and quarks. This glory aside, I am yet compelled at times to think of a supercomputing session as, if you will, a pagan roast. Let's get the hottest fire pit we can, the most impressive pig we can, and let's turn and baste and cook that beast with vigor! By way of contrast, imagine a workstation application that allows you to sample delectable symbolic and numerical morsels from the *haute cuisine* of higher mathematics. Imagine then, an application called *Gourmet* that provides for you these tasting sessions, while at the same time insulating you from the commotion of the kitchen; that is, from the complications of program syntax.

To make these notions more tangible, let us refer to the the main window figure, showing the appearance of the *Gourmet* application.

At the upper left is a program area, where actual *Mathematica* programs can be entered. Usually this area will be used only by an aficionado of the *Mathematica* language. Indeed, much work can be accomplished without using this area. In the upper right text area one obtains text output, examples of which I describe below.



The main ***Gourmet*** window, showing input and output areas for numerical and symbolic calculation.

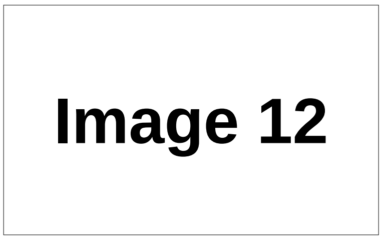
At the lower right is a typical plot output. This kind of output is, of course, PostScript, so that from a menu one can copy the plot and later paste it into a wide variety of applications. At the left of center one finds an expression area, in which raw expressions can be entered for processing. It is this area that perhaps best exemplifies the true spirit of *Gourmet*. If you know the expression to be processed, you can enter it and then you are "home free;" from that point you use controls, such as buttons, to do language-independent processing.

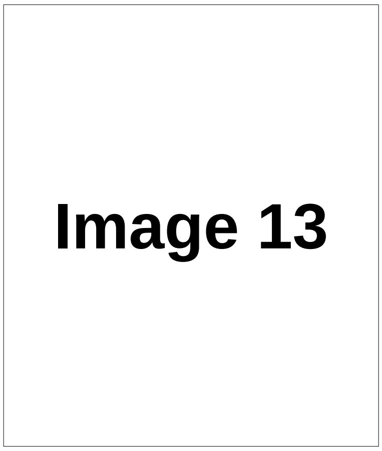
Note that the keypad has interesting symbol keys, such as the column: e, π, I, ∞. The appearance of key labels such as "I" and "∞" is not facetious; indeed Gourmet can handle correctly complex numbers (with imaginary part I) and infinite quantities. Referring to the close-up figure, you see that the entity $e^{i\pi}$ can be entered using only keypad presses: E^(I Pi). The output in the program window on the right shows the celebrated Euler identity: $e^{i\pi} = -1$. Complex numbers are of great utility in engineering fields such as electronics. *Gourmet* has no trouble in the inversion, magnitude assessment, or plotting of complex values and functions. Referring to the second part of the close-up figure, you see an example of rigorous integration, in which one simply hits the integral button to get the theoretical answer. One can also remove the limits to get the indefinite integral, or check the numerical "N" button to get a numerical integral. The summation button likewise performs exact or numerical sums. The "Solve:" area is of interest. One can enter in the Operand field a logical expression such as $x^3 + x^2 - x + 1 == 0$. Then entering x into the Solve: field and pressing the Solve button yields the cubic solutions.

Gourmet handles graphics in the following way. When you ask for a 2D or 3D plot, or a Contour plot or a ListPlot, whatever; *Gourmet* sends a message to *Mathematica*, commanding that the PostScript for the plot be placed in a temporary file. *Gourmet* then grabs this file and displays the plot in the graphics area. A typical graphics operation would be to enter in the Operand: field an expression such as Sin[10 x] Cos[5 y] (this can be done with the keypad), then to simply press the "x-y-z" button for three-dimensional plots. The limits on any plot, as well as the plot resolution, are determined by the text fields just to the left of the plot area.

Programmers and developers may be interested in how *Gourmet* communicates with *Mathematica*. This is accomplished through a so-called *Droid* object, created for scientific applications. This object is named according to the folk notion of an "imperial droid," as it appears in the movie *The Empire Strikes Back®*. Your application (such as *Gourmet*) launches a Droid (a process, such as a *Mathematica* kernel). This Droid sends back answers (such as factored polynomials, integrals, and so on) when and only when it really has an answer to send. This means that while *Mathematica* is thinking, you can still peruse the menus, quit *Gourmet*, and so on. The point is that the coexistence of *Gourmet* and Droid processes is asynchronous. The technique is similar to the Speaker-Listener paradigm of the standard NeXT Application Kit™. The Droid is a special object of this type, designed for scientific applications *per se.*

This work is experimental, and there is by no means any claim that *Gourmet* is the ultimate calculator. But I feel that *Gourmet* is some kind of elementary harbinger of a future class of supercalculators *Gourmet* will appear in a future NeXT software release as a developers' utility. Hopefully, the next few years will bring, on the part of developers, educators, and researchers alike, a new array of supercalculators that take this preliminary *Gourmet* concept to the extreme limits allowed by the NeXTstep environment.





Close-ups of the *Gourmet* window, showing (upper) complex number calculation and (lower) setup for exact integration of $1/(1+x^4)$.

Academic Projects

By publishing a list of academic projects, NeXT hopes to encourage communication among researchers, developers, and instructors. Many of these projects are under development. Please contact the project manager for more information. A more complete list of academic projects will be available at the archive sites this fall.

ActNet—A Lisp-based artificial intelligence language and a mouse-based environment in which users define Action Networks to control an on-screen robotics simulation.
Nils Nilsson
Professor of Computer Science
Stanford University
nilsson@cs.stanford.edu

Agricultural Distributed Database System—A system to store, retrieve, and analyze data for crop species.
Farhad Shafabakhsh
Oregon State University
(503)737-4513
farhad@oscs.orst.edu

Analysis of Blood Pressure and Blood Flow—The application will rapidly assess vascular impedance by taking waveforms and breaking them down into harmonics.
Stata—A port of the Stata statistics package. A NeXTstep interface and a program to translate between Stata and NeXT .snd formats are under development.
Paul Heerdt
Assistant Professor of Anesthesiology
(314)362-6584
Brian Dunford-Shore
Programmer
(314)362-1184
Department of Anesthesiology
Washington University

Animation Production Environment—A graphic environment for scientific and artistic animation.
Jeffrey Faust
The Supercomputer Graphics Project at Ohio State University
(614)292-3416
jeff@cosimo.osgp.osc.edu

Architectural Modeling—A system for three-dimesional architectural modeling.
Paul J. Sorum
Assistant Professor of Architecture
University of Southern California
(213)743-2723

Atmospheric Modeling—Global atmospheric modeling on remote supercomputers using the NeXT Computer for code development and image manipulation.
David Randall
Professor of Atmospheric Science
Colorado State University
(303)491-8474
randall@redfish.atmos.colostate.edu

The Audio Disk Controller—A system for direct-to-disk multitrack recording in AES-EBU/SDIF digital or analog formats.
Doug Karl
Ohio State University
(614)292-9754
karl-d@osu-20.ircc.ohio-state.edu

Blues—Blues composition using CSound and cmix.
Brad Garton
Director of Computer Music
Columbia University
(212)854-3825
brad@woof.columbia.edu

Chaos—An application to generate chaos plots of sound samples.
NDSP—A program that displays sound files and allows zooming, axis scaling, and other manipulations.
Sound Manager—The program reads .snd files and displays sampling rates and other sound specifications.
Douglas Keefe
Assistant Professor of Music
University of Washington
(206)543-9876
keefe@blake.u.washington.edu

Color Graphics Board—An add-in board for color processing. The board provides a 1280 x 1024 true-color display that is windowed anywhere within a 2k x 2k x 32-bit frame buffer.
Yongmin Kim
Professor of Electrical Engineering
University of Washington
(206)543-7425

Concepts in Philosophy—Applications to help students in introductory philosophy courses visualize and understand abstract concepts.
Joel Smith
Professor of Philsophy and Director of Educational Computing
Allegheny College
(814)332-3312
js01@alleg.music.edu

Distributed Computing—A conversion of the Parallel Distributed Software Package to the NeXT environment. The conversion involves the creation of a NeXTstep interface and a custom Interface Builder to aid in the creation of new networks.
Karl Knight
Associate Professor
Gustavus Adolphus College
(507)931-7479
karl@gac.edu

Earthquake Hazard Estimation—Using *Mathematica* to study wave propagation, chaos, and nonlinear dynamic systems in geophysics, this research helps to predicate how various areas will behave during an earthquake.
José A. Rial
Associate Professor of Geophysics
University of North Carolina at Chapel Hill
(919)966-4553
jar@antipode.geosci.unc.edu

Fast Algorithms for Signal Processing and Numerical Analysis—Work in progress includes the use of spectral transforms to compress acoustic signals and digitized images. Experiments have yielded compression rates of up to two times better than current technology.
Mladen Victor Wickerhauser
Assistant Professor of Mathematics
Yale University
(203)432-7312
victor@lom1.math.yale.edu

Forms-Based Character Recognition—Image character recognition based on the context available in forms-based processing.
Kelly Anderson
Student in computer science
Brigham Young University
(801)378-7817
kla@batman.byu.edu

Grammatica—A prototype application for interactively exploring the relationships of spatial grammars and their languages. The program will work like a conventional draw package with the added ability to graphically define rules of composition.
Christopher Carlson
Doctoral candidate in architecture
Carnegie Mellon University
(412)268-6272
cc3z+@andrew.cmu.edu

GraphView—An easy-to-use tool for interactively creating, editing, manipulating, and displaying graphs. Arbitrary PostScript programs can be used to draw any vertex or edge. GraphView can serve as a prototype front-end for almost any graph- based application.
Gregory E. Shannon
Assistant Professor of Computer Science
Indiana University
(812)855-7071
shannon@cs.indiana.edu

Gray's Anatomy Digital Version—The classic human anatomy book on line with over 1,600 pages of text and 1,000 illustrations. The book has search, bookmark, and notebook features.
John S. Mayer, M.D.
Assistant Professor
Hershey Medical Center
(717)531-7589
jsm8@psuvm.psu.edu

Health Care Professionals Workstation—Software to enable rapid, high-quality health care decisions. The software will provide smooth integration among existing hospital and clinical systems, access to a database of medicine, and the ability to network with health care professionals locally and statewide.
Kent Spackman
Director of Research and Development
Biomedical Information Communication Center at Oregon Health Sciences University
spackman@ohsu.edu

Integrated Freshman Curriculum—A curriculum based on the principle that students learn better when they discover themes that link different disciplines. Programmers have written more than 30 courseware packages to help teach physics, mathematics, and chemistry.
Dr. Jeff Froyd
Professor of Electrical Engineering
Rose-Hulman Institute of Technology
(812)877-8340
froyd@sem.rose-hulman.edu

Intelligent Guidance for Headway and Lane Control—An expert system for vehicle guidance and a highway traffic simulator.
Axel Niehaus
Graduate student
(609)258-5340
aniehaus@pucc.princeton.edu
Robert F. Stengel
Professor
(609)258-5103
stengel@pucc.princeton.edu
Department of Mechanical and Aerospace Engineering
Princeton University

MailManager & EasyMail—Applications for graphic-based management of UNIX mail and mail.txt formatted mail. The managers allow multiple mailboxes to be open on multiple hosts.
Mark Crispin
University of Washington
(206)543-5762
mrc@milton.u.washington.edu

Machine Perception of Music—Musical perception research to develop a cognitive model of listening.
Dave Mellinger
davem@ccrma.stanford.edu
Midi—A real-time Midi performance system.
Lounette Dyer
(415)723-4971
loo@ccrma.stanford.edu
Modeling Stringed Instruments—Using *Mathematica* to model the physics of stringed instruments.
Chris Chafe
(415)723-4971
cc@ccrma.stanford.edu
SPASM—An application which models the human vocal tract to create the human singing voice. Other uses include linguistic research, lessons in voice control, and performance, treatment, and training of the hearing impaired.
Perry Cook
(415)723-4971
prc@ccrma.stanford.edu
Center for Computer Research in Music and Acoutics
Stanford University

MediaView—An application that combines text, images, live video, sound, links to other applications, and various forms of "paste-on" notes to create an interactive learning tool.
Richard Phillips
Staff Member
Los Alamos National Laboratory
(505)665-1343
rlp@lanl.gov

Music Composition Lab—Users compose musical pieces using Music Kit and CSound.
Paul Lansky, Ph.D.
Professor of Music
Princeton University
(609)258-4241
paul@winnie.princeton.edu

Music Composition Tools—An application to perform common compositional tasks such as inversion, retrogressions, and augmentation. The program works with score files and allows the manipulation of arbitrary selections of a score.
Kent Black
Systems Manager
Reed College
(503)771-1112 x640
kab@reed.bitnet

News—A newsreader with a NeXTstep interface.
William Shipley
Undergraduate in computer science
University of Washington
(206)525-8920
wjs@cs.washington.edu

NXSpice—Spice 3c1 with a NeXTstep interface.
Scalable Coherent Interface Multiprocessor Digital Signal Processing System—A reconfigurable DSP system for real-time signal processing applications.
Dr. Ronald D. Fellman
Assistant Professor of Electrical and Computer Engineering
University of California at San Diego
(619)534-4913
rfellman@ucsd.edu

PHIGS_View—A tutorial that demonstrates the 3D viewing of pipeline in the PHIGS and GKS-3D international graphics standards.
The Shader—A dynamic shadow projection tutorial for design disciplines. Users can manipulate a single light source in 3D space and view the resulting shadowing.

3D—A 3D graphics tutorial that displays simple wireframe or solid objects according to object transformation viewing parameters and projection types set by the user.
Dr. Michael K. Mahoney
Professor of Computer Science and Engineering
California State University at Long Beach
mahoney@grafix.cse.csulb.edu
(213)985-1550

Photoreceptor Model—A model of the enzyme reactions that underlie the excitation and adaptation of vertebrate rod photoreceptors.
M. Deric Bownds
Professor of Molecular Biology and Zoology
University of Wisconsin
(608)263-4063
bownds@ros.molecbio.wisc.edu

PopMail—A port of the Post Office Protocol version 3 client applications.
Bob Debula
Ohio State University
(614)292-2591
debula-r@osu-20.ircc.ohio-state.edu

PROTEGE—An automated system for the generation of interfaces to perform knowledge acquisition for expert systems. The interfaces help experts enter their expertise directly into an expert system's database.
Mark Mussen
Assistant Professor of Medicine and Computer Science
Stanford University School of Medicine
musen@sumex-aim.stanford.edu

The Reading Assistant—A computer-assisted system for foreign language learning. Users can browse through foreign language texts. By pointing to words on the screen, they can access a context sensitive on-line dictionary. Students can access translation aids and hear the proper pronunciation of words. The system supports Chinese, French, Italian, Japanese, and Portugese. Spanish is under development.
Dario Giuse
Senior Scientist, School of Computer Science
Carnegie Mellon University
(412)268-7671
dzg@cs.cmu.edu

Real Time Teleconferencing—A system to set up teleconferences using Ethernet networks and UNIX workstations. The system is being developed for NeXT computers and Sun SparcStations®.
Bill Putnam
Research Scientist II in Information and Computer Science
Georgia Institute of Technology
(404)853-9393

Reason—A statistical analysis package for complex structured datasets. It includes histogramming and function fitting capabilities. The analysis chain can include loops and if-then constructs. Calculations with interactive expression evaluators and compiled C and FORTRAN code can be inserted into the analysis chain.
Paul Kunz
Physicist
Stanford Linear Accelerator Center
(415)926-2884
pfkeb@ebnextk.slac.stanford.edu

Speech Recognition Interfaces—Speech interfaces to NeXT applications using Sphinx, a speaker-independent continuous speech recognition system.
Robert Brennen
Project Manager in Computer Science
Carnegie Mellon University
(412)268-3806
rab@cs.cmu.edu

Stay Tooned—An interactive framework for creative foreign language practice. It presents a story in picture form. Students click on speech bubbles to see and hear text in the target language and in translation. They may also write and record their own version.
John Barson
Professor of French—Teaching
(415)723-4183
barson@portia.stanford.edu
Brodie Lockard
Systems Programmer
brod@jessica.stanford.edu
Stanford University

Tape Backup Utility—An application to make backing up to Exabyte tape drives simple.
Bill Barker
Systems Administrator
University of Washington
(206)543-7315
bill@biostr.washington.edu

Tarski's World—A courseware project that teaches students first-order logic. Students construct worlds made of different sized and shaped blocks and then write logical sentences to describe the world. The program tests the truth of the sentences and provides feedback.
John Etchemendy
Professor of Philosophy
Stanford University
etch@csli.stanford.edu

Teaching Typography on the Computer—An electronic typography course consisting of a series of modules to teach basic typographic terminology and demonstrate, with interactive exercises and historical examples, the complex relationships inherent in typographic composition.
Roy McKelvey
Assistant Professor of Design
Carnegie Mellon University
(412)268-3453
rm0n@andrew.cmu.edu

Text Search Tools for the Humanities—A client application that allows quick and powerful searches through massive texts stored by using the PAT text search engine.
George Drapeau
Workstation Environments Specialist
Academic Information Resources
Stanford University
drapeau@jessica.stanford.edu

Timbre and Temperament—An application for the performance of musical scores in various timbres and temperaments.
Mary Simoni, Ph. D.
University of Michigan
(313)764-1152
Mary_Simoni@um.cc.umich.edu

TopDrawer—A general mathematical drawing tool. It is used to investigate knotted surfaces in four-dimensional space and can be used to draw and study other mathematical forms.
Dennis Roseman
Associate Professor of Mathematics
University of Iowa
(319)335-0779
droseman@umaxc.weeg.uiowa.edu

Tuning System Laboratory—A tuning system application for listening to extended just intonation and non-standard tuning systems.
Bill Parod
Northwestern University
parod@baris.acns.nwu.edu

Underwater Sound Analysis—Ananlysis and plotting of underwater sound using *Mathematica*.
Bill Kooiman
Applied Physics Lab Engineer
University of Washington
(206)543-1300

Videotape Training Seminar—Videotapes of a Local Developers Seminar held at Simon Fraser University. The five-and-a-half hours of video include lecture, demonstration, and lab. The seminar provides an introduction to object-oriented programming and Interface Builder. Companion exercise and demonstration software can be found at the University of British Columbia anonymous ftp archive site— cs.ubc.ca.
Lionel Tolan
Computing Services Advisory Consultant
Simon Fraser University
(604)291-4702
Lionel_Tolan@cc.sfu.ca

Virtual Reality—Researchers are using the NeXT Computer to control a high-speed, optical-fiber network of workstations in the Virtual Reality lab.
Steve Aukstakalnis
Network Information Analyst
Human Interface Lab
University of Washington
(206)543-5375
hitl@hardy.u.washington.edu

If you would like your project included in future sections of Academic Projects, we need the following information:
Project title
Project manager's name and title
Institution/Organization
Department
Address, phone, and e-mail
Number of systems in department
Brief description of project

Please send to:
next_on_campus@next.com or
NeXT on Campus
NeXT Computer, Inc.
900 Chesapeake Drive
Redwood City, CA 94063

Third-Party Products

This section includes some of the software and hardware available for the NeXT computers. For more information about products listed here, please contact vendors directly. For a more complete list of third-party products, please consult NeXT's *Software and Peripherals* catalog. To receive a copy of the catalog, call 1-800-848-NeXT.

3270Vision‰—A family of products to satisfy IBM communication requirements. Conextions, Inc. (508)475-5411

Abaton Scan 300/GS‰—A 300 dpi, 8-bit scanner. Abaton. 1-800-444-5321

ACUCOBOL-85‰—A COBOL compiler that produces optimized, machine-independent object code. Acucobol, Inc. (619)271-7097

A/D64x™—An analog/digital interface that provides 16-bit delta-sigma conversion, 64x oversampling, linear phase anti-aliasing, and AES/EBU input/output. Singular Solutions. (818)792-9567

Adobe® Plus Pack—Twenty six popular typefaces. Adobe Systems, Inc. 1-800-344-8335

AFS 3.0—A system for sharing files across large networks. Scales easily from small to large installations and provides file location transparency. Transarc Corp. (412)338-4400

AKGH—Provides a framework for building context-sensitive on-line help. Information & Communications, Inc. (619)454-9160

Ariel QuintProcessor™—An add-in board with five 27 MHz M56001 DSP chips and on-board RAM. Ariel Corp. (201)249-2900

BioTRACE 8™ Biomedical Research System—An eight-channel data acquisition, monitoring, and measurement system for biomedical research. Bio-Medical Design Group, Inc. (612)645-9062

Calendoscope™—An appointment calendar for individuals and organizations. Stained Glass Software, Inc. (408)249-3337

ClickArt® for NeXT—400 illustrations in EPS format. T/Maker Co. (415)962-0195

Communicae™—DEC VT220™ and Tektronix 4010/4014™ terminal emulation and standard file transfer protocols. Active Ingredients, Inc. (617)576-2000

Cube Digital I/O™—An add-in board with 64 channels of digital I/O, a Centronics-compatible parallel port, and breadboarding area for circuit development.
Cube Floppy™1.4—An external 3.5 in. floppy disk drive that reads and writes MS-DOS® 720 KB and 1.44 MB, Macintosh 800 KB and 1.44 MB, and UNIX formats. Digital Instrumentation Technology, Inc. (505)662-1459

DAN—A complete engineering and scientific data analysis system. Supports several input/output file formats. Math++—A C-language math library of numerical analysis functions. Triakis, Inc. (505)672-3180

DaynaFILE™—An external disk drive that reads and writes to MS-DOS and UNIX floppy disks. Dayna Communications, Inc. (801)531-0600

Dazzl 16/12 A/D Converter—An add-in board with 16 single-ended or 8 differential channels, a maximum sampling rate of 200 kHz, and a centronics-compatible parallel port. Dazzl, Inc. (309)674-9317

Diagram™—A general-purpose diagramming and charting tool.
The First Compilation Disk—When uncompressed, the disk contains 400 MB of public domain software and utilities. Lighthouse Design, Ltd. 1-800-366-2279

Digital Ears—Records and edits CD-quality sounds.
Digital Eye—Records and edits still and moving NTSC video images. Metaresearch, Inc. (503)238-5728

DM-N™ Ariel Digital Microphone™—High-fidelity stereo microphone with lab-quality data acquisition capabilities. Ariel Corporation. (201)249-2900

Extron Board—The board allows the NeXT Computer to display video on a large-screen data projector or monitor.
Extron RGB 111™—A video interface that plugs into the MegaPixel Display port and provides monochrome output through RGB and sync channels. Extron Electronics. 1-800-633-9876

Flexible License Manager®—A network-wide multiaccess package that allows software to be licensed on a concurrent-usage basis. Highland Software, Inc. (415)493-8567

FORTRAN 77—Object-oriented FORTRAN™ compiler compatible with NeXT's Interface Builder toolkit. Absoft Corp. (313)853-0050

FrameMaker 2.0—Technical publishing software package; includes word processing, graphics, page-layout, equation-editing, and book-building tools. Frame Technology Corp. (408)433-3311

GatorBox®—Intelligent Ethernet-to-LocalTalk® gateway.
GatorMail-Q™—Allows you to link QuickMail® users with NeXTmail users.
GatorShare™—Software for file sharing between Macintosh and NeXT computers. Cayman Systems, Inc. (617)494-1999

INGRES™ Relational Database Management System—An integrated application development environment providing 4GL, SQL, and visual programming methods for relational database management. Ingres Corp. (415)769-1400

JETSTREAM®Tape Backup—A tape backup device that archives up to 2.3 gigabytes per tape. Personal Computer Peripherals Corp. (813)884-3092

Klip It™ 1.0—Nearly 400 high-quality TIFF and EPS images. Adamation, Inc. (415)452-5252

LaSTLock™—A cable and plate security system. Prevail. (408)296-6550

MacLink®Plus/PC—Provides file transfer and translation between the NeXT and Macintosh environments. DataViz Inc. (203)268-0030

MediaStation—A tool for multimedia archiving, computer-based training, interactive documentation, and desktop presentations. Imagine, Inc. (313)487-7117

Mirage Fax™—A 9600 bps Group III networkable fax modem. It includes software and a 2400 bps Hayes®-compatile modem. Objective Software Engineering Corp. (604)261-0186

Oasys FORTRAN, C, and Pascal cross-compilers—Oasys. (617)890-7889

OcéColor™—A 300 dpi color PostScript printer capable of monochrome, CMY, or CMYK printing. Océ Graphics, USA Inc. 1-800-545-5445

[OT Palettes: 1.0]™—A collection of Interface Builder palettes of Objective-C objects. SmartFields™ add format and validation capabilities to text fields. Chooser™ is a scrollable, selectable list. Math palette contains objects to link applications to *Mathematica*. Objective Technologies, Inc. (212)227-6767

PaperSight—A personal digital file cabinet and image management system. Supports optional Kurzweil optical character recognition.
PaperSight Developer's Toolkit—Seventy code and data modules for image management such as scanning and compression.
VISUS® Network Fax Modem—A high-volume, network fax that fully supports PaperSight work groups.
VISUS Digital Document Scanners—Scanning devices ranging from the Personal Scanner to the Industrial Scanner. Visual Understanding Systems, Inc. (412)687-3800

PLI SuperFloppy 2.8™—An external SCSI 3.5 in. floppy disk drive capable of reading and writing to 720 KB and 1.44 MB MS-DOS or UNIX formatted disks as well as the new 2.88 MB disk standard as implemented by NeXT. Peripheral Land, Inc. 1-800-288-8754

PM1.44—A SCSI floppy disk drive. Pacific Microelectronics. 1-800-628-DISK

PMHDE—An external SCSI enclosure with power supply and space for two 5 1/4" hard drives. Pacific Microelectronics. 1-800-628-DISK.

Rubik Algebra, Spring, and Taylor—Courseware for exploring various mathematical theories. Halchin and Fleming. (217)348-0917

Scan-X 1600™—Scanner with 1600 dpi line-art scan resolution and 400 dpi grayscale scan resolution.
Scan-X Color™—A 24-bit color scanner with 2400 dpi line-art scan resolution, and 400 dpi color scan resolution. Includes Scan-X software.
Scan-X Professional™—An 8-bit scanner with 1500 dpi line-art scan resolution, and 300 dpi grayscale scan resolution. Includes Scan-X software.
Scan-X Software—Scan package provides gray-level control and optical character recognition. HSD U.S., Inc. (415)964-1400

SCSI488/N™—An IEEE 488 interface and software driver. IOtech, Inc. (216)439-4091

TextArt™—Drawing package that produces a wide range of special text effects. Stone Design Corp. (505)345-4800

TheLibrary™—An information system for reading on-line material. Includes access and duplication control. We Design, Inc. (415)479-1105

TopDraw®—Object-oriented drawing package with sophisticated illustration and layout capabilities. Media Logic, Inc. (213)453-7744

TouchType™—A tool designed for setting large size type for headlines, advertisements, and signs. Right-Brain Software. (415)851-1785

Uni-Kit™—A cabling system to secure monitor and cube to work surface. Qualtec. (415)490-8911

Who's Calling?™—Telephone tracking system with multiuser access and voice response. Adamation, Inc. (415)452-5252

Wingz 1.1—A graphic spreadsheet and HyperScript® language. Informix Software, Inc. (913)599-7100

Worldtalk™/400—Products to connect a variety of mail messaging systems such as NeXTmail™, IBM PROFS™, DEC ALL-IN-1™, Sprint-Mail™, MCI Mail™, and AT&T Mail™.
Touch Communications. (408)374-2500

NeXT User Groups

If your group is not listed here, if you would like to start your own group, or if you would like to share with NeXT what your group is doing, please contact: user_groups@next.com or conrad_geiger@next.com
For more information about user group meetings, call 1-800-848-NeXT.

Canada

British Columbia

Vancouver NeXT User Group
Simon Fraser University
Lionel Tolan, chairman
(604)291-4702
lionel_tolan@cc.sfu.ca
meetings: last Wednesday of the month

Quebec

Montreal NeXT Section of Club Macintosh
Robert Paulhus, president
(514)939-0382
paulhus@calvin.cs.mcgill.ca

Ottawa NeXT User Group
Hugo DeRosier, president
(416)236-0609 (NeXT office)
phume@next.com

Japan

Tokyo

NeXT User Society
Katsuhiro Ohashi
NeXus-office@etl.go.jp
meetings: fourth Wednesday of the month

United States

Alaska

Arctic Circle NeXT User Group
University of Alaska at Fairbanks
Aaron Morse
(907)479-2247
fsapm@alaska.bitnet

Arizona

Phoenix NeXT User Group
Gary Frederick, president
(602)869-0316
frederic@cimnext.cim.eas.asu.edu

Tucson NeXT User Group
University of Arizona
Robert W. Layhe
(602)621-2284
layhe@rcnext1.rc.arizona.edu

California

BaNG
Bay Area NeXT User Group
Eric Ly
BaNG-request@meta-x.stanford.edu

JPL/Caltech NeXT User Group
California Institute of Technology
Leo Blume, president
(818)397-9521
leo@emerald.jpl.nasa.gov

Nuggets
California State University at Los Angeles
Gary Novak, president
(213)343-2400

SCaN
Long Beach NeXT User Group
Calfornia State University at Long Beach
Michael Mahoney
(213)985-1550
mahoney@grafix.cse.csulb.edu

SNuG
San Diego NeXT User Group
Nicholas MacConnell
(619)481-7535, (619)565-9738
tfinn@next.com

Santa Barbara NeXT User Group
Amir Gharaat, president
(805)968-5584
erone%pumpkin@hub.ucsb.edu

STuN
Stanford NeXT User Group
Chris Overton, president
louiex2@portia.stanford.edu
meetings: third Wednesday of the month

UC Riverside NeXT User Group
Paul Lowe, president
(714)787-3883
plowe@ucrac1.ucr.edu

Colorado

rmNUG
Rocky Mountain NeXT User Group
Dave Hieb, chairman
(303)530-2560
davehieb@boulder.colorado.edu

District of Columbia

NeXT Special Interest Group
Hugh O'Neill, president, or
Joel McClung
(703)938-NeXT
joel@next.com

Naval Research Labs
NeXT User Group
Richard Pitre
(202)767-3524
pitre@ccf.nrl.navy.mil

Georgia

BUZZNUG
Georgia Institute of Technology
Erica Liebman
(404)352-5551
erica%kong@gatech.edu

Illinois

Chicago NeXT User Group
Argonne National Laboratory
Mark Henderson
(708)972-5963
henderson@mcs.anl.gov

NU NeXT User Group
Northwestern University
Bill Parod, president
(708)491-5368
parod@baris.acns.nwu.edu

Massachusetts

Boston Computer Society,
NeXT User Group
Dan Lavin, president
(617)969-6555

Michigan

Michigan State University NeXT User Group
Ray Silverman
(517)353-9114
bonduku@msu.bitnet

Minnesota

Minnesota NeXT User Group
Carleton College
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mtie@carleton.edu
meetings: second Tuesday of the month.

Missouri

St. Louis NeXT User Group
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New Mexico

Albuquerque NeXT User Group
Sandia National Laboratories
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Los Alamos NeXT User Group
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New York

New York City NeXT User Group
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Ohio

Columbus NeXT User Group
Ohio State University
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Oregon

Oregon State University NeXT User Group
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meetings: second Thursday of the month

Portland NeXT User Group
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Interface Builder User Group
Allegheny College
Joel Smith
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Texas

Austin NeXT User Group
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NorTeNUG
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meetings: third Wednesday of the month

hAng
Houston Area NeXT User Group
University of Houston
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meetings: first Wednesday of the month

Utah

Salt Lake City NeXT User Group
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meetings: third Wednesday of the month

Washington

NeXT Medical User Group
University of Washington
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University of Washington
NeXT User Group
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meetings: third Wednesday of the month

Washington State University
NeXT User Group
Joe Gerkman, president
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gerkman@bongo.csc.wsu.edu

The following mail lists are for information exchange, accessible by electronic mail. To join, please send inquiries to:

Topic & Electronic-mail address

Mathematica

mathgroup-request@yoda.nc-sa.uiuc.edu

Medical

NeXTMed-request@
ulnar.biostr.washington.edu

Music

next-music-request@usc.edu

Network & Security Management for Installed Labs

next-lab-request@cs.ubc.ca

Programming

hardcore-request@
warhol.gatech.edu

Programming

next-prog-request@
cpac.washinton.edu

NeXT Archives

Public archives are used to share public-domain software, documentation, programming examples, and other resources. Here is a sampling of what is available. Resources are accessible either by using the ftp program or electronic mail. If you do not know how to use ftp or access the e-mail archives, please contact your campus support center.

Archive Sites

FTP Archive Sites

Site	***Focus***	***Hostname***	***IP Address***
MIT	Gnu	aeneas.mit.edu	18.71.0.38
Oregon State	General	cs.orst.edu	128.193.32.1
Princeton	Music	princeton.edu	128.112.128.1
Purdue	General	nova.cc.purdue.edu	128.210.7.22
Stanford	Kip	sumex.stanford.edu	36.44.0.6
University of British Columbia	General	cs.ubc.ca	128.189.97.5
University of Maryland	General	umd5.umd.edu	128.8.10.5
University of Washington	Mail	ftphost.cac.washington.edu	128.95.112.1
University of Illinois	*Mathematica*	ftp.ncsa.uiuc.edu	128.174.20.50

E-mail Archive Sites

Adobe	PostScript	ps-file-server@adobe.com	na
Purdue	General	archive-server@cc.purdue.edu	na

Resources

Application Name	***Site***	***Pathname***	***Description***
AltDoc	Purdue	pub/next/binaries	Use multiple application docks
Archive	Oregon	pub/next/binaries	File archiving tools
Cassandra	Purdue	pub/next/binaries	Appointment minder and scheduler
CharFind	Purdue	pub/next/binaries	Keycaps
Hitchiker	Oregon	pub/next/binaries	A modem communications package
Lock	Purdue	pub/next/binaries	Locks the screen until a password is typed
MazeWar	Purdue	pub/next/binaries	The classic net-wide video game
Mixer	Purdue	pub/next/binaries	Mix sound files
NXSpice	Purdue	pub/next/binaries	Spice 3c1 circuit design package
NX_VOID	Purdue	pub/next/binaries	A space shoot-out video game
Robots	Purdue	pub/next/binaries	A simple video game
SCSIInquirer	Purdue	pub/next/binaries	Displays information about SCSI devices connected to NeXT computers
SpeechCompact	Purdue	pub/next/binaries	Records speech and removes pauses
Stuart	Purdue	pub/next/binaries	vt100 emulator with advanced features
Tetris	Purdue	pub/next/binaries	The popular Soviet video game
MailManager	Purdue	pub/next/binaries	Advanced mail management
News	Purdue	pub/next/binaries	A graphic based usenet news reader
XNeXT	Purdue	pub/next/binaries	X-windows

Objects

Name	*Site*	*Pathname*	*Description*
FileQueue	Purdue	pub/next/classes	Manages item queues
Gauges	Purdue	pub/next/classes	A kit of scientific gauges
PercentDoneDemo	Oregon	pub/next/classes	A kit of percentage done bars
ScrollWindow	Oregon	pub/next/classes	A window with advanced sizing features
SliderDualActing	Oregon	pub/next/sources	A kit of sliders with advanced features
tcp_network_objects	Oregon	pub/next/classes	Objects for TCP access

Demos

Calendoscope	Purdue	pub/next/demos	An appointment minder
Communicae	Purdue	pub/next/demos	Dec and Tektronix terminal emulation
TextArtDemo	Purdue	pub/next/demos	Create PostScript text effects
TheFormatter	Purdue	pub/next/binaries	Formats Wren hard drives

Utilities & Programming Examples

background	Purdue	pub/next/source	Sets the screen to gray or an EPS file
BitmapTest	Purdue	pub/next/source	How bitmap imaging methods effect speed
BlinkExample	Purdue	pub/next/source	A custom Interface Builder
Clocks	Purdue	pub/next/source	Clocks that demonstrate bezier curves
CSound	Purdue	pub/next/source	A UNIX sound generation tool
Cube/Rotation	Purdue	pub/next/source	A rotateable 3D wireframe cube
define	Purdue	pub/next/source	Command line access to Digital Webster
Emacs	Purdue	pub/next/source	Emacs support for the mouse and meta-key
Eyecon	Purdue	pub/next/source	An icon with eyes that follow the cursor
fsectbyname	Purdue	pub/next/source	Extracts data from and inserts data into Mach-O segments
f2c	Purdue	pub/next/source	A Fortran-to-C cross-compiler
FrontEnd	Purdue	pub/next/source	Converts Mac snd files to NeXT .snd format
globe	Oregon	pub/next/sources	A rotating 3D globe of the Earth
IconBounce	Purdue	pub/next/source	An icon with qix lines inside it
iDrag_0.6	Purdue	pub/next/source	How to drag file icons into an application
Lab[1-4]	Purdue	pub/next/source	Four developer camp labs
LispExample	Purdue	pub/next/source	A mouse interface to Common Lisp
LispScorefile	Purdue	pub/next/source	Functions for using Score in Lisp
Looching	Purdue	pub/next/source	Uses the DSP to generate new-age music
mac-2nextfont	Purdue	pub/next/source	Convert Mac PostScript fonts to NeXT
Magnify	Purdue	pub/next/source	Magnifies areas pointed to by the mouse
MazeDemo	Purdue	pub/next/source	Generates and solves complex mazes
Monitor	Purdue	pub/next/source	Displays CPU and ethernet loads
MOTD	Purdue	pub/next/source	Displays a message-of-the-day at login
NeXTCmix	Princeton	pub/music	A powerful sound mixer

Utilities & Programming Examples

Name	***Site***	***Pathname***	***Description***
nextdvorak	Purdue	pub/next/source	Remaps the keyboard to Dvorak
NeXTedsnd	Princeton	princeton: pub/music	A sound file editor with fft analysis features
Pfind	Purdue	pub/next/source	A text file database and search utility
popi	Purdue	pub/next/source	A bitmap image editor
PSHacks	Purdue	pub/next/source	A collection of PostScript examples
pstools	Purdue	pub/next/source	A PostScript previewer of a file splitter for two-sided printing.
QuickPlot	Oregon	pub/next/sources	For simple plotting from text file
RecordApp-4	Purdue	pub/next/source	A sound recorder
Remotes	Purdue	pub/next/source	Manages remote terminal sessions
Reverb	Purdue	pub/next/source	A software digital reverb
ShellPanel	Purdue	pub/next/source	Alert, open, and save panels for shell scripts
SketchDemo	Purdue	pub/next/source	Draws, composites, and animates images
SoundAndLight	Purdue	pub/next/source	Sets the volume and brightness at login
SoundGenerator	Purdue	pub/next/source	Generates sine waves on the DSP
tifftoeps	Purdue	pub/next/source	Converts TIFF files to EPS
Tools	Purdue	pub/next/source	Mouse access to UNIX commands
2DLab	Purdue	pub/next/source	View Minimum Spanning Tree algorithms
Twin	Purdue	pub/next/source	Graphical front end to T language
Unknown	Purdue	pub/next/source	Gives custom icons to various file types
ViewGif2	Purdue	pub/next/source	A GIF viewer that converts GIF to TIFF
Wn2troff	Purdue	pub/next/source	Converts WriteNow to troff/nroff
Newsletters			
BuZZNUG	Purdue	pub/next/BuzzNUG	BuZZings and the NeXT user Journal
NeXTVieW	Purdue	pub/next/NeXTVieW	University of British Columbia user group journal
OnCampus	Purdue	purdue pub/next/OnCampus	NeXT on Campus Journal
Tao	Purdue	pub/next/tao	Robert Lin’s tabloid about NeXT
Miscellaneous			
ClassicalGas	Purdue	pub/next/sounds	A muscial composition
iwscript	Purdue	pub/next/binaries	A print driver for ImageWriter® printers
King James Bible	Washington	pub/	The Bible formatted for Digital Librarian
mandelbrot.top	Oregon	pub/next/misc	Draws a 3D fractal in TopologyLab.app
NeXTAnswers	Purdue	pub/next/docs/NextAnswers	Answers to technical questions
TomPoikerGraphics	Purdue	pub/next/graphics	Maps from a cartography course

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Department ....

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Country .... ZIP ....

Phone Number ....

Electronic Mail Address ....

Faculty: ☐ Assistant Professor ☐ Associate Professor

☐ Full Professor ☐ Other Faculty

Student: ☐ Undergraduate ☐ Graduate

Other: ☐ Developer ☐ Reseller

☐ Support Center ☐ Service Center

Do you currently use a NeXT computer?

☐ Yes. I own a NeXT computer.

☐ Yes. I work on a NeXT computer that my institution owns.

☐ No. I have never used a NeXT computer.

Please describe what you use the NeXT computer for and which applications you use.

What other kinds of computers do you use?

Which computer do you use most frequently?

What applications do you use on that computer?

What types of articles would you like to see in the winter issue of *NeXT on Campus?*

Suggestions, contributions, and subscription request can also be sent to us electronically at next_on_campus@next.com

NeXT on Campus is a quarterly journal provided by NeXT Computer, Inc. for the higher education community. In each issue the journal highlights advances in instruction and research in which NeXT computers have played a key role, as well as NeXT-related news, feature stories, products, and resources available to the NeXT community. *NeXT on Campus* welcomes your comments, suggestions, and contributions. Send e-mail inquiries to next_on_campus@next.com or write to *NeXT on Campus*, NeXT Computer, Inc., 900 Chesapeake Drive, Redwood City, CA 94063.

COLOPHON

The fall issue of *NeXT on Campus* was produced on a NeXT computer. Text was written with WriteNow 1.0. Page composition was done in FrameMaker 2.0. Proofs were printed using a NeXT 400 dpi Laser Printer. Final, camera-ready artwork was created on a Linotronic 300 imagesetter.

COVER

About the cover: A NeXT computer digitally acquired the spoken phrase “next on campus.” A SoundEditor application was used to display the envelope of the sound. Through the standard CODEC channel, microphone signals can be stored, processed, or even sent in the form of voice mail.

CREDITS

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