Editor’s Note: Welcome back for the fall semester at NYU. We’ve been busy over the summer — as you’ll see from the reports and explorations in this issue of Connect.

The NYU-NET II project has been brought to a successful conclusion, with increased bandwidth and reliability throughout the university’s network. This hardly means an end to construction and improvements, though. As Gary Chapman writes in his Report on a Work in Progress (p. 6), the NYU-NET II Project “represents just a first, highly organized phase of the continuing rapid evolution of our campus information infrastructure.”

This ‘phase’ has supplied the base for a new financial system using client/server architecture (p. 13). It has created the opportunity for public NYU-Internet Stations and plug-in network connections at Bobst Library (p. 15). It connects astrophysicists to visualization systems (p. 46) and supports the Web that mounts gallery exhibitions (p. 25), teaches genetics (p. 35), and reminds undergrads about their homework assignments (p. 44).

NYU has been named one of America’s 100 Most Wired Colleges by Yahoo! Internet Life. In the next sixty-some-odd pages you’ll see a few of the reasons why.

—Melissa Whitney
Towards a Global Information Infrastructure

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Last June in Kuala Lumpur, Malaysia, about 1400 people from over 120 countries gathered at INET '97, the annual conference of the Internet Society. These conferences provide an intriguing window into the state and direction of the global Internet.

The Internet Society was founded in 1991 as an outgrowth of the various bodies associated with the development of internetworking. As an international not-for-profit association, the Internet Society’s mission statement is “to assure the beneficial, open evolution of the global Internet and its related internetworking technologies through leadership in standards, issues, and education.” It accomplishes this through a variety of programs, including steering the agenda for the Internet Engineering Task Force (IETF), the standards-making body for the evolution of the TCP/IP protocol set which governs the operation of the global Internet.

The most notable changes since the first INET conference in 1991 are those of size and scope. When the first conference convened, the Internet linked networks containing about a million nodes; this year, the number of linked nodes approaches 20 million. In 1991, the Internet connected only a subset of developed countries. At this year’s conference, Larry Landweber, a University of Wisconsin computer scientist who has both substantially contributed to and documented the growth of the international aspects of the Internet from its beginnings, announced that 173 countries and territories are currently interlinked.

The chief beneficiaries of the recent extensions of the Internet have been countries in Africa. Africa has been regarded as a relatively intractable part of the world for the Internet because of generally weak infrastructure components, but in the last year significant headway has been made in establishing initial nodes in the capital cities of a significant number of the African countries remaining to be connected. Bilateral programs such as USAID’s Leland Initiative, combined with the slow but steady increase of networking knowledge within the countries themselves and a realization of the benefits of networking, have contributed to this growth. This year, for the first time, Africans organized an African Networking Symposium in conjunction with the INET '97 conference. African networking leaders gathered at the Symposium to review the state of networking on their continent and to establish stronger links with each other.

Multilateral development agencies are recognizing that the Internet is an essential part of infrastructure for national development, as well as a support for their specific development projects and activities. INET '97 opened with a video conference linking panelists in Malaysia with panelists at the World Bank’s Global Knowledge Conference in Toronto. Members of the panel discussed the potential of the net both for amplifying the benefits of development aid and for providing critical infrastructure for economic and social development. The United Nations Development Programme used the occasion of the conference to announce a multi-million dollar program to assist the countries of Asia and the Pacific in developing skills to build and exploit network infrastructures in their countries.
As the host nation, Malaysia took the opportunity to display its investment in networking technology and its belief in the importance of access to the net. As one of the keynote speakers, Malaysia's Minister of Telecommunications talked about the importance of using information technology to leapfrog stages of national development. Malaysia is in the process of constructing a Multimedia Super Corridor (MSC) south of Kuala Lumpur, a residential-commercial area of several hundred square kilometers containing residences for about 250,000 people in which every home, school, office and factory will be connected with high-speed broadband telecommunication links. The MSC will serve as a testbed for advanced information technology products and services that require large scale deployment for development and testing. This ambitious scheme currently has no counterpart anywhere else in the world.

The Malaysian government has a strong commitment to providing ubiquitous access to the Internet for its citizens. The quasi-governmental Malaysian Institute of Microelectronic Systems operates the national ISP, named Jaring, one of a growing number of ISPs serving the country. Access to the Jaring requires only a local call from any telephone in Malaysia; just dial 1-511 and you are connected to a modem offering IP connectivity to the net, identical to the NYU DIAL service.

With all of this growth, Internet governance was a hot topic. In the conventional wisdom, no one governs the Internet. Yet there is a necessary minimum authority required for the coordination of basic addressing functions of the network (Internet (IP) addresses and domain names) to provide consistency and interoperability throughout the net. The last 12-18 months have seen the beginning of a reexamination of this area, with discussions of how best to serve a networked constituency that is straining the scope of some of the original coordination and governance mechanisms.

As internetworking and the accompanying skills have spread, the focus of the Internet Society technical program has changed significantly. In 1991 a commodity Internet had not yet emerged, and papers tended to focus upon technical issues and network industry issues. In 1997, there is not only a commodity Internet, but one which touches many aspects of human lives.

Issues of content regulation were a significant theme of the conference. Some countries such as Iran, Singapore, and China (but not limited to them only) have explicit policies limiting legal content on their parts of the Internet, and have a variety of technical and legal mechanisms for enforcing their policies. Other countries have considerably fewer restrictions and more proponents arguing for freedom of expression and the right of anonymity on the net. Given the Internet's ability to support millions of parallel instantaneous interactive communications, it is surprising that there are as few clashes of cultural norms as there are.

While the conference was in progress, the U.S. Supreme Court issued its ruling upholding the Federal District Court's decision that the Communications Decency Act was unconstitutional. This is of significant importance to us in the United States, both as individuals and as an educational institution. It will also help to set a framework for discussion regarding what the bounds of freedom should be on the net. Although the discussion may be aided by this and other events in the U.S., there are a sufficiently large number of differences among nations on these matters to continue the debates and disagreements for a long time to come.

The most important part of the conference appeared to be the human networking that took place outside of the conference sessions, in the hallways, lobbies, and social events. Participants at INET conferences are generally veterans of the networked environment and have constant opportunities to discuss issues via e-mail with colleagues all over the world. The conference provides the unique opportunity to interact at a personal level and to set the stage for continued interaction through the net during the coming year.

Observing these interactions provided the reminder that while the technological advances and abilities of the Internet are quite impressive, the real services that the Internet provides should be measured by the value that they add to all aspects of our lives, including supporting instruction and research, enabling electronic commerce, providing a wide variety of information on demand, enabling virtual special interest communities, and supporting more effective public services. INET '98, to be held in Geneva, Switzerland next July, is expected to reaffirm that point of view and report on internetworking progress and achievements in the coming year.

You can read Connect Online on NYU Web at http://www.nyu.edu/acf/pubs/connect/
“Good Morning New York, Everyone Please Plug In”

Anthony Townsend
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Every weekday morning William Martin, a computer programmer and Puerto Rican immigrant, boards the E train in Elmhurst, headed to Penthouse magazine headquarters in the heart of the Midtown Manhattan. About the same time, Troy Bentson, a recent arrival from Austin, Texas with a background in film production, fires up his desktop Macintosh in his Park Slope studio, makes coffee and checks out the latest technology headlines on Yahoo! If you are wondering what these two very different people could possibly have in common, the answer is that they are both part of New York’s booming new media industry — an octopus-like network involving freelance geeks, publishing gurus and visual artists in an information revolution which has placed New York City at the center of cyberspace. And while New York is arguably the biggest hub on the information highway, central cities across the country are quietly rising as the dominant centers for Internet development, and redefining themselves in the process.

From 0 to $1.8 Billion in 60 Seconds

Just a few years ago, the Internet was still a research and academic network, connecting a handful of high-profile military labs with colleagues and collaborators in universities across the country. As recently as 1994, when the National Science Foundation began to transfer operation of the national backbone to private hands, there were only a handful of companies actively using the Internet, mostly technology companies or small companies founded by university expatriates. Intensive Internet use was confined to highly intellectual communities like Cambridge, Massachusetts, Berkeley, California, and the high technology complexes of Silicon Valley and Austin, Texas.

But with the invention of the hypertext transfer protocol (HTTP) in Switzerland, using the Internet to exchange text and visual information became fantastically simple compared to earlier systems like Gopher or FTP. The subsequent growth of the World Wide Web and the ensuing media attention made “information superhighway”, “cyberspace”, and “virtual reality” phrases that no ambitious entrepreneur could ignore. The cyber-land rush had begun.

The latest reliable figures estimate that in the United States there are about 400,000 companies, schools, and organizations and over 40 million people online. This growth occurred so rapidly over the last two to three years that only recently have credible techniques for studying and surveying the online world emerged. Nonetheless, a remarkable amount of progress has been made in this short time, driven by advertising and marketing needs. We now know that Internet users are overwhelmingly white, male, educated and affluent — but becoming more diverse as knowledge and access to technology spreads. Little attention, however, has been paid to where the Internet is developing.

Our efforts over the past year at the Taub Urban Research Center have focused on this question. Every sign we have found points towards cities like New York, San Francisco and Los Angeles — vibrant urban centers for fast-paced, creative, and unconven-
tional lifestyles — as the hotbeds for innovation and development in electronic communications.

When futurists proclaimed the end of the American city as early as the 1970s, it seemed that they were right. After a decade of urban violence, the defeat of Lyndon Johnson’s War on Poverty, and the end of the post-War economic boom, the problems of cities seemed insurmountable. At the same time suburbia beckoned with cheap land, nature’s surrounds, and a willing and able workforce of liberated housewives.

However, global data networks, most recently the Internet, are changing the basic economics underlying the trade-off between city and suburb. While recently the New York City Council decided not to revise the city’s zoning code and thereby ease barriers restricting the location of big-box superstores, electronic commerce threatens to redefine the rules of retailing. By using the Internet to market and sell both standardized and specialized products, many stores no longer need a location with large showrooms and oceans of asphalt parking lots. For example, Amazon.com, which bills itself as the world’s biggest bookstore, operates out of a single downtown Seattle location, holding only a minimal inventory, and capitalizing on the technical, business, and marketing talent who prefer Seattle’s hip urban lifestyle. Its web of suppliers and customers, tied together with telecommunications, has already forced a wary Barnes & Noble into online merchandising well ahead of plans. Amazon needs to be downtown for convenient access to the workforce, telecommunications infrastructure, and business services it needs to survive.

These changes in the way we communicate and do business are starting to have a direct effect on cities. New York’s multimedia industry, responsible for writing, coding and presenting the content which graces all varieties of web sites, grew from almost nothing in the early 1990’s to a $1.8 billion industry employing over 27,000 people by 1995. And the city’s first growth industry in a decade is sparking a renaissance in Lower Manhattan’s sluggish office market, as new firms replace those ousted in the recession of the early 1990’s.

Elsewhere, the story is same. In San Francisco’s Multimedia Gulch, aging warehouses are being leased faster than they can be renovated and “wired.” Even Los Angeles, the archetype of the sprawling city, shows a remarkably dense multimedia district, stretching from Hollywood out to the Pacific Coast. Meanwhile, rural towns like Lusk, Wyoming and Staunton, Virginia that promise bucolic landscapes and state-of-the-art telecommunications infrastructure have failed to sell themselves as viable locations for firms engaged in information-intensive activities.

It seems odd at first that the people shaping the future of the Internet are clustering in central cities, often within blocks of each other. Many pundits still think that the Internet will bring us closer to Broadacre City, Frank Lloyd Wright’s utopian marriage of nature and city. The renewed interest in cities seems to lie somewhere between the changing nature of work, moving towards more flexibility and less security, and the vibrant and chaotic social structure born of the ‘net: chat rooms, mail lists, and newsgroups. The great urban sociologist Jane Jacobs, wrote in The Death and Life of Great American Cities that “a city’s very wholeness in bringing together people with communities of interest is one of its greatest assets,” a wholeness that the Internet has brought to a new level in some 17,000 newsgroups covering every imaginable topic.

The changing relationship between employer and employee too, makes a dense and interlinked professional network a matter of survival for both parties. As loyalty on both sides of the paycheck wanes, having access to multiple employers (or employees) is vital when business opportunities present themselves. In her study of Silicon Valley’s computer industry, the prototype for the emerging new media industry, Annalee Saxenian of the University of California at Berkeley found that many workers felt that they “worked for the Valley” rather than any specific company — for just this reason.

City governments are acting remarkably fast to capitalize on the opportunities for job growth and development that the Internet presents. New York City offers substantial tax abatements for technology-oriented building conversions in Lower Manhattan, and has earmarked $30 million to assist
six high technology industries, including new media. The Los Angeles City Council dramatically cut the business tax on multimedia firms, and San Francisco's City Planning Department has just completed an exhaustive survey of the Bay Area's multimedia industry, the first study of its kind in the nation. At the state level, New York and California have both repealed the sales tax on fees for Internet services and advanced telecommunications.

The Information Ghetto?
All is not wine and roses in the cybernetic city, however. As the city's new media and financial services industries are creating a record number of high-paying "good" jobs, the school system produces few graduates even qualified to apply, making headhunting for computer programmers and analysts a cottage industry in the Big Apple. In the poorest neighborhoods, more than twenty percent of households lack basic telephone service, much less a computer, modem, and Internet access. The few web sites that do represent New York's most distressed neighborhoods, such as Bedford-Stuyvesant's losnegros.com, make headlines in part by virtue of their scarcity.

Although New York is now officially the safest city with over one million residents, it is also the only one which lacks a citywide public Internet service, commonly known as FreeNets. Over the last ten years, public community computer networks have been providing an ever-enlarging base of government, employment, and social service information as well as e-mail and web access to in nearly one hundred metropolitan areas across the country — but not in New York. The closest FreeNet system is in Philadelphia, hardly a local call. New York also lacks a functioning local chapter of Computer Professionals for Social Responsibility, a trailblazing national organization working to promote equity and responsibility in the application of computer technology.

The Internet has the potential to breathe new life into our cities, reinforcing their vital role as centers of communications and information. However, cities like New York need to recognize that a future based on information-intensive industries requires strategies aimed at including everyone in the opportunities for prosperity. In the end, such efforts can only contribute towards making the informational city a safer, more productive, and more interesting place to live.

NYU Computer Store Teams Up with IBM Global Network

The NYU Computer Store is in the process of contracting with the IBM Global Network to provide alternate Internet service for the NYU community. For those of you who live outside the metropolitan area or who travel regularly and will incur long distance charges when dialing into NYU-NET, the IBM Global Network offers some distinct advantages as an ISP (Internet Service Provider).

Most importantly, IBM's service has over 935 local access sites in 52 countries around the world, 500 of which are in the United States, so you can almost always get onto the Internet with a local phone call. If you happen to be in one of the few places without a local access number; IBM also provides an 800 number service for a minimal fee (currently $6/hour).

On the subject of fees, IBM offers its educational customers special pricing on their services. There is a one time registration fee of $10. They offer three pricing plans for NYU: unlimited service for $17.95/month; 50 hours of access for $12.95/month; or 3 hours of access for $4.95/month. If you select the 50 hour plan, additional hours (over 50) are billed at $.95/hour. If you select the 3 hour plan, additional hours (over 3) are billed at $1.95/hour. If you want to change plans, you may do so after the first month. Services are conveniently billed to the credit card of your choice.

IBM offers an excellent support program for subscribers to their Internet service. They have support access through an 800 number or an online problem management system. Their support staff handles technical and administrative questions 24 hours per day, 7 days per week. Their network is monitored 24 hours per day and if a particular phone number should experience a problem, they offer an 800 number for customer access while the problem is resolved.

The IBM Global Network supports X2 56K modems (based on the US Robotics chipset), and ISDN support is being offered in selected cities in the United States. Whatever the speed of your connection, you'll have complete access to your NYU-Internet account.

Software for the IBM Global Network may be downloaded from IBM's web site at http://www.ibm.net. With this economical, reliable service you can have access to the Internet and NYU-NET anywhere you live or travel.

— Kathy Bear, Manager, NYU Computer Store
Some two years ago, the Academic Computing Facility undertook a large formal project to enhance NYU-NET, the university’s data communications network. Anticipating a day when network-based computing would be central to nearly all instruction and research, a set of major improvements was planned for implementation in parallel during this period — with the intent of producing a network infrastructure to support sustained future growth at the same time it enhanced reliability, security and manageability.

Now, in the summer of 1997, the NYU-NET II Project is reaching a successful conclusion. Interestingly, the project has incorporated many details and additions not specifically anticipated during the original project planning. We also now understand, with great clarity, the truth of a basic assumption of our original planning: that the 1995-1997 network improvement represents just a first, highly organized phase of the continuing rapid evolution of our campus information infrastructure. Just as outside NYU the Internet is evolving along manifold lines of development, inside NYU the network must change and grow in response to the needs of the community.

This article reviews the progress made over the past two years, describes some of the important developments which have influenced the precise characteristics and capabilities of NYU-NET as it exists today, and points to some of the remaining needs and emerging trends which will influence the future evolution of the network.

At the beginning, I would like to note that the NYU-NET II Project, like most of the detailed networking work that we do on a day by day basis, has been an intensely collaborative endeavor involving many individuals throughout the university. Within ACF, networking crosses all group boundaries; outside ACF, we work closely with departmental computer and network managers, with other large computing organizations on campus (such as the University Computer Center, the Bobst Library technical staff, the MIS department at the NYU Medical Center, and the networking staffs at the Stern School, the School of Law, and the College of Dentistry), with the Office of Telecommunications in extending and enhancing the physical wiring infrastructure of the network, and of course directly with the many faculty, student, and administrative client users of the network. The ACF networking staff is grateful for all the help and cooperation that we have received throughout this period.

A Summer 1995 Connect article described the incipient NYU-NET II Project in some detail, and included project background and overview information which holds up remarkably well today: see this history reprinted on page seven.

**Goals of the NYU-NET II Project**

The specific goals of the NYU-NET II Project, and how they have been achieved are described below.

**Increased Bandwidth to the Internet**

The bandwidth of NYU-NET’s link to the Internet, via the New York State regional network NYSERNet, was enhanced by a factor of thirty in 1995.
then, nearly any communications delays experienced by NYU network users have been attributable to network congestion outside of NYU, and typically outside of NYSERNet. Communications bandwidth availability across the Internet at large has not kept pace with the surge of demand by Internet users. Quality of external connectivity has become a serious issue for educational and research institutions, and is the fundamental motivation for the Internet2 Project (see below).

**Increased Bandwidth across NYU-NET**
A major feature of the new NYU-NET architecture has been installation of a high-speed (100 megabits per second, FDDI technology) backbone interconnecting major buildings and running over fiber-optic cabling. Nearly all reliance on the old, low-speed broadband cable plant has been eliminated in favor of high-capacity fiber optics, installed in the past several years by the NYU Office of Telecommunications and by ACF.

**Improved Intra-building Wiring**
As a result of the NYU-NET II Project and other capital improvement projects undertaken over the past two years, a majority of NYU buildings now have basic, internal ethernet cabling plants based on coaxial or fiber-optic cabling. Such vertical wiring, rising

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**A Short History of the NYU-NET II Project**
Reprinted from Connect, Summer 1995

The background information supplied with the Summer 1995 article on the NYU-NET II project holds up remarkably well, though some items which were predictions then are realities now — such as virtual libraries (JSTOR and Project MUSE, p. 33), virtual art galleries (Nahum Zenil at Grey Art Gallery, p. 25), and interactive multimedia instruction (Student Genome Project, p. 35, and Virtual College, p. 40).

NYU-NET is New York University's data-communications network, which supports research, instruction, and administrative activities at the university. It provides the means for sharing and delivering information within NYU, and is the university's link to the larger Internet — the worldwide network made up of interconnected networks like NYU-NET.

By the early 1990s, several characteristics of NYU-NET were becoming impediments — for example, severely limited communications bandwidth, and a reliance on devices that could be configured, managed, and monitored only to a limited degree. In the same period, we have seen a major expansion in use of the network and in types of use, especially in the transmission of graphics and other image data. The popularization of the Internet and emergence of Mosaic and the World Wide Web have been major factors in this growth. Further, there are increasing concerns about the reliability and the security of the network, as so many people access its resources from around campus and from remote locations via the Internet or dial-in modems.

In 1993, under the leadership of Assistant Chancellor Richard Stanley, a high-level working group was formed to draw up plans for improving the network. Members of the group came from the Academic Computing Facility, Bobst Library, the Department of Telecommunications, the University Computing Center, the Medical School, and the Stern School of Business.

The group developed a plan that calls for major improvements over a two-year period, as well as experimentation with new technologies to enable their future use as part of NYU-NET. Thus the project now beginning represents the first stage in a disciplined evolution of NYU-NET to enable it to meet the data communications needs of the university as they emerge in coming years. It is meant to set the foundation for future stages, in which NYU-NET becomes a fully integrated, multimedia-capable network.

The vision for this future network, to evolve step-by-step over the next decade, provides for the full capabilities (within the university and out into the larger network world) now being plotted for the national information infrastructure (NII) — capabilities that are or soon will be integral to the research, instructional, and administrative work of the university community. These include applications for sharing information, such as those for virtual libraries, museums, and art galleries, and for electronic publishing, as well as applications to enhance productivity and study, such as those for virtual LANs, video conferencing, and interactive multi-media instruction.

— Gary Chapman

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from floor to floor through the entire height of each building, permits relatively easy attachment of horizontal data wiring (typically twisted-pair copper) which is used to hook up each computer to the network on any given floor of a building.

The original NYU-NET II Project plan focused on the use of fiber optics between buildings. In keeping with industry trends of the past few years, fiber optics have begun to be slowly introduced within NYU buildings as well. This is an important area where much work remains.

**Network Architecture Improvements**

A major goal of the NYU-NET II Project was to revamp the fundamental architecture of the network: to introduce multi-protocol routers as the basic infrastructure devices which connect segments of the network together. The use of routing technology adds many management, configuration, and security capabilities to a network.

ACF has installed a set of high-performance routers from Cisco (the leading vendor in the field) at Warren Weaver Hall, 8-10 Washington Place, 7 East 12th Street, 715 Broadway, Bobst Library, Goddard Hall, and at the College of Dentistry. These routers form a core backbone connected via fiber-optic cabling. Several routers managed by collaborating computing organizations are also linked into this backbone — at the Stern School, at Bobst Library and at the Medical Center. (See NYU-NET Infrastructure map on page nine.)

The implementation of a router-based network has facilitated the evolution of NYU-NET in at least two major, but originally unplanned, ways: it has made it easy to extend NYU-NET connectivity to facilities which are not reached by NYU's own fiber-optic wiring plant; and it has enabled creation of a set of special-purpose sub-networks within NYU-NET.

Two years ago, we had no ready ability to bring NYU-NET connectivity to buildings such as the 42nd Street Midtown Center to which NYU wiring does not extend. But as the new NYU-NET routed infrastructure came on line, it proved to be a straightforward matter to use small Cisco routers and data lines leased from NYNEX (instead of physical cabling) to extend the network to these buildings. Thus far, the Midtown Center and the Barney building as well as several other far-flung locations, have been brought on line in this way.

Secondly, in 1995 we had no definite plans for how we would implement computer networks in student residences, in public locations such as building lobbies, or in small-scale departmental computer labs and classrooms. In tune with desires of the student body for enhanced access to computing and network resources, the university has moved forward aggressively in the last two years to 'wire' student residences, to deploy networked terminals in many public locations, to outfit carrels in Bobst Library with plug-in data jacks for laptop users, and to establish several small computer facilities (e.g. in the Morse Academic Plan classrooms in Main and at the humanities computing lab at King Juan Carlos I Center).

Each of these access points has its own specific utilization characteristics. Our extensive fiber-optic wiring plant, in combination with the NYU-NET routed network infrastructure, has permitted ACF to tie together various facilities into separate physical networks spanning multiple buildings: a residence network, an X-terminal network, a roaming laptop network, a classroom network, each linked at router connection points.

Such logical and physical definition of different types of networks helps prevent problems in one area from affecting others. This arrangement allows for different network access and security policies to be enforced as appropriate. For example, as a result of the technologies deployed, it is not possible for a Macintosh computer in a student residence room to inadvertently print to an AppleTalk printer in an administrative office; nor is it possible for even the most determined computer hacker to unplug one of our public X-terminals and in its place plug in an unauthorized laptop computer.

**Enhanced Network Communications Services**

In order for network-based applications to function — electronic mail, World Wide Web access, network news, telnet access to remote computers, and so on — an array of robust, behind-the-scenes network communications services must be maintained. These are computer-based services such as Domain Name Service, boot service, time synchronization service, and directory service, which run on centrally-managed network service computers. In early summer 1997, the last of various system upgrades and replacements in support of these services were performed, including the deployment of two GPS (Global Positioning System) based clocks to provide high-precision time service to computers on the network.
This map outlines the interconnection of core routers on NYU-NET and indicates some special networking projects in place, such as the Fast Ethernet Building Risers installed in Kimball Hall, as well as some experimental attachments of particular interest, such as the DVMRP Tunnel to the MBONE. NYU-NET currently consists of two FDDI backbones that are used to interconnect core backbone routers at 100Mbps, while providing the redundancy and fault-tolerance offered by the FDDI technology. Each router is then used to provide backbone network connectivity to local networks (LANs), thereby segregating NYU-NET into smaller subnets to regulate network traffic flow and provide greater security and network access controls.

— Jimmy Kyriannis
Establishment of a Network Operations Center

The NYU-NET II Project, and the continuing management of the network, would not have been possible without the dedicated efforts of a number of ACF staff members who focus on various aspects of networking and network computing. Together they form a central Network Operations Center (NOC) staff for NYU-NET. The core group dedicated to this project from its inception collectively represents many decades of experience in computing, data networking, and computer security: Bill Russell, Jimmy Kyriannis, Carlo Cernivani, Gary Rosenblum, Tim O'Connor, Stephen Tihor, Eray Ekici, and Mario Clagnaz and his group of energetic data technicians.

The NOC provides the capability to design large and small-scale network extensions, to troubleshoot network-related problems, and to liaison officially with outside organizations such as the InterNIC (the Internet’s central Network Information Center, providing registration and database services) and the CERTs (Computer Emergency Response Teams for security-related matters) and with the internal network operations groups which run some of the school-based networks (e.g. the Medical Center, Stern, and the School of Law). Today, members of ACF’s networking group are participating in Internet2/NYSERNet 2000 network planning, in the design and implementation of many network improvements around campus, and in the expansion and improvement of major central network resources such as the DIAL modem pool.

Recent Developments and Influences

Several important developments have occurred during the NYU-NET II Project which have strongly influenced the network as it exists today: technology evolution, the remarkably accelerated adoption of computing and networking throughout the university community, the emergence of computer and network security as increasingly important concerns, the adoption of TCP/IP-based networking and client-server computing for administrative purposes, and a large set of facility renovations and expansions which have called for new departmental data networks.

All of these developments were on the horizon and were under discussion during the planning phases of the NYU-NET II Project, but the specifics and timing in each area could not be anticipated. Fortunately the underlying technologies and approaches used to create the Internet, and NYU-NET as a microcosm of the larger Internet, were expressly designed to scale from small to large implementations, and to lend themselves to new uses of a data network as they emerge. Thus, network expansion and the integration of new approaches or technologies have occurred with ease. Here are a few notes on these trends.

Technology Evolution

The past two years have seen the emergence of two technologies now proliferating within NYU-NET: ethernet switching and 100 megabits-per-second ethernet. The prices for gear using these technologies have now decreased to the point where ACF’s standard recommendation for departmental networks is ethernet switches instead of ethernet hubs. Switches provide greater manageability, security, and communications bandwidth to attached computers, and typically offer the ability to hook up one or more individual machines at the high speed of 100 megabits per second. This approach is particularly useful for attaching servers, such as Novell file servers, which many other machines access.

Switches and 100 megabits-per-second (Mbps) ethernet are also useful for interconnecting different sections of a network, for example if a department spans multiple floors of a building. At the largest scale, we have now begun to attach entire building networks to NYU-NET routers via this high-speed ethernet technology — recognizing that the likely future of much high-speed data networking on NYU’s campus will be based on highly economical 100 Mbps ethernet as opposed to the older 100 Mbps FDDI technology currently deployed across the campus backbone.

Accelerated Adoption of Computing

There are numerous indicators of the penetration of network-based computing in the lives of NYU students and staff. For example, the number of electronic-mail accounts provided by ACF has grown by a factor of 10, from several thousand to more than 30,000, within the past three years. On a small scale, we receive a steady stream, day after day, of requests for new computers to be attached to NYU-NET. In the aggregate, these add up to a major increase in network usage. A number of large-scale university initiatives also reflect this growth in demand.

In Spring 1996, a set of enhanced computing resources was implemented to meet requests by NYU students for increased access to NYU-NET and
the Internet. In the course of this implementation, NYU-NET was outfitted with the special-purpose network segments described above. And, as a result, the framework is now in place for incremental expansion as needed for public terminals, dial-in modems, laptop plug-in locations, and so on. See http://www.nyu.edu/studentcomputing for details.

By fall of 1997, NYU's Residential Network (ResNet) will expand to make six major student residences ethernet-ready, accounting for nearly 4,000 potential connection points. Staff from the ResNet group assist students in attaching their computers. In the 1997-98 academic year, we expect between 500 and 1,000 students to take advantage of this service, with accelerating adoption in coming years. For more information, see http://www.nyu.edu/acf/resnet.

Because many students live off-campus, and because need for nighttime and week-end access to network resources has grown, dial-in access to NYU-NET has increased remarkably in the past two years: the central DIAL modem pool now represents one of the most heavily utilized network-based services offered by ACF. In the last year, some four million sessions were completed by members of the community dialing in from home. With a dial-in "prime-time" between 9 pm and 2 am, NYU-NET is nearly as busy at night as during the day!

Importance of Security
With the increase of applications to which the Internet is being put has come a rising awareness and concern for computer and network security. Although only a tiny percentage of computer users are interested in attempting to exploit weaknesses in computer security or in accessing private data of others, the possibility that systems can sometimes be compromised by a dedicated 'hacker' demands increased attention by computer managers and users alike to reduce the likelihood or success of such attacks.

As the NYU-NET II Project has evolved, security concerns have played an increasing role in network design and implementation choices, so as to limit potential vulnerabilities wherever possible. For example, ACF has continued its advocacy of the principle that 'anonymous user access' to Internet resources is inconsistent with responsible use of the Internet: if a security incident (e.g., a computer break-in attempt) were to originate from within NYU-NET by an anonymous computer user, then we would have little or no chance of determining what happened or who was involved. In the reverse case of an NYU computer system under attack from somewhere out on the Internet, we would certainly seek help from network administrators at that location in hopes of stopping the attack and identifying the intruder.

Some organizations, especially in the business community, attempt to protect their network assets from intrusion by use of "firewall" technology. Firewalls are computer systems (and software) which control data communications access to specific systems or portions of a network. Although certain types of firewall capabilities are implemented within portions of NYU-NET, ACF has thus far found it technically infeasible to implement a comprehensive firewall strategy that would not seriously compromise the flexible data communications capabilities needed by a research university community. This is an area, however, which we expect to continue to explore in the future.

Administrative Use of NYU-NET
Administrative use of NYU-NET, providing access to resources both within departments and across campus, has been growing steadily for the past few years, with a major acceleration anticipated during the summer and fall of 1997. Until now, cross-campus network-based administrative computing has

Useful URLs for NYU-NET Users

<table>
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<th>Status Information on NYU-NET and ACF Systems:</th>
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<td><a href="http://www.nyu.edu/acf/resnet">http://www.nyu.edu/acf/resnet</a></td>
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<td>Policies and Technical Information for NYU-NET:</td>
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focused on electronic mail for person-to-person communications and on mainframe terminal-emulation access for financial and student information services. But now we have the introduction of a new generation of central administrative servers and applications based on the “client-server” model of computing, most strikingly with the initial implementation this summer of the university Controller’s financial systems redesign project, “fame.” (See the accompanying article on page 13.)

First hundreds, and eventually thousands, of university staff will be using sophisticated microcomputer client software to access (over NYU-NET) new Unix and Novell servers maintained by the University Computer Center. The client-server approach brings many benefits to administrative computing processes, but it does place a premium on having a capacious and reliable network infrastructure. ACF has worked closely with the Controller’s Division and the University Computer Center to improve network capabilities in several key locations in support of this project. We now look forward, in coming years, to more administrative systems adopting the client-server model, which will further push the evolution of the network.

Stimulating Network Projects
The Financial Systems redesign project typifies a recent trend in the evolution of the network: the rise of significant medium- and large-scale projects calling for extensions and improvements to the network. As academic and administrative departments improve their facilities and services, the need arises for new design and implementation of modern data networks. This is very striking in the case of large, brand-new facilities, such as the Cantor Film Center on 8th Street, the new home of the University Health Services at 726 Broadway, the entirely renovated King Juan Carlos I Center (formerly Judson Hall), the School of Continuing Education’s Center for Advanced Digital Applications, and at the forthcoming University Hall student residence.

In addition to implementation of such “new networks” in the past year, ACF has coordinated a host of network improvements in existing facilities which have undergone renovation: at the School of Social Work, TSOA’s Interactive Telecommunications Program and Department of Film and Television, the Courant Institute’s new Applied Mathematics Laboratory, the Midtown Center, Kimball Hall and 715 Broadway in support of the Financial Systems Project, Chemistry department facilities in Main and Waverly buildings, and so on.

A comprehensive networking approach has emerged: the full installation of data wiring and jacks throughout a facility hitting any location where a computer might someday be located, combined with provision of sufficient network electronics so that a computer can quickly and easily attach at any of these points without additional networking expense. This approach, which makes provision for future needs and growth, contrasts sharply to past practice, whereby infrastructure elements were installed only as immediately needed.

Prospects
Several technology developments and initiatives promise to markedly influence NYU-NET in the coming years, of which I shall mention only a few:

- The coming of ‘gigabit’ ethernet, a technology which provides 100 times as much communications bandwidth as standard ethernet, and promises to be a viable replacement for FDDI for inter-router links on the NYU-NET backbone.
- Deployment of recently developed protocols such as the Internet Protocol version 6 (IPv6) and RTP, a protocol to govern transport of real-time data communications over a network. ACF has begun working with IPv6 as part of an international experimental testbed, and will soon be testing an implementation of RTP as part of a data network-based audio/video conferencing and broadcasting package which could scale to full university-wide use via NYU-NET.
- NYU participation in the implementation of Internet2, a new Internet for (at first) research universities which will provide qualities of data communications service which can be guaranteed. A NYSERNet grant proposal to the federal government has been in preparation during the spring and summer of 1997; funds are being sought to assist in the building of high-speed connection points between New York State research universities and the national Internet2.

Such technologies, now becoming available for experimentation and trial, can eventually be deployed across all of NYU-NET, and promise to make possible the truly “multimedia-capable” network described, two years ago, as the eventual goal of NYU-NET.
NYU adopts Client/Server Technology for fame Financial System

Mary Brooks
brooks_m@cdvfs01.cdv.nyu.edu

This September, NYU will see the first installations of its new financial system, fame (financial administration made easier). In 1995, NYU undertook a review of its financial system. In this assessment it was concluded that centrally-based systems, like the system in place, would not meet the developing and expanding needs of the university community.

About the same time, client/server technology was becoming a viable option for replacing legacy mainframe systems. This new technology had experienced some growing pains in its few short years, but as the '90s progressed, client/server came into its own as a mature, reliable technology. The university decided to replace its financial system with a package that makes the most of the client/server approach. After an exhaustive search, PeopleSoft Inc.'s financial suite was selected as the base for NYU's new financial system.

The Need for a New Financial System

Early computer application systems, like NYU's present Financial Accounting System, were designed for rather simple data storage, with limited retrieval and reporting capabilities. Serving primarily as large transaction processing engines, these systems were generally used just by central support units. Those outside of central areas were forced to conduct their financial business manually or, with the advent of personal computing, to create duplicate systems themselves in order to speed their work. The amount of paper flowing through this kind of systems environment was enormous. These systems did little to facilitate effective business processing across the organization and typically resulted in significant redundancies.

These have been very real factors at NYU. The university's 1995 needs assessment quickly revealed that it was time to move on to a new financial system. Our current processes are not integrated among departments, schools, or central locations — creating a fragmented environment. Mountains of paper, redundant data-entry, and reports with very little usefulness, like the locally infamous "ECR", have made it a challenge to get needed information, track work, or resolve problems. The resilience and creativity of the campus community has gotten the work done over the years, despite circumstances that promote apathy and lower the sense of financial control all along the process chain. Most importantly, this environment has diverted valuable human resources from other vital efforts.

NYU's exciting plans for the future as a global university must be accompanied by our ability to provide a financial environment that is efficient, service-oriented and which affords appropriate controls. All this being said, it is no small challenge to take on the implementation of a new, integrated financial system.

Ease of implementation was one of the key reasons for selecting a client/server architecture. Client/server provides rapid implementation by phases, far different from the multi-year implementation path of a legacy system. As the modern architecture of choice, extensive client/server development is being done in many quarters, promising future improvements that can be incorporated into the NYU system as they become available. One attractive feature is that this architecture will eventually support automated workflow that can be integrated with the Web for easy access to financial services. Client/server technology's modular structure provides significant flexibility in selecting other system components, such as server hardware and relational databases. The fame software, PeopleSoft,
can be implemented with any one of a wide variety of relational databases as the underlying storage base — we selected Oracle from PeopleSoft's list of possible or compliant databases.

What is Client/Server?
Client/server architecture combines the resources of a central server, local servers, and desktop PCs. These are linked over a network, in our case, over NYU-NET II. The central server houses a powerful Oracle database that keeps a wealth of stored data. The combination of a central database with individual PC processors gives users desktop access to a tremendous information base and powerful software tools. In a client/server system the processing load is spread over multiple locations, leveraging processing capacity. If the demand for processing power changes over time, it is not difficult to readjust the loads between servers and desktops.

Client/server systems originated less than ten years ago. Their hybrid structure builds on the strengths of both PC and mainframe solutions. Client/server solutions sought to combine the speed, security, and ease of maintenance offered by central mainframe systems (the server) with the flexibility, friendliness and end-user empowerment offered by PCs (the client). Client/server development has been rocky at times, but many elements are boosting its effectiveness and popularity. These elements include the availability of more powerful PCs, network improvements, the potential of the World Wide Web, and the availability of higher quality client/server applications.

PeopleSoft is Selected
When it came time to choose its first client/server package, NYU selected the financial suite from PeopleSoft Inc., a star in this segment of the software industry. PeopleSoft demonstrated a clear commitment to the higher education market and to the continuous improvement of its product in the long-term. The selection process involved over 150 members of the NYU community and spanned six months. After careful analysis of our functional and technical requirements, and of the offerings in the marketplace, it became obvious that PeopleSoft was the vendor of choice for the new financial system.

PeopleSoft reports that they "seek to develop products that characteristically support the freedom of selection between operating systems and other hardware. Systems are flexible and easy to customize or upgrade. They are designed to enhance productivity by automating processes and deliver fast, accurate information."

What are the Benefits to NYU?
Client/server software will allow NYU to streamline its financial services across the university. The software implementation will follow a gradual path, continuing over a period of several months. Services and procedures will change progressively through this time and fame system capabilities will be distributed more widely.

Financial requests, including purchases, will ultimately be processed and approved online, speeding the approval process. Information will be reflected in real-time, making it possible to get relevant, up-to-date information in straightforward ways. Staff will have the ability to complete a job the first time they do it, eliminating the redundancies that are currently a component of our financial processes. Modern reporting tools and access to historical financial information will enhance the financial officer’s managing opportunities. Faculty will have access to financial information to support their work on sponsored projects.

It is expected that NYU will continue this transition to client/server administrative systems, with the fame as only the first piece. Client/server computing requires less overhead to maintain its central structure, another benefit of this type of system. Local areas will have their own needs for equipment, technical support, and user training. These transitions will be worked through as a part of this and any future implementations.

Getting the Juice from NYU-NET II
The cultivation of NYU-NET II over the last few years played a significant part in our ability to adopt client/server architecture. These systems increase network traffic as volumes of data travel from desktops to servers. This past summer, the NYU-NET II project upgraded network services to the Controller's Division, Purchasing Services, and University Computing Center to accommodate the increased traffic. The upgrade will continue to add capacity all along the routes that financial information will follow.
NYU-Internet Stations Across Campus

Last summer, NYU-Internet Stations made their debut on our campus. Providing quick e-mail and World Wide Web access for students on their way from class to class, or while hanging out with classmates in a student lounge, the Stations have proved to be a popular service. The original installations in the 25 West 4th Street Study Center, Loeb Student Center and Bobst Library have been joined by installations on the ninth floor of the Main Building, in Kimball Commons, and at Shimkin Hall. The stations at Loeb Student Center saw such high volume use that we doubled the number at that location to sixteen. There are now fifty-eight Internet Stations available for student, faculty and staff use — allowing the NYU community to stay in touch from all over the campus.

As this summer draws to a close we are bringing up four Internet Stations at TSOA Commons — a student lounge area in the lobby of 721 Broadway. In addition, we are working with the School of Social Work to install three stations on the Garden Level of 1 Washington Square North. These installations will bring the total number of Stations to sixty-five.

If your school or department is interested in installing Internet Stations for NYU community public access, contact ACF Distributed Computing at 998-3100. Any problems with existing stations can be reported to the ACF HelpLine at 998-3333 or via e-mail to comment@nyu.edu.

— Amy Hernández

LAPTOPS IN BOBST — BRING YOUR OWN, OR BORROW ONE OF OURS!

Recognizing the growing need for access to the university’s many networked information resources, Bobst Library and ACF have joined forces to provide connections to NYU-NET from the Library. Network ports are available throughout Bobst to provide direct access to NYU-NET from personal laptops.

Register your laptop to connect from Bobst
To connect to NYU-NET, your laptop must be registered with ACF. There’s no need to register if you just want to plug in to an electrical outlet in Bobst and use your laptop for word processing or other applications.

To connect your laptop to NYU-NET you need
a. a laptop with networking software:
   a. an IBM PC-Compatible running Windows95 or
   a. a Macintosh running MacOS 7.1 or higher.
b. A 10Base T ethernet adapter with an RJ-45 female connector.
c. An NYU-Internet account — available to students at any of the ACF computer labs, and to faculty, staff and administration at the ACF Accounts Office.

Once you have the ethernet adapter installed, complete a registration form at the ACF Accounts Office, Room 305, Warren Weaver Hall, 251 Mercer Street.

Or take the easy route and borrow one of ours!
Both IBM-compatible and Macintosh laptops can be checked out by NYU students and faculty for three hour periods (in-library only).

The laptops are configured with network cards for Internet and e-mail as well as software for word processing, spreadsheet and presentation applications. Results will be downloadable. There’s no charge for this service. For complete details, consult Bobst Library’s Information Bulletin #23 Laptop Computers.

— Tom McNulty, Fine Arts Librarian

Connect: Academic Computing and Networking at NYU Fall 1997 15
Quietly, steadily, and pervasively, everyone is becoming networked. Increasingly we communicate by e-mail instead of using the phone. We supplement libraries and newsstands with the World Wide Web for reference, research, and news, and for contact with the zeitgeist and the world. Here at NYU we tread the paths of our local network, NYU-NET II, interchangeably with the Internet as software developments erase all signs of geographical boundaries between networks.

There's no doubt that the laying of the “information superhighway” will rival the construction of the transcontinental railroad and the interstate highway system in scale and in its impact on our lives. This is a global phenomenon, but one which is most keenly felt on the campuses of universities all over the world.

Direct Ethernet connections to the Internet provide the high-speed, instantly available links integral to the online lifestyle. No waiting for dial-up sequences, no periods of voice-communication down-time while surfing. Ethernet users talk on the phone and surf the Web at the same time. On campus it’s called “ResNet” and it makes online living practical.

The resources present online are potentially of great value to students. NYU is a diverse community and neighbors in residence halls often are focused on very different issues, both personal and educational. The percentage of students from beyond New York attending NYU and living in residence halls is increasing. One way to forge a sense of group identity is through online conversations on the Internet via newsgroups, listservs and e-mail lists. Many professors create e-mail lists which enable their students to carry their discussions beyond the classroom. Online group discussions can be a safe and comfortable way for dispersed people with common interests to share those interests. People new to this form of communication can simply read, without taking part, and benefit from the information and views expressed. This kind of communication is fostered by direct Ethernet connections, which make connections easier and faster, without annoying any roommates by tying up the phone line. As larger numbers of students partake of direct connections, we can expect an increase in the quantity and quality of online academic and community life at NYU.

The NYU ResNet project began last fall with three residence halls: Brittany, Goddard, and Third Avenue North (see the Spring ’97 issue of Connect for technical and historical details). The initial roll-out saw almost three hundred students activating their connections. Over the summer of 1997, three more residence halls were added: Hayden, Rubin, and Weinstein. Now, over thirty-six hundred students will be able to have a direct Ethernet connection at home in their residence hall rooms. We estimate over seven hundred and fifty will do so, up over a hundred and fifty percent from last year.

Why don’t all of the students living in those six halls activate their data jacks? First of all, you need to own a computer. Second, that computer needs to be equipped and configured for Ethernet. In an effort to help new students quickly get equipped and online, we have teamed up with the NYU Computer Store to offer in-room installation of Ethernet cards, as well as installation and configuration of the software of the Internet (a TCP/IP stack, Telnet, Netscape, Eudora, and FTP).

Students participating in this program purchase their gear at the NYU Computer Store and make an appointment for installation. When the technicians leave, the student is on the Internet. We hope that this path provides an easy way for people who are intimidated by the configuration and connection process to get online with expert help. Visit...
Students who already have an Ethernet card, or who choose to install their cards themselves, can register to have their data jacks activated at the ResNet web site: http://www.nyu.edu/acf/resnet. The jacks are activated remotely, via the network, with documentation and software arriving via campus mail. This method works fine for most people. Windows95 and Macintosh systems are easy to configure for TCP/IP. If someone gets stuck, ResTechs are standing by at 998-3435 to provide technical help and to go on-site to the residence hall room if required. The documentation helps new users get their bearings, and ACF offers classes for those looking to get the most out of the TCP/IP suite of Internet applications.

The documentation is also available online at http://www.nyu.edu/acf/pubs. Find out about ACF classes at http://www.nyu.edu/acf/classes.

Currently the Internet, as New York City itself, is a self-serve environment where the onus is on the user to seek out the paths to knowledge and entertainment. The vast and diverse resources of NYU and its unique campus — deeply integrated into the city — are, like the Internet, obscure by nature of their overwhelming abundance. Search engines (such as NYU’s search engine at http://www.nyu.edu/search.shtml) help people navigate the depths of the Web. Social resources help people navigate the cultural domains as well. ResNet, NYU-NET II, and the Internet have the potential to make NYU a more intimate place.

NYU World Wide Web Server Switches to Apache

NYU’s World Wide Web server www.nyu.edu has new web server software — Apache 1.2. Since its establishment as NYU’s official web server, www.nyu.edu has been running various versions of NCSA. The decision to switch to Apache was based on Apache’s speed, reliability and feature set.

Apache does out web documents about five times as fast as the NCSA server. Apache incorporates the HTTP 1.1 protocol, which offers even greater speed increases when used with a 1.1 compliant browser. HTTP 1.1 is not yet supported by the two most popular browsers — Netscape Navigator and Microsoft Internet Explorer — but both companies have expressed plans to include support in future releases. NYU’s web server will be ready when they do.

The name Apache comes from the fact that the project was started by a group of individuals creating “patches” for the NCSA 1.3 web server. As the patches developed into a distinct server, it became known as “A PATCHy server” from which Apache is derived. In contrast to the roots of the name, Apache is very robust. When IBM put up a web site to track the most recent chess match between Gary Kasparov and Big Blue, it passed over Lotus Development’s Domino and chose Apache and its own OS/2-based Internet Connection Server. According to NCSA’s most recent survey, Apache holds a forty-three percent market share. In June’s PC Week Online, UUNET’s webmaster Patrick Ward repeated a familiar mantra that Apache has never crashed on him.

Apache’s popularity is also attributable to the large number of advanced features it offers. Among those most useful to NYU web authors are:

- Extended Server Side Includes (XSSI) offers the ability to set variables and use conditional HTML. See www.apacheweek.com/features/ssi and www.apache.org/docs/mod/mod_include.html.
- The User-Agent string is available in Server Side Includes, allowing web authors to determine what browser is making a request and deliver an appropriate HTML file for that browser’s capabilities. For details, see www.apacheweek.com/features/ssi.
- Content Negotiation allows the presentation of documents in different languages and formats. See www.apache.org/docs/content-negotiation.html for details.

Apache has a complete API, and many additional features can be added to the server by incorporating “modules” into the server software. A repository of public modules is available at www.zyzzyva.com/module_registry. In true Internet fashion, the modules and the Apache web server itself are maintained and extended entirely by volunteer efforts. The server software is free of charge, and is publicly available at www.apache.org. Originally written for UNIX, the code has been ported to OS/2 and Amiga, with a Windows95/NT port in the works.

For those interested in following Apache developments, the online magazine Apache Week is devoted to the topic: connect to www.apacheweek.com.

— Randy Wright
Information Technology Specialist
From the Postmaster

When Bad Things Happen to Good Accounts

Jane DelFavero
cpostmaster@nyu.edu

When you sign up for an NYU-Internet account, you are required to sign a “Rights and Responsibilities” statement (reproduced on the ACF Accounts Office web page at http://www.nyu.edu/acf/accounts/practices.html). Most of these standards seem abstract and a bit removed from your everyday use of your account. This article will attempt to flesh out the rules and responsibilities that go along with access to the Internet, as well as to give you an idea of what the ACF can and cannot do for you when things go wrong.

As the following examples illustrate, most complaints that we get come from people outside of NYU. They know that every Internet host is required to have a person who answers mail to the address postmaster@host.name regarding problems with e-mail or with users at the host. As postmaster for New York University, I have seen the trouble that can result when the basic rules of usage are ignored. Most people are unaware that once e-mail is sent or a message is posted in a newsgroup, it becomes public and permanent. Mail gets saved on hard drives; newsgroups get archived at sites like DejaNews, so be aware that what you send to a newsgroup or say in e-mail could come back to haunt you. These stories are true, but the names have been changed to protect the innocent.

Jane DelFavero is NYU’s trusty postmaster. She will be contributing regular columns on netiquette and what she optimistically calls ‘appropriate usage.’ If you have questions or issues that you would like to see covered in future “From the Postmaster” columns, please write to her at postmaster@nyu.edu.

Off-Topic Posting

To: postmaster@nyu.edu
From: Amanda Bannon (ban@hypno.com)
Subject: Off-topic posting
Cc: xyz200@nyu.edu

I attach a recent posting from one of your students. She clearly did not read the names of the numerous groups that she posted to (the attached is but one of many); please teach her to post to appropriate groups in the future.

Amanda

-------- Forwarded message --------
> To: rec.pets.cats
> Subject: my web page
> 
> Hey, check it out!
> http://pages.nyu.edu/~xyz200
> Xanthippe

To: ban@xyz.com
From: xyz200@nyu.edu
Subject: Re: Off-topic posting
Cc: postmaster@nyu.edu

Hey Amanda,
I’m very very sorry that you feel that way about how I tell people about my page. Maybe ‘you’ could tell me how I should do it. I mean, duh, I’m new here, and I want people to see the page that I worked REALY hard on, so don’t get on my case!
Xan
The first lesson of this interchange is that you should be careful about the tone of your e-mail. Our user compounded a simple mistake by being rude. In spite of the much-touted multimedia aspects of the Internet, e-mail is still a text medium whose technical simplicity tends to make people more careless about word choice. Unlike the phone, there are no tone and inflection cues to help recipients understand whether you mean something as a joke or as an insult.

Regarding the specific complaint, it's considered "good netiquette" to post messages only to Usenet newsgroups on the same topic. In this case, rec.pets.cats is probably a group related to the care of house cats. Unless the message relates to that topic, posting there is considered inappropriate. An on-topic group would be something with a more open topic, such as nyu.general. If you are unsure, read the group and see the kind of postings that are there to see whether your posting fits. Users can also register with Web search engines, such as Yahoo or Infoseek, to let more people know about their page.

If you want to post the same message to several groups whose topics overlap, you can "cross-post" by putting the names of all the newsgroups (separated by commas) on the "newsgroups" line of the message header. This gives one message ID to all of the postings, so that once someone reads the message, it is marked as read in all other groups where it is posted and they do not have to see it again. If the message is posted to each group separately, it would have to be viewed multiple times. This tends to annoy people and provoke heated responses from seasoned newreaders.

Hacking by Permission

To: xyz200@nyu.edu (Hot Babe)
From: concerned guy (smithb@podunk.edu)
Cc: postmaster@is.nyu.edu
Subject: NYU student

I attach a message that you posted to alt.binaries.dogsncats. This newsgroup is for pictures of normal people with their pets, not sickos like you. This message is beyond off-topic, so I am cc'ing a copy of this vile posting to your postmaster so that the administrators of NYU will know how you students are using their accounts.

Bob Smith
Concerned Citizens for Proper Internet Behavior

To: postmaster@nyu.edu
From: xyz200@nyu.edu (Hot Babe)
Subject: Re: NYU Student

Dear Postal Person:
I understand from your last letter about off-topic posting, but this time I don't know WHERE the message came from. I certainly didn't post it. Please tell me if someone broke into my account, because all my saved messages are missing and my friends say I sent them weird mail. Also, my name has been changed! Help! Xan

Unfortunately, this is an all too typical occurrence. No one "hacked into" this account — they were let in. Users at the public terminals (such as those in Loeb) often minimize the session window without logging out. This leaves the account open so that the next person who walks up to that terminal can open the window, going directly into the account without having to know the username or password. Malicious users can then make changes to the account, deleting or altering files, sending mail, or posting to sexually oriented newsgroups, just to "teach the account owner a lesson." There have even been death threats to the President, which brings a visit from the Secret Service — not fun. This is why you should let us know when your account has been compromised, so that records of follow-up can be kept to protect you. Report security problems to postmaster@nyu.edu or to security@nyu.edu.

Tips for Smoothing Your Way onto the Infobahn:

- Re-read your e-mail before you send it. Would you say the same thing in a face-to-face conversation?
- Make sure to log out from public terminal sessions.
- Know when to give up an argument. There is no shame in letting the other person have the last word.
- Do not give your e-mail address to anyone you would not give your phone number to.
- If you are having problems with a user at another site, write to their postmaster. Try both postmaster@host.name and abuse@host.name, replacing host.name with whatever follows the @ symbol in the problematic user's address.
The other type of hacking by permission is when users give their passwords to their friends or significant others, who then do something wrong. Remember that your account is for your individual use only and you are responsible for everything that happens through it. Sharing your password is a violation of the Rights and Responsibilities agreement that you sign when you get an NYU account. By giving your password to someone else, you are saying that you are willing to take responsibility for anything that they do as if you had done it yourself. Many users have gotten burned by trusting someone they should not have.

There are several steps to bringing your account back to full working order once a problem has happened: For file recovery, you can write to restores@nyu.edu, giving the names of the files to be restored. The name that appears on the From line when you send e-mail can be changed back by going into Pine and choosing Setup, then Config, and entering your name on the “personal-name” line. If you get harassing mail as a result of the unauthorized use, contact us and we can help you deal with the senders.

Personal Debates via E-mail and News

To: postmaster@is.nyu.edu
From: mars1uvr@awl.com
Subject: evil NYU student

As an avid reader of alt.culture.martian, I wish to protest the malicious venusian-loving comments by a user of yours. xyz200@nyu.edu (venusgal) has been extremely disruptive to the loving (if thin) atmosphere of a.c.m. I attach a copy of her latest posting “Better dead than red (was: Green is keen)” I demand that you close her account at once and ensure that she never posts to a Usenet newsgroup again.

Bob Jones
Mars Alliance

To: postmaster@nyu.edu
From: xyz200@nyu.edu (venusgal)
Subject: Re: evil NYU student
Cc: mars1uvr@awl.com

I would like to complain about the following user from awl.com. He is constantly sending me e-mail about my postings to alt.culture.martian, trying to stop me from pointing out the inaccuracies of his beliefs of life on Mars. Has Pathfinder seen anything? No!

Xan

We do not get involved in personal discussions such as this one. Users are free to engage in public (or private) debate on issues that concern them. Before you wade into such a debate, however, be aware that others may not agree. The Internet can be a contentious place, and this is nowhere more true than in Usenet newsgroups, especially those which include discussion of political and sporting issues. Just as you have free speech rights to express your opinion, so do others who may be reading your comments. One of the strengths of the Internet is the ability of strangers to communicate on topics of interest to them, but the flip side of that is the ability of those same strangers to take you to task for your opinions.

It is generally in your best interest to know when to let an argument go. As I pointed out above, it is very easy to shoot off an e-mail without considering the impact it will have. Insisting on having the last word will often prolong an argument past its natural death, causing annoyance not only to you, but all the other readers of the newsgroup.

Commercial Use of Account

To: postmaster@nyu.edu
From: KrisKringle (santa@northpole.com)
Subject: Re: Pictures of Venus--cheap!

I didn’t know that universities allowed their students to use their accounts to spam unsuspecting e-mail users. Do something about this moron!

> To: outer space list
> From: xyz200@nyu.edu (venusgal)
> Subject: Re: Pictures of Venus--cheap!
> If you visit my web site, you can see digital versions of the photos I’ve taken. The print versions are cheap, cheap--be sure to check the price list!
> http://pages.nyu.edu/~xyz200

Your NYU-Internet account is provided as an academic service, and as such, it cannot be used for commercial purposes. This means that you cannot advertise your own or others’ services either on your web page or through e-mail. Also, it is consid-
ered “bad netiquette” to send mail (especially commercial mail) to people you do not know, and it may provoke a very negative response from the people who receive it.

Physical Security
To: postmaster@nyu.edu
From: xyz200@nyu.edu (venusgal)
Subject: Re: I’d love to explore your surface

Dear Jane:
I have been getting the creepiest letters like this one from a guy I met on the #venusmars chat channel. I get several like this every day. I’ve told him to stop, but they just keep coming. Can I change my e-mail address or can you stop these? I’m starting to get really freaked out!
Xan

> To: xyz200@nyu.edu (venusgal)
> From: 102934.3485769@compuserve.com (marsman)
> Subject: Re: I’d love to explore your surface

> Xan baby,
> I know you love my letters. Why don’t you want to meet me? I know we’d have a lot in common.
> just set a time. I saw you go to your Physics class at 10 am yesterday. I know where your classes are. I can just find you and make sure you know who I am.
> marsman

There are several types of harassing e-mail; this one is of the most extreme variety. If you ever feel that you are in physical danger, contact the police or campus security. ACF is happy to help out with investigations, providing records of mail received and other technical assistance to law enforcement agencies; however, we cannot be responsible for your protection.

If you contact us before things reach this stage, there are some ways in which we can be of assistance. The first thing to do is to ask the sender to stop in plain, neutral language and cc that letter to postmaster@nyu.edu and to the sender’s postmaster. Try both postmaster@host.name and abuse@host.name, replacing host.name with whatever follows the @ symbol in the sender’s e-mail address. If the letters continue, ask the sender’s postmaster directly for assistance. They may choose to suspend the account or may otherwise use their influence to encourage the sender to stop. Make sure to send copies of the offending letters with the headers intact (see the Q&A on this page), so the postmaster can confirm that the e-mails came from that person’s account. If you feel that it would be helpful, we can also write to the sender and the sender’s postmaster.

The role of postmaster was designed to be flexible: incorporating security, etiquette and plain old common sense to help resolve the day-to-day problems of users. At the ACF we accomplish this by constant communication between postmaster and the representatives of the other areas.

Q: The postmaster has asked me to forward the problem e-mail, complete with the full headers. When would I ever see the “full headers” and why pass it on?

A: If you have tried to send e-mail and it has been sent back to you undelivered, or if you have received a piece of somewhat mysterious e-mail, you might need to forward that e-mail to the postmaster address for help and advice. In this context, please remember to include any error messages you have received when trying to send mail in addition to the full set of headers. Headers outline what happened to the e-mail from the time it was sent to the time it was received. This process will add lots of funny text, but don’t be concerned, it makes sense to us and is vital for deciphering what may have happened.

If you are sending e-mail from pine, open the message in question. Press Control-h to bring up the full headers (the combination Control-h means you should press and hold the control key, then press the h key). Press f to forward the e-mail and enter postmaster@nyu.edu in the “To:” field.

If you use Eudora, go to the text of the message in question and click on the blah, blah, blah icon to bring up the full headers. Then go to the Menu menu, choose Forward, and enter postmaster@nyu.edu as the “To:” address.

Lisa Barnett
Digital Video Boom at the National Association of Broadcasters

Bill Horn
william.horn@nyu.edu

Any convention held in Las Vegas has to work hard for the attention of its attendees. It is no surprise then that the National Association of Broadcasters (NAB) annual convention is as much spectacle as substance. Filling both of Vegas’s major convention centers and drawing over 100,000 attendees, NAB dazzles the visitor with booming multimedia presentations, trade show “booths” as big as small city blocks, and all the “must have” video and television technologies for the coming year.

Despite its glitzy facade there are serious issues dealt with at NAB. Witness the quiet parade of industry executives making their way past the trade show floor to the concurrent policy meetings. This year almost all the news was digital. The biggest buzz was around high definition television (HDTV), the new digital standard for television broadcast in the United States.

New frequencies have been allocated to stations around the country to begin broadcasting HDTV signals. Ten years from now all the old television frequencies will be taken back, leaving only the HDTV stations on the air. (There is legislation pending that would change this, however. The final disposition of the old channels remains in question.) Industry and consumers have only a decade to make the switch. This involves replacing everyone’s cameras, decks, and monitors, including the ones in your living room. Sales divisions are understandably excited about this.

HDTV was not, however, the end of the digital news. For several years much of video and film post-production has been dominated by digital tools. With the addition of HDTV, Digital Video Disks (DVD), and digital tape for field production, digital technologies are poised to dominate the entire video making process, from production all the way through distribution.

The importance of digital technology and the computer industry was underscored by the size of the NAB Multimedia World Expo, filling the entire Sands convention center. Computer hardware and software companies are vying for traditional broadcast markets, primarily in the post-production arena.

Ten years ago, a small-time producer needing editing equipment would have headed straight to Sony, Panasonic or JVC for editing decks and a controller. Now the same producer can get infinitely more powerful digital editing tools from companies like Miro, Media 100, Truevision, Radius, DPS, Adobe, Macromedia, Avid or D-Vision (to name a few). Some of these are still considered lower-end products, but the distinctions between products are increasingly dominated by issues of speed and interface design rather than sound and image quality. What follows are a collection of notes from items seen and heard at NAB. Be sure to check out the online version of this article for links to other resources (http://www.nyu.edu/acf/pubs/connect/fall97).

HDTV

The HDTV images on display were startlingly crisp. The 16:9 aspect ratio of HDTV (compared with 4:3 for the current NTSC standard) will also bring it into line with the standard for 35mm film production. One of the persistent stories about the impact of the HDTV changeover involves the need to buy com-
pletely new desks and backdrops for news broadcasts. It seems that under the more exacting eye of HDTV the inexpensive veneer and faux-wood grain of existing sets will look as cheap as it really is. These costs may rival those of installing new cameras. One wonders whether similar investments will be made in the appearance of on-air personalities.

HDTV gear is now available from the big video equipment companies, but is still very expensive. It will be three to five years before the prices come down out of the stratosphere, longer still for them to reach those of us firmly rooted on the ground. HDTV should, however, be folded into 5+ year planning at the university. Moving into digital tape formats seems prudent in the shorter term. Compatibility with HDTV will be more likely in the digital realm. Sony has a version of its Digital Betacam format that handles a compressed HDTV signal, but there is a lot of development yet to be done in this area. Look for more news at next year’s NAB.

**DV Format**
The Digital Video format is here in force and here to stay. Many cameras are now available in the $1.5k-$4k range. Professional DV Electronic News Gathering (ENG) cameras, including dockable units, are now available from Sony and Panasonic for $7k and up.

Inexpensive DV/Firewire cards were on display and are now shipping for both Mac and PC. There are two basic type of DV “capture” cards. The inexpensive option is a card that allows you to connect your DV camcorder to your computer via a Firewire connector. The card and attendant software reads the DV information coming from the camera and repackages it into a Quicktime file format and writes it onto a hard drive. Once there it can be edited with a Quicktime editor such as Premiere. When it is time to output your project the card sends a DV stream back to the camcorder which either records it or translates it into a standard NTSC signal you can see on a TV. Radius and DPS are now selling these cards in the $600-$1,000 range.

The more expensive DV cards include all the chips to do DV compression and decompression. These cards allow you to get smooth playback of your DV files on the computer screen and to make (digitize) DV files in real-time from analog sources like VHS or Betacam tape. They also allow you to output your DV files directly from the computer as NTSC video. FAST corporation is the first to market in this category with its DV Master product. The DV Master uses Sony’s DV chipset (basically the guts of one of its DV camcorders) and sells for about $4k. It was still fairly buggy at NAB, but will likely improve over time. Most of its competition comes from turnkey DV editing systems by the likes of Sony and Panasonic, but more products along these lines can be expected in the coming year.

Panasonic and Sony continue to squabble over their respective DV formats. The short story is that both make “consumer” level products that use the same tapes (the small ones) and which are interchangeables. Both also make “pro” versions of the DV technology which use larger, editable tapes. Panasonic’s professional format is called DVCPRO and Sony’s is DVCAM. All the decks in the pro category will play the consumer tapes. Panasonic’s DVCPRO decks will play both DVCPRO and DVCAM tapes, but Sony’s professional decks will not play DVCPRO tapes. There are some minor feature differences between DVCPRO and DVCAM formats, but they do not involve picture quality. Even the consumer tapes should provide the same image quality (depending of course on the quality of the CCDs and lenses in the camera).

DV decks are just coming on the market. These start at around $3.5k but you will have to pay at least twice as much for a deck with RS-422 control (the professional standard for device control). To get the promised 4x transfer speeds you will be paying more than $15k for the deck alone and will be tied to a proprietary Sony non-linear editing (NLE) system.

**Other Digital Tape Formats**
The next format war is already brewing just up-market from the DV format. Sony is pushing their BetacamSX as the new professional ENG format, Panasonic will be releasing its DVCPRO 50 with twice the data of its standard DVCPRO and JVC has their Digital-S format already on the market. All three use 4:2:2 sampling as opposed to 4:1:1 for the less expensive DV format. Sony is hoping that the BetacamSX deck’s ability to play back analog Betacam tapes will ease its transition into the market. All three will be on the market this year, looking to take over the higher end of the existing BetacamSP market.

**SGI**
Silicon Graphics (SGI) had a significant presence at the Multimedia World Expo along with Mac and PC workstations. SGI has long been in evidence in high-end effects and animation stations such as Flint and
Flame, Alias/Wavefront, Elastic Reality and Softimage. With the release of the inexpensive ($5-$12k) O2 line of workstations, SGI has entered the multimedia production arena. Relatively few video applications are available for the O2 at this time, but Adobe has ported Photoshop and will soon add Premiere (summer '97) to its O2 line. The O2 comes with respectable video hardware, making the O2/Premiere combination one to watch.

A Spanish company named Jaleo has released innovative software for editing uncompressed video on SGI’s O2 and Octane lines of workstations. The Octane version ($20k-$40k for the Octane alone) offers real-time effects with uncompressed video. These features have been available for a few years but not at these price points. The spending is not over with the purchase of the SGI, though. Storage for uncompressed video is expensive, as is the software. Still, it is significantly less expensive than the Onyx-based Avid suites, with which they will compete.

**Media 100**

Media 100, makers of non-linear editing (NLE) systems, was showing its high-end real-time effects systems (Media 100sx) and digital video effects (DVE) systems (Gaudi). These systems come in at roughly the same price points as low-end Avids ($30k-$45k), making them attractive competitors if you like the Media 100 editing interface. More interesting, however, was a significant price reduction in its entry level product, the Media 100qx. The qx system offers excellent image quality, and accelerated effects using Premiere as the editing interface. The qx board now sells for around $2k; a version allowing component video input runs about $3.5k. Entry level systems using Media 100’s proprietary software start at around $10k.

**Truevision**

Truevision, makers of video capture hardware for both Mac and PC workstations, seems to be de-emphasizing the lower end of their product line. Truevision makes boards that drive the video systems of a number of big players in the NLE market, including Avid and D-Vision. Products like Truevision’s inexpensive (less than $1000) Bravado were scarce. Look for manufacturers to largely abandon the inexpensive capture card market as DV cameras and firewire cards gain market share. The DV solutions offer significantly higher quality at lower prices.

Truevision also announced its new Madras transcoding unit. The Madras is a rack-mount box which inputs and outputs all major digital and analog video and audio formats in real-time. At around $6k, the Madras may be a little pricey to transcode a single source, but if you work in an environment with multiple formats that need to be fed into an NLE system that only accepts one or two types of signal then something like the Madras may prove worthwhile.

**D-Vision**

D-Vision gained a lot of attention at NAB with a completely revamped line of NLE products. D-Vision On-Line 3.0, running on Windows NT, received positive reviews both during and after NAB and seems to have shaken-off the stigma D-Vision’s former products had acquired. At the high-end, the new systems offer real-time effects, excellent video quality, 8 to 16 playable audio tracks, and CCIR-601 input and output. With its prices ranging from under $20k to more than $50k, D-Vision is competing directly with Media 100 and entry-level Avid systems. D-Vision was recently acquired by Discreet Logic, the maker of the high-end special effects systems Flint and Flame. The addition of D-Vision’s NLE system positions Discreet Logic to provide the kind of editing and effects integration that Avid offers.

**Hard Drives**

The news always seems to be rosy for hard drive users. Price per megabyte of storage continues to fall, and new drives regularly break performance barriers. This is particularly good for those working on long format NLE projects at off-line video resolutions. Here the need is for large amounts of relatively low performance disk space — which the new drives deliver with ease. The news for those working on high performance NLE systems is more ambiguous.

The demands of high-end NLE systems are increasing just as quickly as drive performance. It is not uncommon for a high-end system to require upwards of 12MB/sec throughput to achieve its best video quality, twice as much for real-time effects. Some systems even work with uncompressed video (more than 25MB/sec/stream). So, though drive space is cheaper, a system that required about only 9GB for 30 minutes of best quality video a couple years ago may now require 24GB or more for the same 30 minutes. This demand for ever more gigabytes may wipe out many, if not all, of the gains from lower prices and improved performance.
Nahum Zenil Witness to the Self
Opens at Grey Art Gallery and on the Web

Frank Poueymirou
poueymir@acf2.nyu.edu

"Unless you've got an ISDN hookup, or even a T3, looking at art on the Web is still a bandwidth hogging, patience-testing, time-eating affair — like leafing through an art book after a three-year-old with a mouthful of gum and a lollipop in both hands has just read it. You know there's amazing stuff waiting there, its just so... difficult... to get the pages unglued."

Mark Van De Wall's comment in a recent issue of Artforum is right on target. A web site focused on visual art is demanding by its very nature. Images have to look good — "gifs" don't work and "jpgs" create, in many cases, files larger than preferred. These issues put a damper on any web designer's efforts and the situation is no different when it comes to the Grey Art Gallery's web site component for the upcoming exhibition, "Nahum Zenil: Witness to the Self." The site cannot capture the full depth of Zenil's art work. However, it can supply a thorough context within which to consider his work, as well as offering a glimpse at the artwork itself.

For those of you unfamiliar with Nahum Zenil, he is one of the most well-known and significant contemporary artists in Mexico. A painter, he re-interprets and re-invigorates the folk ex-voto tradition which became popular in nineteenth century Mexico. He is also inspired by the prints of graphic masters such as Jose Guadalupe Posada and others who depicted the realities of turn-of-the-century Mexico. Frida Kahlo is also an important source for much of Zenil's imagery.

The exhibition, "Nahum Zenil: Witness to the Self," opens at the Grey Art Gallery on September 2 and consists of approximately 70 pieces which span the artist's career. The works in question explore Zenil's use of the body as a means to analyze society with powerful, accessible, and intimate results. His highly original style, his creative approaches to traditional art forms of Mexico, and his intrepid confrontation of social issues make his art both compelling and very relevant to contemporary life.

Like the exhibition, the web site for "Witness to the Self" will undoubtedly be a revelation to wide sectors of the art web site-going public and will serve to promote a greater understanding not only of the artist's work but of the social, political, and psychological circumstances of life in Mexico in the twentieth century. In addition to selected images, the site includes a narrative written by co-curator Edward Sullivan of NYU's Fine Arts Department, a checklist of objects in the show, and biographical information on the artist. The web site also includes the schedule for lectures, gallery talks, and a film series, all co-sponsored with the recently opened King Juan Carlos I of Spain Center.

Placing Zenil within an art historical and sociological context, the site also offers a relevant links section, directing the viewer to sites about both modern and contemporary art in Mexico, as well as to sites devoted to contemporary Mexican society. Currently under construction, "Witness to the Self" will debut this September at http://www.nyu.edu/greyart/exhibits/zenil/nzpage1.htm.

Frank Poueymirou is Deputy Director/Director for Publications & New Media at Grey Art Gallery.
New ACF Resources for Artists

Over the summer the ACF Arts Technology Group installed new hardware and software to improve its targeted support for arts programs at the university. Here is a summary of some of the new offerings.

New and Improved Web Site

If you use the ACF Arts Technology facilities, or are just interested in the Arts at NYU, you may want to surf over to our new and improved web site. With a new interface design and dedicated server hardware, the site is the primary source of up-to-date information about ACF/ATG resources, including a complete list of hardware and software offerings, and a staff directory.

Of more general interest are several particular areas. The Arts Technology Gallery includes exhibits of sound, video, multimedia, and digital fine art from the students and faculty of various NYU arts programs. The Library includes a selection of arts related Connect articles, online access to all ATG documentation, and a section for multimedia papers of general artistic interest. The Web Links section offers a large classified point-and-click directory of arts related web sites. Finally, the Shareware section makes it easy for you to download free or inexpensive software we've found to be useful to artists.

New Video Systems

Over the summer we have significantly upgraded our Macintosh based video production systems. There are now six video systems in the Arts Technology Studio at the Education Building Lab, each using Media 100 video hardware to support professional quality video production. Two of these systems support component video via an attached Sony Betacam deck, and four have S-VHS decks. Note, however, that digitized video from Betacam sources can be used on any of the six systems without any loss in quality.

Students have the choice of working at full resolution, or with larger amounts of footage at draft quality. Those with longer projects can do the bulk of their editing at the Arts Technology Studio in draft mode, and then can “finish” their final cut at full resolution at the Innovation Center in Warren Weaver Hall. In the Arts Technology area is another Media 100 based system with much larger disk arrays and component Betacam video for more advanced projects.

New Audio Systems

We have also upgraded the four Arts Technology Studio audio systems to PowerPC Macintosh computers running Digidesign ProTools software for multi-track mixing and production. Digital audio can be loaded in and out of these systems via audio DAT tapes or Jaz and Zip removable storage. In addition, MIDI users have a choice of sequencers with both Digital Performer and Studio Vision Pro now available.

New and Improved Digital Media Server

For NYU faculty interested in experimenting with the World Wide Web as a medium supporting video and audio, we've installed a new Silicon Graphics Origin 200 digital media server running the WebFORCE MediaBase 2.0 suite of software. This is one of a new class of intelligent, integrated web media servers that deliver interactive, real-time, high quality MPEG-1, MPEG-2, and H.263/G.723 video and audio streams to web clients via IP and ATM networks.

What this means for artists is that they can create web pages that include video which does not have to be fully downloaded before it can be viewed. The video is displayed immediately as it is “streamed” to the viewer’s computer from the server. In addition, video can be sent via Webcasting (also called Multicasting) so that hundreds or thousands of people can view a scheduled program, akin to many television sets being tuned in the same video broadcast.

SGI Workstation Classroom Improvements

There are now six SGI Workstations in the ATG classroom at Warren Weaver Hall to support classes in creative 3D animation. Networking within the classroom has been upgraded from 10Mb/sec to 100 Mb/sec to speed the process of moving rendered frames to the Aecom disk recorder and then out to Betacam tape. The older workstations have improved performance thanks to additional memory installed this summer, and the suite of Alias/Wavefront software has been upgraded, including the installation of Power-Animator 8.1.

— Philip Galanter
Associate Director for Arts Technology, ACF
The entertainment industry is now the largest and fastest growing employer in the state of California. The most explosive component of this revolution is digital effects and computer animation. Digital special effects and images are appearing at an astounding rate in film and television. The top seven special effects films of the past year have already generated over 2 billion dollars. The world of digital production is growing. It is no longer limited to big budget movies — the technology has crossed all platforms transforming the Internet, education, politics — basically revolutionizing the way we process information and create art.

In August of 1996, New York University became a part of the digital future when it unveiled the Center for Advanced Digital Applications. CADA is a new phenomena in the area of art and technology. Its philosophical mission is to train artists to use the latest and most advanced digital tools. Theoretical and aesthetic issues are taught simultaneously with the practical problems of self expression with modern tools. The center is a collaborative project with NYU and Silicon Graphics, Inc.

History
Originally the formation of CADA was the idea of Dean Gerald Heeger and Silicon Graphics Inc. Hardware and facility creation was supervised by Vice Dean Fran Gottfried and academic and administrative guidance was provided by Dean William Cipolla. The philosophy of the curriculum and courses were designed by CADA’s current Coordinator and Master Teacher of Digital Production, Peter Bardazzi. One of the most important decisions that set the fundamental tone at CADA was that the Center would be guided by artists.

Facilities
Located in SCE’s Midtown Facility at 11 West 42nd Street, CADA consists of four networked studio labs and several classrooms used for lectures. Currently CADA has 25 SGI Indy workstations and 11 Indigo2 SGI workstations with an additional 15 high-powered O2 SGI machines arriving for the Fall 1997 term. Each machine has loaded and available to the student a wide selection of cutting-edge software used by post-production houses across the country.

Course sizes are kept small to guarantee a quality education and to provide each student with their own machine. In addition to workstations, studio labs are equipped with state-of-the-art audio and video capabilities representative of what students will find in the post-production industry. This video technology allows every student the opportunity to leave class with work on a viewable VHS or BetaSP tape in addition to the standard DAT digital format.

The design of the studios themselves lend to the creative process with emphasis placed on a sensible function and visual aesthetic. CADA class curriculum is designed with focus on art and design, aspects sometimes forgotten when working with the kinds of complex tools used by the students.
Advisory Board
Important to current and continued success of CADA is the relation it has with the digital post production industry. CADA is a joint venture between NYU’s School of Continuing Education, the hardware and software makers, and the digital post production industry. CADA’s Advisory Board regularly meets to discuss how CADA can compliment the rapidly expanding digital post-production industry. Currently the board consists of: Bob Greenberg, President of R. Greenberg Associates, Ed McCracken, CEO of Silicon Graphics, Dean Winkler, President of Post-Perfect and Martin Nisenholtz, President of New York Times Electronic Publishing.

Courses
Currently, CADA offers courses in 3D and 2D computer animation, compositing and digital post production. Classes are offered as non-degree, non-credit courses and open to all interested students. A working knowledge of the hardware and operating system, IRIX, is a strong recommendation for all levels of studio classes. Certificate programs are available for each of the two major 3D software packages; an Intensive Digital Post Production certificate program is also offered.

CADA’s 3D computer animation courses include the industry-standard Alias I Wavefront’s Power- Animator which was used to model the lead “actors” in Toy Story as well as for scenes in Mission Impossible. CADA also offers a course in Microsoft’s Softimage which is used in feature films like Casper and The Mask and heavily relied upon by the video games industry for animation and game effects. To teach compositing (the combination of computer effects and film footage) and 2D image manipulation CADA teaches Discreet Logic’s Flint. Flint is an industry standard compositing and special effects tool used in such films as Twister, Judge Dredd and countless commercials and music videos. CADA also offers a certificate course in Intensive Digital Production which includes six widely used digital post production tools including: Adobe’s Photoshop for SGI, Xaos’ nTitle and Pandemonium, Avid’s Matador, and introductions to 3D and compositing theory using Alias PowerAnimator and Flint.

Featuring only the latest versions of the software, students get hands-on experience using what is current in the very version-savvy digital post-production industry. Students are given exposure to a facility unlike any of its kind, technically on par with the digital post-production houses all over New York city eager to find people trained in this kind of technology.

Instructors
CADA instructors are working industry professionals who bring a professional and practical perspective to the classroom. CADA’s Softimage instructors include Paul Lipsky, a senior animator at Manhattan Transfer and Edit, and Steve Talkowski, senior character animator at Blue Sky Studios. Mr. Talkowski is currently sharing his teaching time with working on Aliens 4: The Resurrection. Other industry professors include Tree O’Donnell, Michael McMahon, and Brad Fox.

The Future
While CADA’s current curriculum centers around computer animation and digital post production with an emphasis on film and video, the program is set to expand upon that area and into others.

Adding to the computer animation program, CADA will add the hot animation package Houdini to its list of courses taught in Fall 1997. In the compositing and digital image manipulation area Avid’s Media Illusion will add to the selection of tools available for the digital artist to learn. Entirely new types of software will also be taught, such as Interactive Effects’ Amazon 3D Paint, which actually allows the digital artist to use 3D models as his canvas, making changes and viewing the results in real time.

In addition to expansion within the animation and digital post-production areas, CADA will also be offering a certificate in Video Games Development which covers all aspects of the design and production of video games. There will also be a new certificate in Special Effects available in the Fall. The Special Effects Certificate will be a combination of lecture and software classes that gives the student history, theory, and knowledge of premiere digital special effects software tools. This is the first certificate of its kind offered at any college.

Software Used in Current CADA Courses
Alias | Wavefront PowerAnimator
Microsoft Softimage
Discreet Logic Flint/Flame
Amazon 3D Paint
Pixar Renderman
Avid Media Illusion & Avid Matador
Side Effects Houdini
Xaos Pandemonium & Xaos nTitle
# Classes and Talks

## Fall '97 Schedule

### Alphabetical Listing

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## About ACF's Fall '97 Classes and Talks

This fall we have added new and exciting talks on the use of digital technology in the arts, humanities, and sciences, as well as new topics in digital multimedia.

All members of the NYU community are welcome at ACF's classes, workshops, and talks. There is no charge for any of the ACF classes, but participants should have a valid NYU Card.

### Seating Capacity

To avoid overcrowding, we have listed maximum seating capacities for each class. We recommend that you arrive a few minutes early in order to secure a spot.

### Classes by Arrangement

Faculty members may arrange special classes for a specific course or research group. These do not necessarily have to be given at an ACF site. For classes in statistics, call Frank LoPresti (998-3398); for other applications, call the ACF Innovation Center (998-3044).

### Additional Information

A list of ACF locations and phone numbers, and pointers to further information about ACF resources, can be found on page C-8.

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Vincent Doogan
Associate Director, ACF
vincent.doogan@nyu.edu
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**Choosing Your Computer (Mac and PC)**

This talk is intended to help you select the best personal computer for your needs. It will cover the basic components of a computer, as well as the other hardware required for various tasks. We will also discuss how you can assess your particular needs to establish your criteria for selecting computer tools. NYU Computer Store staff.

Warren Weaver Hall, room 313
Seating capacity: 30; first come, first served; talk.

Fridays 12:00-1:30
September 12
October 3
Understanding Your Computer
(Mac and PC)
This introductory talk will help you learn about your computing equipment. It will focus on such basic operations as setting up your computer, setting up a printer, and configuring your operating system with the fonts and tools you need. Discussion will include troubleshooting techniques and other strategies for dealing with problems you might encounter while using your PC.
NYU Computer Store staff.
Warren Weaver Hall, room 313
Seating capacity: 30; first come, first served; talk.

1. For Mac Owners
Fridays 12:00–1:30
September 19
October 10

2. For PC Owners
Fridays 12:00–1:30
September 26
October 17

Using a Mac at an ACF Lab
A hands-on introduction to the Macintosh computer. Topics include the ergonomics of proper computer use, working with the graphical user interface, understanding the file system, choosing printers and file servers, and launching software applications. ACF staff.
Education Building, 2nd floor
Seating capacity: 15; first come, first served; hands-on class.
Tuesdays 11:00–12:00
September 9, 16
Saturdays 11:00–12:00
September 13, 20

Using a PC at an ACF Lab
A hands-on introduction to the PC — running Microsoft Windows. Topics include the ergonomics of proper computer use, working with MS- Windows in the labs, understanding the file system, choosing printers and file servers, and launching software applications. ACF staff.

Using Unix at ACF
An introductory class on using the Unix operating system, variants of which run on several different types of computers at ACF. Most are accessed at ACF labs through PCs, Macs, and terminals, but the SGI workstations also use Unix. The basics will be covered: logging onto the host machines, organizing files, editing text, printing files, and using applications. ACF staff.

ACF Unix account required.

ACF Classes and Talks  Fall 1997  C-3
Geographic Information Systems

www.nyu.edu/acf/socscl/  

Introduction to GIS Packages at ACF (Unix, Windows)  
A discussion describing and comparing the four GIS (geographic information systems) packages available at ACF. These are ArcInfo, MapInfo, Atlas GIS, and GRASS. Frank LoPresti.

Warren Weaver Hall, room 313  
Seating capacity: 30; first come, first served; talk.

Tuesday  
2:00-3:30  
October 28

Humanities Computing

www.nyu.edu/acf/humanities

Humanities Computing Series  
An introductory overview of computing applications in the humanities, with demonstrations of software and projects. No computer experience is necessary, and after each presentation there will be time for discussion about how the techniques presented could be applied to personal research and teaching. Talks may be attended individually or as a series. Lorna Hughes.

1. Online Resources for Humanities Research  
An introduction to the range of online information and services of potential interest for humanities research and teaching. This will include a short review of browsing and search tools, a tour of online sites, locating and using libraries and datasets, and looking at electronic text archives.

Warren Weaver Hall, room 313  
Seating capacity: 30; first come, first served; talk/demonstration.

Wednesday  
2:00-3:30  
September 24

2. Electronic Texts & Text Analysis  
An introduction to research with electronic text analysis, such as authorship and stylistic analysis using text indexing, concordancing and collocation. After reviewing the basics of preparing an electronic text and discussing important decisions made when a text is created, this session will demonstrate some of the available tools — such as text analysis software and the browsing/search tools of CD-ROMs.

Warren Weaver Hall, room 313  
Seating capacity: 30; first come, first served; talk/demonstration.

Wednesday  
2:00-3:30  
October 8

3. Multimedia and the Humanities  
A demonstration of multimedia applications developed for the humanities, and a discussion of the pros and cons of using hypertext and multimedia in traditionally text- and book-based humanities subjects. The session will include an overview of the process of digitization and discuss the process of capturing graphics, sound and video.

Warren Weaver Hall, room 313  
Seating capacity: 30; first come, first served; talk/demonstration.

Wednesday  
2:00-3:30  
October 29

4. Introduction to Electronic Editions  
A presentation of electronic journals, CD-ROMs and on-line editions of primary sources. This session will also include a demonstration of tools which can facilitate the creation of basic electronic editions for teaching and researching.

Warren Weaver Hall, room 313  
Seating capacity: 30; first come, first served; talk/demonstration.

Wednesday  
2:00-3:30  
November 26

Internet & NYU-NET Services

www.nyu.edu/acf/accounts.office.html  
www.nyu.edu/acf/help/

Introduction to the Internet and Your ACF E-Mail Account (NYU-Internet Account, Unix)  
This talk-demo introduces new holders of the NYU-Internet Account to its menu interface and components. E-mail concepts and commands will be explained and demonstrated. The account runs on ACF's DEC minicomputers and is connected to NYU-NET and the Internet. Lisa Barnett and Vincent Doogan.

Warren Weaver Hall, room 101  
Seating capacity: 50; first come, first served; talk-demonstration.

Fridays  
12:00-1:30  
September 5, 12, 19  
October 3, 17  
November 7

NYU-NET Software  
This talk is intended for those who have TCP/IP connections to NYU-NET from their office or home. The TCP/IP and PPP protocols will be
discussed, and software based on these protocols will be demonstrated. The software to be discussed includes Netscape, Eudora, and Fetch/WS-FTP. Lisa Barnett, Jane Dellavero.

Warren Weaver Hall, room 313
Seating capacity: 30; first come, first served; talk.

1. For PC Users
   Wednesdays 12:00-1:30
   September 3
   October 1
   November 5
   December 3

2. For Mac Users
   Wednesdays 12:00-1:30
   September 17
   October 29
   November 19

News Groups
News groups are discussion forums on the Internet. The speaker will introduce basic concepts and demonstrate Tin, the software used in NYU-Internet accounts. Strategies for accessing news groups from WWW browsers will also be discussed. William Spears.

Warren Weaver Hall, room 313
Seating capacity: 30; first come, first served; talk.
   Wednesday 12:00-1:30
   November 12

Uploading & Downloading
This talk will introduce the concepts of moving files between computers. The file transfer protocol and the Kermit protocol will be discussed. Specifically, tools for uploading and downloading files from a desktop computer to the NYU-Internet accounts will be demonstrated, including WS-FTP, Kermit, and Hyperterminal (for PCs) and Fetch and MacKermit (for Macs). William Spears and Michael Puskar.

Warren Weaver Hall, room 313
Seating capacity: 30; first come, first served; talk.

2. Introduction to HTML
   Beginning with the basics of what an HTML file looks like, the speaker will explain the structure of a document and its HTML elements. Sample pages will be analyzed and constructed. Topics will include tags, links, URLs, and embedded graphics.

Warren Weaver Hall, room 101
Seating capacity: 50; first come, first served; talk.
   Friday 2:00-3:30
   September 26
   November 7

3. Advanced HTML Topics
   This session focuses on including images on your Web pages; "image maps," frames, CGI, Java and plugins will be explained.

Warren Weaver Hall, room 101
Seating capacity: 50; first come, first served; talk.
   Friday 2:00-3:30
   October 3
   November 14

Multimedia

Introduction to Authoring Tools
A survey of four software applications for integrating multimedia in web-based and CD-ROM-based presentations. These will include: Powerpoint, Flash, Director, and Authorware. Vincent Doogan.

Warren Weaver Hall, room 101
Seating capacity: 30; first come, first served; talk.
   Tuesday 2:00-3:30
   September 30

ACF Classes and Talks  Fall 1997  C-5
Image Scanning
(Mac)
A focused class in the use of a flatbed scanner to digitize photographs and artwork. Basic knowledge of the Macintosh is required. ACF staff.

Education Building, 2nd floor
Seating capacity: 25; first come, first served; hands-on class.
Fridays 1:00-2:30
September 19
October 10

Graphics for the Web
This session focuses on methods for designing and preparing graphics for the World Wide Web. Topics include: creating small fast-loading graphics, cross platform compatibility, scanning tips, image maps, animated GIFs and more. Kristina Abeson.

Warren Weaver Hall, room 101
Seating capacity: 50; first come, first served; talk.
Friday 2:00-3:30
October 10

Practical Non-Linear Video Editing
This session will focus on specific name brand systems, as well as basic concepts, considerations, and technical and economic tradeoffs involved when considering the use or purchase of a non-linear video editing system. Jeffrey Lane, Bill Horn.

Warren Weaver Hall, room 313
Seating capacity: 30; first come, first served; talk.
Wednesday 12:00-1:30
October 8

Powerpoint
(Mac, Windows)
Powerpoint presentation software is platform-independent, part of the Microsoft Office suite. This demonstration and workshop will explain the main features of Powerpoint and how best to use it for lectures or other public-speaking activities. Discussions will include using text and graphics, slide transitions, and options for displaying or distributing a completed presentation. Jeffrey Lane.

Warren Weaver Hall, room 313
Seating capacity: 30; first come, first served; talk.
Tuesday 2:00-3:30
October 7

Scientific Computing and Visualization

www.nyu.edu/acf/science/

High Performance Computing Resources
(NYU multi-processors; NSF supercomputers)
An introduction to high-performance computers and visualization resources at NYU and elsewhere. The speaker will discuss the uni- and various multi-processor and graphic workstation systems at NYU and the various systems available at the NSF supercomputing centers. Edward Friedman.

Warren Weaver Hall, room 313
Seating capacity: 30; first come, first served; talk.
Tuesday 2:00-3:30
October 14

Scientific Visualization Special Topics
This talk will focus on the SGI Cosmo Suite and VRML. Adel Hanna.

Warren Weaver Hall, room 313
Seating capacity: 30; first come, first served; talk.
Wednesday 2:00-3:30
October 15

High Performance Parallel Computing Workshop
This two-day event will consist of lectures and direct experience with parallel programming techniques on distributed and shared memory multi-processor systems. Topics will include: a survey of hardware and software for parallel computing at NYU and Supercomputing Centers; a discussion of scientific applications suitable for parallelization; an introduction to parallel programming techniques and paradigms including MPI and HPF; a discussion of scheduling and job management policies and practices at NYU; and hands-on experience programming, debugging, and monitoring various multi-processor parallel systems using language processors and libraries such as Fortan, C, and MPI. Hua Chen.

Warren Weaver Hall, room 313
Seating capacity: 30; first come, first served; workshop.
Tuesday & Wednesday 2:00-3:30
October 21 & 22

Introduction to Scientific Computing
An overview of local and remote computing and visualization resources. Presentation will include available software, workstations, color printing, and videographics devices. Edward Friedman.

Warren Weaver Hall, room 313
Seating capacity: 30; first come, first served; talk.
Wednesday 2:00-3:30
October 1

C-6 Fall 1997 ACF Classes and Talks
Scientific Visualization Resources at the ACF (Silicon Graphics)
The need to understand large data sets generated from scientific studies makes scientific visualization ever more important. The lecturer will present an overview and hands-on multimedia demonstration of the resources — software and equipment — available to scientists on the Silicon Graphics computers at ACF.

Topics will include software for visualizing fluid dynamics, molecular models, volumes, and abstract mathematics; modular software packages; libraries for 2D and 3D graphics; image processing, movies, and audio; slide presentations; visual debugging and analysis of computer programs; online hypertext documentation; and conversion between image formats.

ACF's stereographics equipment will be demonstrated in relation to visualization packages and solutions for the programmer. ACF staff.

Warren Weaver Hall, room 313
Seating capacity: 30; first come, first served; talk.
Wednesday 2:00-3:30
November 5

Statistics, Databases, and Spreadsheets

Introduction to Excel (Mac)
Microsoft’s Excel is a major spreadsheet for the Mac. A start-up talk-demonstration on creating a basic spreadsheet. Howard Fink.

Warren Weaver Hall, room 313
Seating capacity: 30; first come, first served; talk.

1. Introduction to SPSS
Monday 6:00-7:30
September 22
Tuesday 6:00-7:30
October 7

1. Intermediate Topics
Wednesday 6:00-7:30
September 24
Thursday 6:00-7:30
September 18

2. Intermediate Topics
Wednesday 6:00-7:30
September 24
Thursday 6:00-7:30
October 1

SPSS for Windows (Windows, Unix)
SPSS (Statistical Package for the Social Sciences) is a comprehensive, integrated system for statistical data analysis. These presentations will use either the Windows or the newer Unix version, but the programming concepts are applicable to all versions of SPSS. Frank LoPresti.

Warren Weaver Hall, room 313
Seating capacity: 30; first come, first served; talk.

1. Introduction to SAS
Monday 6:00-7:30
September 22
Tuesday 6:00-7:30
October 7

2. Intermediate Topics
Wednesday 6:00-7:30
September 24
Thursday 6:00-7:30
September 18

Introduction to Microsoft Word (Mac)
Microsoft Word is a major word-processing program on Macintosh computers and is especially strong on typography and formatting. This is a getting-started talk/demonstration. The basics of creating a document will be covered. Howard Fink.

Warren Weaver Hall, room 313
Seating capacity: 30; first come, first served; talk.
Friday 2:00-3:30
September 19
Important Dates for Users of ACF Services
(For updates to this list, please check NYU Web at www.nyu.edu/acf/nyu-events/)

Current — Individual computer account renewal applications accepted.
Aug. 30-Aug. 31 — Labor Day weekend**
Sept. 1 — Labor Day*
Sept. 3 — Fall '97 semester begins; ACF labs' regular hours begin.*
Sept. 2-5 — 1997 class accounts distributed to instructors.
Oct. 1 — New individual accounts and renewals begin.
Nov. 27-28 — Thanksgiving holiday; labs closed.
Nov. 29-Nov. 30 — Thanksgiving weekend; regular hours.
Dec. 1-5 — Instructors apply for Spring '98 class accounts.
Dec. 1-19 — Students expecting incompletes in courses should apply for account extensions. Instructor's signature required.
Dec. 10 — Last day of classes.
Dec. 15 — Students with class accounts should store files they wish to keep after the completion of the course.
Dec. 15-22 — Fall '97 semester finals.
Dec. 23-Jan 17 — Winter recess; holiday hours.**
Dec. 24-Jan 5 — NYU holiday; all offices/labs closed.
Jan. 4 — Class accounts expire.

*NYU holiday: labs & offices closed.
**Please check at labs and at above Web address for updates on ACF hours.

Additional Information

Class Locations
http://www.nyu.edu/acf/classes/
The following are the street addresses of the locations referred to in the course descriptions.
Warren Weaver Hall, 251 Mercer Street
14 Washington Place, lower level
Education Building, 35 West 4th St., 2nd floor
Third Avenue North Residence Hall, 75 Third Ave., C-3
Tisch Hall, 40 W. 4th Street, lower concourse

HelpCenter
http://www.nyu.edu/acf/help/
251 Mercer St., 2nd floor 998-3333
Troubleshooting; software distribution; information about ACF services and academic support.

Accounts Office
http://www.nyu.edu/acf/accounts/
251 Mercer St., 3rd floor 998-3035
Faculty, administration, and staff account applications, activations, and information: individual, coursework (class), and NYU-Internet accounts.

Innovation Center
http://www.nyu.edu/acf/ic/
251 Mercer St., 2nd floor 998-3044
Discipline-oriented resources and services for faculty and advanced students; instructional computing support; new and emerging technologies.

Student Computer Labs
http://www.nyu.edu/acf/labs/
14 Washington Place 998-3457
Education Building 998-3421
3rd Ave. North Res. Hall 998-3500
Tisch Hall 998-3409
Student NYU-Internet Account applications, activations and information; computer and Internet access (see ACF flyers and above Web address for hours and rules of access).

Publications
http://www.nyu.edu/acf/pubs/
Pamphlets, flyers, brochures, and the magazine Connect for users of NYU computer and network services. Printed copies are available at the HelpCenter and labs; online editions are at the above Web address.

News and Announcements
http://www.nyu.edu/acf/nyu-events/
Updates on hours and services; special events and other notices of interest.
Computing Resources in Historical Inquiry

Lorna Hughes
lorna.hughes@nyu.edu

"The past is still there to be discovered ... What the computer gives us is new ways of gaining access to information, efficient ways of storing it, of searching and re-presenting it. It enables us to combine information from a variety of sources in ways so quantitatively different as to approximate a qualitative change. And it enables us to add interpretations to the store of information, automatically or mediated by as many editorial processes as there are editors, without however significantly changing the original stored format of the data.

Simply, it lets us form our own opinions from the available data. As such, it is as potent and as subversive a tool as the printing press ever was."


Computer technology has allowed advances in almost all areas of humanities research and scholarship. The computer’s ability to interpret and analyze qualitative data quickly and on a massive scale; to store large quantities of information; to create a collaborative research environment for scholars through the Internet — all these advantages of the personal computing era have made new technologies accessible and in some cases, essential, to humanities scholars. The discipline in which the use of computer assisted research has one of the richest traditions and the most consistent applications of a defined methodology is that of History. It seems ironic that the discipline which lives by the ability to analyze the structures and evidence of the past is possibly the Humanities discipline in which new technologies have the most loyal followers and some of the most enthusiastic users.

In this overview of the use of computers by historians, I hope to illustrate some of the early adventures in historical computing, practiced by pioneers in qualitative research who caused a great deal of controversy by adopting the techniques of economists — and their methodologies. These early initiatives were hampered by the limitations of the hardware available at the time, however they laid down the foundation for a sound methodological paradigm for historians to build on whilst taking advantage of advanced, sophisticated hardware, software and communications tools.

Early Initiatives
Computers were first used for historical projects which involved calculations with numerical data. Data classification and analysis have been automated since at least the late 19th century, when Herman Hollerith used a "tabulating machine" to compile the 1890 US census returns. Similar machines were used with historical sources in the 1930s. During World War II, computer assisted textual analysis was developed for codebreaking, and these techniques were adapted for literary and linguistic research in the late 1940s. In the 1960s they were adopted by historians, who carried out research on the Federalist Papers, analyzing not only authorship, but the development of political ideas and their origins.

The most significant adoption of computing by historians came in the post war period, notably the late 1950s, with the emergence of "new" social hist-

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tory and its adoption of the techniques of the social scientist. Many social historians began to use quantitative methods and computational techniques to organize and summarize information from sources which had been hitherto unused in historical research, such as censuses, tax rolls, parish registers, etc. The most controversial piece was Fogel's ground-breaking study of slavery, *Time on the Cross*, which was based on economic modeling techniques.

By the late seventies, the use of computers in historical research and teaching was still confined to a very small group of historians, most of whom did not consider their use of computers to be of any special interest. These cliometricians thought of computers as one of many research tools developed in the social sciences, one which they applied to their historical problems without worrying too much about the possible implications. This number-crunching capacity of the computer, then indeed the main reason for its use, did not raise methodological problems other than those common to all social sciences. Only a very small number of historians used computers in other capacities, like database management, record linkage and text analysis facilities. It was this group that first realized there was a distinct historical methodology needed for history and computing.

In the early 1980s low cost personal computers increased the number of historians using computers for research other than number crunching. However, their enthusiasm was not matched by a widely available well of expertise, or information on the subject. Historians tended to struggle at their individual projects, relying upon local computing gurus and a sparse international network of colleagues who had worked with computers and published their results or presented at conferences.

A number of developments contributed to changing this state of affairs. The Association for History and Computing (AHC) was established in 1986, with a journal and conference; several introductory works on this emerging topic were published; and above all, the use of the Internet for communication and dissemination of electronic material began to expand. This all contributed to the acceleration of the establishment of basic methodological "standards" which saved the individual researcher from re-inventing the wheel every time she or he began a new project using computers. Basic methodologies are now firmly established, and indeed, some institutions have established graduate and undergraduate programs in historical computing.

**Techniques Available**
The "building blocks" of historical computing are described below — databases, statistical analyses, text analysis, multimedia and hypertext. The use of these techniques — or, more usually, a mixture of some or all of them — has become the established practice for using computers in history.

**Databases** — The most widely used application of computers in historical research is almost certainly still the database. Databases have been used routinely to store and present archival materials since the experimentation with quantitative methods in the 1960s. However, their value is not simply in quantitative terms, but in their role as a classification tool. Historians are by necessity constantly developing systems for collecting, organizing, and selectively retrieving information. Whether computerized or not, such systems are database management systems — lectures notes stored by course in folders in filing cabinets, bibliographic references on notecards, research projects classified by category and groups in card indexes. Computerized databases simply automate manual information management systems.

Database packages allow one to record and analyze information that is generally stored in the form of records, such as census and cadastral data. The most popular type of database software is called a "relational database," in which the user can perform searches relating one type of record with another. Some commonly used relational databases are INGRES, Dbase, and Microsoft Access.

Databases can be extremely complex and detailed, or small and based on a single source. They vary widely in size: Some are prepared by individual researchers from an individual ledger or roll. Others can be huge city databases or national census material. For example, government funded projects in

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**Useful WWW Sites for Historians**

The Association for History and Computing  
[http://odu.let.rug.nl/ahc](http://odu.let.rug.nl/ahc)

History and Computerization Project  
[http://www.directnet.com/history](http://www.directnet.com/history)

HUMBUL: International Humanities Resources (Oxford)  
[http://info.ox.ac.uk/oucs/humanities/international.html](http://info.ox.ac.uk/oucs/humanities/international.html)

Index of online resources for historians (Kansas)  
[http://ukanaix.cc.ukans.edu/history/index.html](http://ukanaix.cc.ukans.edu/history/index.html)
often packages are WordCruncher for Windows, TACT, the analysis of interviews). With great success. Text analysis packages allow you to look for certain words in selected texts, in order to determine individual's opinions and actions. In addition they allow one to create indexes, run concordances, investigate collocations, and perform some basic statistical analysis. Text analysis falls into two categories: quantitative (looking at words and their occurrences), and qualitative (studying themes). The most commonly used quantitative packages are WordCruncher for Windows, TACT, and the Oxford Concordance Program. For qualitative analysis, researchers tend to use such programs as Ethnograph or NUDIST (particularly popular for the analysis of interviews). 

Statistical Analysis — Databases tend to manage, but not to analyze, the type of information which can be highly structured without sacrificing its richness and meaning. However, databases are incapable of performing advanced statistical analysis or retrieving information from more complex written materials like charters. Statistical Analysis is used for interpreting large quantities of numerical data. It can often be applied to information already stored in a database, so statistical analysis is frequently the "next level" of research which is carried out. There is a level of basic statistical numeracy that must be achieved in order to use statistical measures effectively — nowhere is the adage "garbage in, garbage out" more applicable.

Spreadsheets (such as Microsoft Excel) allow for simple statistical analysis, performing straightforward calculations and converting output to graphs and charts. More advanced analysis can be conducted using applications like SPSS or SAS. Most quantitative historical research relies on certain key statistical manipulations — deriving new data from old by arithmetic manipulation of the existing data; summarizing single variables with descriptive statistics; and cross-tabulating and measuring the association between the two variables.

Textual Analysis — Often historical data is not quantitative at all, rather it is in the format of textual material, such as correspondence, memoirs and minutes. For these materials, Textual Analysis can be used with great success. Text analysis packages allow you to look for certain words in selected texts, in order to determine individual's opinions and actions. In addition they allow one to create indexes, run concordances, investigate collocations, and perform some basic statistical analysis. Text analysis falls into two categories: quantitative (looking at words and their occurrences), and qualitative (studying themes). The most commonly used quantitative packages are WordCruncher for Windows, TACT, and the Oxford Concordance Program. For qualitative analysis, researchers tend to use such programs as Ethnograph or NUDIST (particularly popular for the analysis of interviews).

Hypertext — New developments in the realms of Hypertext and Hypermedia have also been applied to history, with varying degrees of success. A number of "off the shelf" commercial teaching packages have appeared which claim to offer "a total history experience," integrating text, image, sound and video. A number of these applications are of extremely dubious quality. The use of hypertext for historical research is still in its infancy. The key applications of the new technology appear to be in the creation of electronic editions, where all available materials can be linked to source materials.

The Expanding Internet and 'New' Archives
By far the greatest advance in encouraging the use of computers by historians — and indeed, all humanists — is the development of the Internet and the possibility it affords for remote access to other machines and information. Examples of such resources are library catalogues, databases, electronic texts, and software archives. Information can usually be retrieved from user-friendly World Wide Web sites, which store their documents in a standard form. These documents consist of text but can be linked to graphics, sound files, and movies, and to other documents, creating a hypertext environment.

The question of where to start when seeking information is a daunting one. However, for historians, there are a number of useful "gateways" to excellent sources of information online, such as the Economic and Social Data Archive at the University of Essex in the UK (http://dawww.essex.ac.uk). This houses the History Data Service which has a large collection of data sets, census materials, and information about online materials. The Historical Text Archive, housed at Mississippi State University (ftp://ftp.msstate.edu/pub/docs/history/index.html) provides access to a large number of primary source materials as well as maps. Another valuable collection of historical materials is accessible at the University of Kansas (http://history.cc.ukans.edu/history/WWW_history_main.html), which has an important selection of Internet resources for historians by era and by region. Both the Mississippi and Kansas sites are clearinghouses for a huge selection of links to historical Internet resources around the world.

Increasingly, libraries look to resolve issues of preservation and dissemination of primary sources by creating digitized versions of their holdings. The British Library (http://portico.bl.uk) is a pioneer of
this process with its *Beowulf* project and other primary source materials.

A number of state funded projects in Europe are seeking to make city archives and public records — mostly early modern, but some dating back to the middle ages — available electronically over the Internet or on CD ROM. Examples of these initiatives include the Danish Data Archives ([http://gate1.dda.dk/dda.html](http://gate1.dda.dk/dda.html)) and the Netherlands Historical Data Archive ([http://oasis.leidenuniv.nl/nhda/nhda-welcome-nl.html](http://oasis.leidenuniv.nl/nhda/nhda-welcome-nl.html)).

In addition, electronic publication is becoming recognized as a means of dissemination for specialist, low-circulation journals. Electronic editions are slowly becoming acknowledged as a valid means of publishing an edition, and as an easier means of including glossary and annotation materials. Commercial publishers are also taking the initiative in electronic publishing, and standard source materials such as the *Patrologia Latina* are now available on CD ROM.

The proliferation of electronic information is rapidly changing the way in which historians work with archival materials — in many respects, for the better. Previously, the only way to work with primary source materials was to spend many painstaking hours in archives transcribing and then keying in data. Now, in certain cases, primary source materials may already be available in electronic form, and many are even freely available online. If so, it affords the possibility of conducting archival research from one’s own desk. An additional advantage of this proliferation of electronic record materials is that electronic materials can also easily be manipulated for analysis, for example by importing them into a database or text analysis program.

There are, however, disadvantages. Advances in technology are forcing changes in archival practice, and in some cases, necessitating the establishment of new guidelines. For example, how can we tell if an archive we download is “authentic” — electronic information can be easily manipulated or changed.

There are also considerations for contemporary (and future) historians. The dependence of late 20th century society on information in electronic form continues to increase, and this shift is changing the fabric of historical source materials. Financial data, medical records, airline databases, tax records and vast amounts of other information about 20th century society exist only in electronic form. Electronic mail is an important historical source, one which is changing the way in which we correspond professionally (and personally), the kind of materials we include in a message, and the speed of the communication. There is much to suggest that private e-mail messages could become the electronic equivalent of the Paston letters, the rich source of much enquiry into fifteenth century English social history. In addition, e-mail plays a crucial role in the way in which the results of scientific research are exchanged before publication, and so historians of science will need access to electronic messages and data in addition to traditional printed materials. There are complex archival issues involved in the use of electronic records. It is essential to ensure, for example, that standardization of the computer formats of records guarantees that electronic data can be read by the computers of the future. Electronic cataloging requires that metadata information be defined for resource discovery in the archive, and adequate support and staffing for these new kinds of finding aids, “virtual” archives and access equipment needs to be provided.

**Conclusions**

The computer is a tool which has general utility for the historian, despite the unwillingness of some to disassociate computers from the field of quantitative social history with which they made their debut in the 1960s. To some, the computer is still viewed as the natural ally of the once “new” historians who challenged the “traditional” narrative with theoretical models and methods borrowed from the social sciences. There is still a nascent confusion between historical computing and quantitative history.

This perception — and the impenetrability of some of the literature published on history and computing — can mean that historians may be in danger of missing out on technical advances which have made computation accessible to non-specialist and non-technical historians in a way which promises to benefit their work. Recent technical innovations and the proliferation of online source materials mean that it is no longer necessary for the historian to engage in a Promethian endeavor of collection and digitization of materials in order to find the computer a useful tool.

**Further Reading:**


JSTOR and Project Muse: Two New Approaches to Electronic Publishing

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As information technology evolves, libraries are presented with a seemingly endless array of new and innovative ways to process, store and retrieve information. In the not-so-distant past, scholars used their computers to determine if a journal, book or other entity was held by their library, but obtaining the sought-after item always required making a trip into the library. Today’s network-savvy researcher not only expects to find out if something is available, but increasingly, she or he wants instant access to the item itself. Recognizing this trend, Bobst Library now provides access to two major electronic journal resources: JSTOR and Project Muse.

**Evolution of Electronic Journal Publication**

Most of the earliest Internet-based electronic journals were highly specialized and experimental publications. Using the text-only capabilities of the early Internet, these journals were often free-of-charge because pricing and distribution structures did not exist for this unique type of distribution. Today, the situation is changing as an increasing number of commercial publishers are using World Wide Web technology to distribute their journals to the global community.

Two of the most interesting initiatives — Project Muse and JSTOR — could change the world of electronic scholarly publishing as we know it. With coverage in the humanities, social sciences, history and literature, Project Muse and JSTOR hope to ease the transition to electronic formats for publishers as well as users, while serving as models for future publishing initiatives. JSTOR and Project Muse have different objectives, but both provide an unprecedented degree of instant access to vital scholarly publications.

**JSTOR**

Established in 1995 with funding from the Mellon Foundation, JSTOR provides the complete text of back issues of journals in economics, political science, history, ecology and population studies. Because its stated goal is to become a comprehensive and reliable archive, current issues are excluded from JSTOR. Instead JSTOR has reached an agreement with publishers to maintain a three to five year publication lag period, which also serves to protect the latter’s main source of income — current issues. Each year, an additional volume is added to the archive and within the next three years JSTOR plans to offer the complete backfiles of at least 100 academic journal titles in 10 to 15 different fields.

JSTOR uses high resolution (600 dpi) imaging technologies to provide reproductions of the original journal pages, including all tables, charts, photographs and other graphic material. The bit-mapped image of each page is linked to an ASCII text file that allows the user to search for specific terms within the text. After identifying pages by searching this “transparent” ASCII file, users retrieve an image of the page via the World Wide Web.

**Project Muse**

Project Muse covers the humanities, social sciences, history, and literature. It provides access to journals such as the American Historical Review, the Modern Language Association, and the Journal of American History. Project Muse is structured around the concept of a digital library, allowing users to search across multiple journals and access full-text articles. The platform supports a range of features, including advanced search functions, citation indexing, and full-text downloading.

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A magnified clip from the JSTOR archives — at 600 dpi the text prints cleanly, retaining the original typography.
**Project Muse**

In one of the first ventures of its kind, The Johns Hopkins University Press and the Milton S. Eisenhower Library are collaborating on Project Muse, an electronic collection of the Press’s 40+ journals in the social sciences, humanities and mathematics. With funds from the National Endowment for the Humanities and the Mellon Foundation, Project Muse (in direct contrast to JSTOR) includes current issues only, starting with the first issue in the current year’s volume. No backfile is currently available, but future plans may include the addition of pre-1995 issues. Like JSTOR, Project Muse titles offer many advantages over their printed counterparts, including hypertext links to related material and Boolean search capability.

**Implications for Libraries and Scholars**

The ability to retrieve journal articles from home or office is an obvious boon to busy students and faculty members. For libraries, these electronic archives hold even greater promise as the solution of longstanding challenges. Most academic libraries are faced with shrinking budgets for journals while paper-based journal prices are rising at rates often far higher than the general rate of inflation. In addition to the cost of acquiring individual journals, finding the physical space to store growing collections is a similarly daunting challenge. Paper and microform materials also require significant preservation and processing costs, which increase as collections grow and age. Electronic journals, such as those offered by JSTOR and Project Muse, offer viable solutions to these challenges.

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**Connecting to JSTOR and Project Muse**

There are two ways to use JSTOR and Project Muse periodicals. All of the titles in each service are cataloged separately in BobCatPlus, the World Wide Web version of Bobst Library’s catalog, where users can link directly from the catalog record to the desired title. BobCatPlus terminals are available in Bobst and at NYU branch libraries, or remotely at:

http://www.bobcatplus.nyu.edu

JSTOR and Project Muse also maintain their own home pages which offer links to individual titles and information about the history and objectives of the projects:

JSTOR: http://www.jstor.org

Project Muse: http://muse.jhu.edu

Note that access to the full database is available only to holders of accounts ending in “nyu.edu.” In addition, use of JSTOR requires an Internet browser with graphic capabilities (e.g. Netscape), because the journal articles are graphical images of the original scanned pages.

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**ACF Humanities Computing Seminar Series Launches**

June 9th saw the first event in a new initiative at ACF, the Humanities Computing Seminar Series. This special interest series, organized by the Humanities Computing Group, is aimed at providing a small, informal, subject-specialized setting for examining computing developments. Modeled on the successful and larger ACF colloquia series, we hope this rather more experimental format will encourage attendance by a discipline-focused group and facilitate discussion and debate with our speakers. Twice a semester these seminars will feature speakers who have applied computer based research and teaching methodologies to a wide variety of humanities disciplines. We look to this series as an opportunity for interdisciplinary exchange among NYU colleagues who have an interest in humanities computing. Intended topics for the coming semester include electronic editions and online archival projects, from disciplines such as History and Literature.

In the first of this series, Paul Groves from Oxford University Computing Services gave a presentation on the “Virtual Seminars for Teaching Literature” project based at Oxford’s Humanities Computing Unit. The Virtual Seminars project is creating an electronic archive of the poetry of Wilfred Owen, together with associated historical and interpretative materials relating to the First World War. From this collection of poetry, texts and illustrations, they will develop a series of interactive tutorials built around the idea of teaching WWI poetry. Each of the tutorials will explore different methods of literary study and of delivery. Lecturers and students will be able to use the archive and tutorials over the Web, creating their own tutorials or online essays. Mr. Groves presented an overview of the issues involved in creating a digital archive, including editorial and intellectual content considerations, as well as issues of digitization, storage, copyright, and dissemination of the electronic materials. A reception followed, during which a number of issues raised in the talk were discussed and demonstrated, and people were able to ask questions of the speaker in a relaxed atmosphere — over a glass of wine and a canapé!

Thanks to all who attended. For information on the fall schedule of Humanities Computing Seminars feel free to contact Lorna Hughes at lorna.hughes@nyu.edu. Announcements will be sent out to all humanities faculty and graduate students. Watch your mailboxes — we hope to see many of you there!

— Lorna Hughes, Assistant Director for Humanities Computing
The Student Genome Project
A Glimpse of the Future of Genetics Education

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Most of us at one time or another have sat through an excruciatingly boring science lesson. The teacher droning in front of a lectern, inexorably flipping new overheads onto a screen, or scribbling on a blackboard. Those of us who experienced this in a genetics class probably remember strange terms, boxes within boxes and lots of confusing names for very abstract concepts we just couldn't quite grasp. Part of the problem lay in the teaching methods, and part in the fact that the science that was being taught just didn't connect to anything we knew, understood or cared about.

In May 1997 a new site was born on the World Wide Web — the Student Genome Project (http://www.cat.nyu.edu/sgp). One important aim of this project was to break the mold, to dare to be different, to put students' needs and interests first, and to create lifelong learners of science. The most powerful learning takes place when there is a passion, joy, and excitement experienced by the learner. There is absolutely no reason why learning needs to be synonymous with boring, hard work. New generations of students do not need to learn in exactly the same ways as previous ones.

Several developments led to the initial idea for this project: the flood of scientific data onto the Internet; the increasing access to the World Wide Web by schools; the rapid advances being made in the fields of molecular genetics, biotechnology, and bioinformatics; and the availability of new tools to create interactive multimedia. Our primary goals were to develop interactive multimedia on the World Wide Web that would enable secondary school students to learn the principles of genetics, and to allow the students to engage in scientific research using genetic data from the Internet.

The NYNEX Foundation and the NYU Center for Advanced Technology funded the project for one year. A partnership was formed between the NYU Department of Teaching and Learning and a high school in East Harlem, the Manhattan Center for Science and Mathematics. A class of talented and energetic high school biology students and their teacher, Carlos Franco, worked with NYU students and faculty to create the site. NYU Faculty and students with expertise in the following areas participated, as paid employees and volunteers: Biology, Science Education, Computer Science, Graphics/Design, and Web Administration and Design. Invaluable assistance was obtained from individuals in the Academic Computing Facility's Innovation Center, the NYU Center for Advanced Technology, the Academic Computing Facility's Scientific Visualization Center, and others.

Technology Applications
A strong commitment was made at the beginning of the project to explore as many new technology applications as possible. The extremely rapid changes occurring in hardware, software, programming languages, and authoring tools make it essential to be aware of the latest advances, otherwise one could throw away resources and time on dead-end applications. For example, Director and Shockwave were used to create highly interactive 2D multimedia where 3D capability did not seem to be necessary.
Shockwave movies were also not as time-consuming to make as VRML worlds. On the other hand, VRML was used to create different learning situations where presence, discovery, and more manipulation were deemed desirable. A VRML world requires more active exploration by the learner. VRML was used when it was thought that 3D graphics would lead to greater student understanding than 2D graphics. For example, many students have the misconception that cells are flat from seeing two-dimensional drawings and pictures of cells in textbooks. In the VRML world, students can manipulate and rotate a cell, and move around the different organelles.

Java, Javascript, and cgi scripts were investigated as possible ways of introducing more interactivity, learner control, and feedback into the resources on the web site. At this point, all three methods have their advantages and drawbacks. Web boards using cgi scripts were used to provide asynchronous communication between the high school students and the project team members, and their use also eliminated the need for all students to have e-mail accounts. Web authoring programs for the high school students such as PageMill and Corel Web Graphics Suite were necessary as the student’s time in the computer labs was limited, and these tools allowed the rapid development of web pages by novices.

To improve the high school’s access to the World Wide Web, they were provided with software, a high speed modem, extra RAM for their server, and technical expertise from Johannes Lang, an ACF staff member, and Mark Chen, a undergraduate computer science student. In addition, Vanessa Go, a science education graduate student, made weekly visits to the high school to help the students with their genetics research projects. A biology professor, Malka Moscona, worked with Debjani Roy, a doctoral student in genetics, instructing all team members in the intricacies of molecular genetics and validating the content on the web pages. The success of the project was the direct result of the tremendous enthusiasm, skill, and tireless commitment of the high school students, their teacher Carlos Franco, the Principal of Manhattan Center for Science and Mathematics Steve Askenazi, and all the NYU project team members.

Keeping It Interesting
Certain specifications for the interactive multimedia modules were agreed upon at the beginning. All materials would:

- have a strong science component,
- be modular — able to stand alone,
- be non-linear — allow the learners to choose how they will proceed through modules,
- be engaging and fun — the first stage in teaching is acquiring the student’s attention and focusing it on the task at hand. Afterwards, it is just as important to maintain this focus. Very powerful learning can take place when work is blended with play,
- utilize as many senses as possible — this is necessary as learner’s have preferred sensory modalities.
- relate to the students’ everyday experiences and cultural backgrounds — a basic principle of constructivism. Children’s minds are not empty vessels and new concepts are acquired by being subsumed by and integrated with concepts already present in the learner’s cognitive structure.

Because of the limited amount of funds available, it was not possible to develop the comprehensive set of modules that we wished. Instead, we established an overall framework and then developed a few modules in-depth to illustrate what was possible. Johannes Lang orchestrated the design of the entire web site and created a front-end interface that is truly a “visual confection,” in the spirit of the great graphical designer, Edward R. Tufte.

The “hook” chosen to focus students’ attention on genetics was the disease sickle cell anemia, which is a genetic defect commonly found in African and African-American populations. Since the school and community where we were working is predominately African-American and Latino, this genetic defect was of great interest to a large number of students. The genetics of the disease are explained using stories about an African-American family living in Harlem. The young boy in the family suffers from sickle cell anemia. To make the connection more powerful, the students were asked to write stories about the family — to give them names, occupations, and even voices. Thus was born the Jones family.
In year two of the project, a middle school in Chinatown, I.S. 131, will take part, and a Chinese family will be added. Eventually, the Student Genome Project site will represent all the diversity of New York City schools and every child will be able to identify with someone in the modules.

**Maximizing Metaphors**

All of this was presented to the students by the use of a very familiar metaphor, cable television channels. This decision is an example of taking a potentially negative influence on children, and using the hold it has over American society to produce an educational advantage. The powerful influences on children should always be examined for ways in which they can be harnessed to yield positive educational outcomes. Cable TV was chosen for several reasons: different channels appeal to different viewers and many different communication genres may be accommodated, maximizing the possibility of providing something that will appeal to almost every student. A special effort was to be made to make science attractive to females and students from groups under-represented in the sciences. For example, a Soap channel was designed to appeal to female students, while the MTV channel contained a DNA rap song designed to appeal to African-American and Latino students.

We have all seen the tremendous rate of the advances in genetics. Every day, new genes are discovered, and new ethical dilemmas and intellectual problems confront us. New careers will be opening up in the fields of molecular genetics, biotechnology, and bioinformatics and all of our children deserve a chance to enter these exciting new professions.

**The Future in the Student Genome Project**

In order to accommodate this rapid change, a future world was created using Virtual Reality Modeling Language, the 3D language of the World Wide Web. Mark Chen developed virtual cells, organelles, DNA molecules, Dolly clones, and a future New York City. The year of this future city was carefully chosen, 2061 A.D. Those of you who are familiar with astronomy will recognize the significance of that year, when Halley's comet will again pass by the Earth. The world of the future allows all of us to think ahead, to anticipate, and to wonder about the world our children's children will inherit.

In this future world, information is embedded in objects. For example, clicking on the fish in the pool leads to web sites which are related to the genetics of zebrafish, a commonly used organism in genetics research. Clicking on the grass leads to web sites related to genetics of grasses and other monocots.

The other way in which learning takes place in the future world is through interactive adventures. Coincidentally, the family in the future are the descendants of the Jones family in the present. The first adventure involves the visitor in an attempt to cure the baby brother's sickle cell anemia using the advanced techniques of the 21st century. The visitor must navigate through the cell to the correct chromosome to find the defective gene, and then choose a method to correct the defect. Many additions to the future world are planned.

The highlight of the project was the presentation of the high school students' research projects at the school science fair. NYU science and science education students and faculty helped to judge the student's projects. The topics ranged from the genetics of HIV, breast cancer, and Tourette's syndrome, to explorations of the X and Y chromosomes. The students then used the web authoring program Pagemill to present their results on web pages.

The future of the Student Genome Project looks very exciting. The information density of the VRML worlds will be increased substantially. Work will begin on the design, construction, and testing of user-friendly information handling and analysis tools. Plans are under way to integrate the VRML world with a Multi-User Dimension Object-Oriented (MOO) to allow online group work by students engaged in research projects. The gateway to the MOO will be through the DNA Café which is presently under construction. A public web board has been made available for students to use in their research projects. An English as a Second Language (ESL) genetics dictionary has been created, and is available in Chinese and Spanish. Other language versions are on the way. And finally, The Student Genome project will journey back to the past, to investigate the genetic history of the earliest humans on Earth. The best is yet to come.
League of World Universities Conference Focuses on Technology

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New York University President L. Jay Oliva hosted the conference of the League of World Universities in February. Presidents, chancellors, and rectors of nearly 40 universities were in attendance. Technological linkages, among them the world’s first multi-national “Tele-Course Catalog,” lead the agenda for the conference.

The League of World Universities is an organization which brings together the rectors and presidents of 47 great urban universities from all five continents. It was established in 1991 by Dr. Oliva, and had its initial meeting at the time of his inauguration. The motivation for the establishment of the League of World Universities lay in the realization that urban universities around the world face similar problems and challenges, and that dialogue and cooperative action relating to these problems and issues may assist in their resolution.

These leaders believe that global videoconferencing and other communication technologies could change the face of education for university students, giving them access to teaching, resources, and knowledge on distant campuses. A pilot tele-course collaboration was conducted in the fall of 1996 by New York University and the Université Libre de Bruxelles (ULB) in Belgium. Professors Dennis Smith and Ian Holliday, from NYU’s Robert F. Wagner Graduate School of Public Service, and professors from ULB co-taught a video tele-conference course on the status of the European Union, comparing its foundation to the political structure of the United States.

A short film about this course was screened during the conference. The tele-course — which met weekly at 6:00 p.m. Brussels time, noon New York time — not only enabled NYU students to see and speak with their peers in Brussels, it also created a technological infrastructure for class discussion, including web pages and e-mail addresses. The course’s syllabus and assigned readings were compiled from resources in the United States and abroad. Based on the success of this pilot course, the group is now collaborating to develop a Tele-Course Catalog.

The conference also addressed the impact of emerging communications technologies on intellectual property. Issues such as the changing nature of publication and copyright, and the production and sharing of intellectual capital were examined.

Other featured conference events included a breakfast with a videoconference link to The Queen’s University of Belfast; a demonstration of a greatly expanded League of World Universities website (http://www.nyu.edu/rectors), including content about each of the 47 member institutions; a panel discussion about the impact of internationalization on university research and teaching, chaired by Thomas Bender, Dean for Humanities at NYU; and demonstrations of educational innovations, featuring the NYU School of Continuing Education Virtual College and the University of Edinburgh resource-based learning using the World Wide Web.

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New Instructional Technology Resources

Instructional technology support is part of ACF User Services Group, and includes the Innovation Center for faculty, student computing labs, nomadic computing, and talks & workshops.

Improvements at ACF Student Labs

Over the summer new purchases of software and hardware have improved the resources available at ACF student labs.

The ACF Macintosh Multimedia Lab in the Education Building (35 West 4th Street, second floor) has 50 new high-performance systems with 64 MB RAM, large hard drives, and built-in Zip, floppy, and CD-ROM drives. All workstations at the site will also benefit from a newly upgraded internal network which provides greater speed and reliability. A new multimedia projector for video and computer-based presentations is available for use in the lab’s classrooms. The entire suite of multimedia software applications available at the lab has been upgraded to the newest versions.

At the ACF Tisch Hall (40 West 4th Street, lower concourse) and 14 Washington Place (basement) computer labs, new computer acquisitions and memory upgrades this summer facilitated the upgrading of approximately 140 systems to Windows95. With 40 MB RAM each, these systems will run existing applications faster and more reliably. In addition, new file servers have been installed at the labs, providing additional reliability and speed. At Washington Place, 35 of the new Windows systems are also equipped with Zip drives and soundboards.

Laptops for Lectures

Computers for use in classrooms located at the Study Center (25 West 4th Street) have been upgraded to laptop computers. A limited number of high-performance Macintosh and Windows laptops are available for use by faculty in the 30 classrooms of the Study Center which are equipped with high-speed connections to NYU-NET and the Internet. Faculty with laptops that are equipped with network connection cards may register their own computers with ACF for use in these rooms too. For further information regarding an ACF plug’n play laptop for use at the Study Center, or registering your laptop to plug in to the network at a Study Center classroom, contact the ACF Innovation Center at 998-3044.

Nomadic computing is emerging across the campus as a viable research and teaching capability. Register now with ACF to use your network-ready laptop in Bobst Library, where more than 150 data ports are distributed throughout the library, providing access to NYU-NET and the Internet.

Improved Web Sites

Over the summer, ACF staff have continued to improve two existing web sites which provide access to instructional and learning resources.

The ACF Multilingual Web Site provides access to resources for nearly seventeen languages which are taught at NYU (http://www.nyu.edu/acf/usg/multi-l). Another Innovation Center web site provides information on technology used for teaching and learning (http://www.nyu.edu/acf/usg/teach-learn). This site includes low-tech demos, and explanations of current technologies such as Quicktime VR and Macromedia Director. It also includes how-to’s for image processing and video capture, among other topics, and provides links to information regarding conferences and web-centered activities at other universities.

— Vincent Doogan
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Online Collaborating in the Virtual College

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New York University pioneered distance learning in the 1950s with its Sunrise Semester series, which aired for twenty-five years on national television. In the spirit of Sunrise Semester, NYU’s School of Continuing Education introduced the Virtual College in 1992 to expand the boundaries of learning and respond to the increasing professional education needs of working adults.

Currently, 6.7 million Americans are enrolled part-time in colleges and universities. Over 80 percent of these part-time students are adults aged 25 and over, and 60 percent are women. These large numbers mask an even larger adult population that would like to attend college but cannot.

Adult Education Boundaries
Despite decades of higher education growth and change, adult students today face three boundaries towards quality educational access — spatial, temporal and instructional.

SCE’s Information Technologies Institute enrolls over 2,000 adult students who are completing one of seventeen professional certificate programs in the information technology field. Most of these students work within a mile or two of the Washington Square campus, and all live within a fifty-mile radius of NYU. But what about the remaining 24,800 miles of the planet? SCE would certainly like to enroll students beyond the typical commuting range. And traditional on-campus instruction definitely creates spatial limits for millions of exurban and rural adults.

Most of our students are systems professionals and managers, and like their colleagues in other fields they have felt the impact of downsizing and globalization in very tangible terms — more responsibility, longer hours, frequent travel. We recently surveyed a representative sample of our students to identify how many classes were missed for business related reasons such as having to work late and being out of town on business trips. The answer was troubling — students missed twenty percent of their course sessions for these reasons. This in a discipline where subject knowledge is very cumulative and gaps are difficult to make up. How many potential students, anticipating these temporal problems, never even registered for our courses?

While eliminating spatial and temporal boundaries are oft-cited goals of distance learning programs, the real payoff comes when online technologies address the more subtle instructional boundaries facing adult students.

Like many disciplines, information systems is characterized by two broad categories of knowledge — declarative and procedural. Declarative knowledge represents the concepts, methods and tools of our field — just the facts, ma'am. Declarative knowledge is relatively easy to teach and relatively straightforward to learn, lending itself to traditional classroom lecture and discussion.

Procedural knowledge represents the processes inherent in a field — the difficult and very human interaction of generalist users and technical specialists that transform methods and models into working business information systems. Procedural knowledge is best acquired by doing, through collaborative teams of students simulating the real thing.

Many of our faculty have tried to get students to meet after class and team-up on case study systems projects — all to little avail. Time and again they recount students’ frustrating attempts to meet, only to have them spend more time in agreeing on a meeting time than they actually spend meeting. The result is too often courses that instructionally reduce the key procedural concepts to declarative how-to lists.

Asynchronous Telecourse Solution
The Virtual College was designed to address these three access problems facing the typical working
adult student and provide them with the same level of dynamic, hands-on instruction that characterizes the best on-campus course, laboratory and faculty access available to full-time students. With $1.3 million in grant support from The Alfred P. Sloan Foundation, SCE has developed and evaluated the cost-effectiveness of a digital network to provide instructional video-on-demand and online computer laboratory access to student home PCs. The four main teleprogram media elements — digital video, audiographic tutorials, discussions and laboratories, and hypertext readings — are described below:

**Digital Video** — Videos consist primarily of computer animations, faculty demonstrations and case study simulations to increase student mastery and retention of telecourse concepts, methodologies and tools. Each telecourse session contains approximately one half-hour of video files.

**Audiographic Tutorials** — Tutorials provide additional course and software instruction in the form of graphic and audio presentations. Similar to narrated slide presentations, these full-screen audio-visual lessons both provide more content on the digital video topics and walk students through the features and use of telecourse software packages.

**Discussions and Laboratories** — Computer Conferencing supports asynchronous student-faculty discussions of telecourse topics, case studies, projects, and assignments. Online laboratories permit collaborative student groups to complete projects using sophisticated systems software tools.

**Hypertext Readings** — Online readings give students dynamic cross-references to all text materials and permit them to “jump” to various information sets as desired. All hypertext readings provide complete text search, annotation, print, and navigation capabilities.

A study conducted at West Virginia University found that transmission speeds of 80 Kbps made users believe that they were on a local LAN. The teleprogram’s Integrated Services Digital Network (ISDN) phone lines provided a 128 Kbps remote local area network connection to the teleprogram servers, projecting the on-campus computer laboratory “look and feel” of sophisticated software applications directly to student home PCs.

A 16-credit, graduate certificate in information technology for non-technical managers and professionals has been the academic basis for most of the program’s curriculum design, delivery and assessment. The program consisted of four 6-week courses — Systems Analysis, Database Management, Systems Auditing, and Information Security — that were taken sequentially by a cohort of twenty students.

During the six-week telecourses, students and faculty collaborated online to analyze, design, and build a prototype information system using Lotus Notes and various applications software packages. In each course, the twenty students were divided into four groups to work on various phases of systems projects. Functioning as members of their virtual project teams, the students established discussion guidelines, critiqued and edited each other’s work, managed online workplace responsibilities, and at times ran an asynchronous groupware package as if it were an online chat service. This level of interaction was maintained even when many students were traveling on national and international business trips.

![figure 1 — The assignment](image)

**Anatomy of a Telecourse Session**

Since 1992, I have taught the introductory Systems Analysis course in the Virtual College teleprogram. This six-week course is divided into six variable-length online sessions. Unlike on-campus courses whose two-hour class sessions unvaryingly meet on the same night each week, asynchronous classes are always “in session” and run for as many days as are necessary to cover their topics. The Systems Analysis online sessions “meet” as follows:

**Session 1. Course Overview (5 days)** This session familiarizes students with the conferencing and electronic mail features of the Lotus Notes groupware package and with its use as an effective workgroup collaboration tool. Students are introduced to the systems development life cycle, the case study systems project and client, and to each other.
Session 2. Preliminary Analysis (10 days) This session covers the preliminary analysis phase of an information systems project. Within their five-member project workgroups, students identify, survey and analyze data on aspects of the case study database and communications system.

Session 3. Alternatives Analysis (8 days) This session requires the four project workgroups to propose and analyze alternatives to the current case study system. Students identify the scope and objectives of their proposed alternatives and analyze its costs and benefits.

Session 4. Output Design (6 days) This session designs the initial set of information outputs for the new case study information system. Two of the workgroups are chosen to identify the data elements and output formats for the new case study system.

Session 5. Input Design (6 days) This session covers the principles of data input and data file design. The other two project workgroups are chosen to determine the client's input requirements, and translate these into final Lotus Notes input forms for the new system.

Session 6. System Implementation (7 days) This session completes the development of the prototype case study system. All four groups work on completing the system's final Lotus Notes output views, online help, and user documentation.

To get a clearer understanding of what actually goes on in a typical telecourse, let's look in more detail at session 2, Preliminary Analysis. During this ten-day session, students collaborated online to collect the fairly-detailed workload, procedural and cost data necessary to prepare the preliminary analysis of the case study system. In the interests of time, the students were divided into four equally-sized groups with each group being responsible for one aspect of the preliminary analysis' data collection and analysis. Each group conducted its work within its own Lotus Notes discussion database.

During the first two days of the session, the students and I discussed the overall requirements of a preliminary analysis, and we reviewed the organizational and operational environment of the California-based case study project. On the morning of day 3 of the session, I provided each group with their particular preliminary analysis responsibility (see figure 1). Students used their own group database to discuss approaches, divide responsibilities, and formulate questions for the client or me (see figure 2). Both the client and I actively monitored each group database to ensure that work was progressing satisfactorily and that all questions for us were answered promptly. While each group's deliberations were private, there were often questions or findings raised that had to be shared with the class as a whole, and these I posted in the course discussion database.

Each group's survey form or questionnaire had to be completed by 11:00 a.m. on day 6 and transmitted to the client in San Francisco. The client then collected as much data as possible and returned the completed survey forms to the workgroups by the evening of day 8 (see figure 3). The student groups analyzed the returned data and prepared a short summary for me by 9:00 p.m. on day 10 (see figure 4). I incorporated the four group summaries into the completed preliminary analysis report.
During the course, a total of 1,400 documents were created by participants. Within this aggregate total, students and faculty generated 1,100 course-and group-database documents related specifically to the curriculum. This was an average of 50 discussions, analyses, questions, and assignments per student — a level of participation that would be rare in most on-campus courses over a similar time period. Computer conferencing and electronic mail provided 24-hour faculty access to answer questions, evaluate assignments and examinations, and provide advisement.

Impact on Learning and Costs
An evaluation of student achievement and program cost-effectiveness was conducted for introductory and intermediate course topics using the four online media technologies — hypertext, conferencing, audiographic, and digital video. Student performance in forty telecourse topics was measured by a combination of written assignments, group participation, project reports, and software utilization.

Introductory course topics delivered using digital video had the highest student achievement levels, with a mean score gain of 13 points over the baseline hypertext score of 80. At the intermediate level, video was a close second to conferencing in achievement with mean gains of 14 and 16 points respectively over the hypertext score of 76.

Introductory topics delivered using video were the most cost-effective, with a production/delivery cost of $89 per point of achievement gain, as compared with $136 per point gain for conferencing topics and $195 per point gain for audiographic topics.

At the intermediate topic level, video was also found to be the most cost-effective with an $83 cost per point gain versus $102 per point gain for conferencing topics and $292 per point gain for audiographic topics.

The teleprogram evaluation found that while faculty-led computer conferencing could effectively instruct students in the process inherent in a subject area, it could be unnecessarily labor-intensive in conveying the subject's content. NYU's Virtual College has shown that well-designed digital video presentations can often cover in minutes what asynchronous discussions would take hours to complete — and do so in a highly cost-effective fashion.

The On-Demand Future
Today Virtual College students can work on their telecourses at any time of the day and from practically anywhere, but they must still adhere to the fixed class and semester schedule established by NYU. But today's busy professional increasingly needs a new kind of telecourse — one that is available on a schedule established by the individual, not the institution.

Responding to this need, future Virtual College courses will be offered in an “education-on-demand” format. Once students are admitted to a program, they can register for telecourses anytime — and have from four to fourteen weeks to complete each one. The telecourses will use Notes workflow automation capabilities to track, prompt, and record student progress through the courses. Each on-demand telecourse will consist of multiple sessions that contain video, tutorial, laboratory, and reading modules.

While students largely work independently on these courses, computer conferencing, electronic mail, and even desktop videoconferencing access to faculty will be available to answer questions, evaluate assignments and examinations, and provide advisement. And throughout each telecourse, the network will support groups of students and faculty to work together on lessons and assignments.

The physical infrastructure of the global economy is rapidly changing from concrete and steel to computers and communications. The quality distance education program will likewise change to give working adults those collaborative and technical skills necessary for working within (as well as on) decentralized and networked workplaces — in effect, a virtual college preparing employees for tomorrow's virtual organizations.
For most new students at NYU, just arriving from high school, there is a drastic change in perspective regarding the Internet and its uses. When I arrived in late August 1996, I was amazed that every faculty member and student had access to computing resources, e-mail, and the World Wide Web. As a freshman last fall, I was one of the first to get an ID card with a “NetID.” I was enthusiastic about this netopia and within a few days had my home page online and listed at the NYU People Pages (http://www.nyu.edu/pages/advocacy/nyu_people). As the year went on, I discovered that I am part of large (and quickly growing) portion of the student body making serious use of the Internet in their education.

In my classes, the Teaching Assistants have been the university’s front-line in getting the faculty and students to utilize the Internet. The T.A.s are the ones I have found encouraging students to activate their NetIDs, and extolling the virtues of using the Internet for research and communication in the class.

In Writing Workshop I, a class that virtually every freshman in the university takes, a net-savvy instructor set up an ad-hoc mailing list using Pine’s address book function. Our class made good use of this system. It was a primary source for announcements, homework assignments, and discussions about the class’s progress. The most beautiful thing was that half of the discussions started in class went on at a good pace in the comfort of our computers. The instructor went even further by permitting us to use web pages as sources in our essays (though we had some trouble figuring out how, exactly, URLs fit into bibliographies).

In my “Conversations of the West” class (one of the College of Arts and Science’s Morse Academic Plan requirements) the T.A. gave a strong incentive for all of the students to activate their NetIDs — continuous access to him. We could e-mail him questions and he would answer them via e-mail, sometimes as far outside ‘office hours’ as 10 o’clock on Saturday night. He accepted early drafts of papers via e-mail and returned his comments over the net. The papers came back with comments inserted between the quoted text of the draft, which was easier to read (and less psychologically scarring) than red handwriting in the margins.

The Chemistry department has been doing the most interesting things I’ve seen with computers and the Internet. The newly renovated General Chemistry laboratory in Brown has been equipped with more than 50 Power Macintoshes, enough for each set of lab partners to have their own computer. Under the instruction of Professor John Halpin, we used digital computer probes in more than half of our experiments, getting measurements like temperature, pressure and pH with the probes. Results from some of the experiments look as though they could have come out of a textbook.

This fall, Halpin’s popular lecture is being reworked to include more technology. He is considering ways to use computer-based simulations to illustrate material which might come across more effectively in simulation than it could in conventional demonstration. He is also in the process of building a comprehensive web site with information...
complementary to the class (the syllabus, information about the many T.A.s, and lists of homework assignments).

Computer Advocacy @ NYU got the opportunity to help get a Biochemistry II class online. Professor Randall Murphy started by putting his syllabus and a course outline on the site. A form was then added so students could e-mail him questions right from the web page. As the class progressed, slides and transparencies were scanned in and made available on the site. Rather than having to worry about having missed something while scribbling down notes and running out to Unique Copy Center to pick up course materials, the students were able to get everything online at http://www.nyu.edu/classes/murphy/.

On top of the usual supporting materials distributed for a class, the Biochemistry II site has molecular models which can be viewed and manipulated online. Using Netscape with the Chemscape Chime plug-in, or using the external viewer Rasmol, students can examine PDB files of molecules discussed in class. It is surprising how useful these things can be when you are in the middle of Biochem homework at four in the morning!

While I had great experiences with technology in some classes, I also had many classes in which the Internet was not addressed as a meaningful way to spread knowledge. Out of a course book with thousands of classes, I found only handful of classes up on the Web. I know that the Internet is not going to completely change the way we learn overnight, but judging by the professors and T.A.s I have had, it is being recognized as a way to augment and enhance what is taught in the classroom.

Max Goldstein Prize for Undergraduate Creativity in Computing Awarded to Ilya Slavin

The annual Max Goldstein Prize for undergraduate creativity in computing was awarded to Ilya Slavin on April 29, 1997. Professor Jerome Berkowitz spoke eloquently on Max Goldstein’s contributions to the Courant Institute, ACF, and New York University. George Sadowsky, Director of ACF, presented the award.

The award honors the memory of Max Goldstein. As Professor Berkowitz recalled him, “Max was a talented negotiator — intelligent, tenacious and completely honest.” Professor Goldstein was on the computing staff at Los Alamos at the time of the Second World War, when Los Alamos was preeminent in scientific computing. When NYU became an Atomic Energy Commission computing center, Goldstein helped transfer the Los Alamos computing culture to New York, becoming the director of computing facilities for the Courant Institute of Mathematical Sciences. He was a founding member of the Computer Science department, working with Jack Schwartz to establish Computer Science as an independent department in 1969.

In 1980 Max Goldstein managed the transition of the CIMS computing facilities from a government laboratory to an academic facility. Professor Berkowitz remembered Max Goldstein’s success at that task, saying, “It required finesse and was not an easy trick.” Professor Goldstein directed ACF, while continuing to teach, up until his retirement in 1990.

Ilya Slavin graduated in May from the College of Arts and Sciences with a long list of computing accomplishments. He served as the second president of Computer Advocacy @ NYU, a student organization whose mission is “to increase access to, awareness of, and education on the computing and networking resources at NYU.” During his presidency, CA@NYU launched Computer Awareness Week — a successful series of events addressing topics from voice recognition systems to encryption and privacy to alternative treatments for RSI. Ilya also designed and taught the innovative Unix by E-Mail course, which covered Unix and Internet utilities using twice-weekly e-mail lessons. Over the two years he taught the course, almost 500 people learned Unix with Ilya’s electronic assistance.

After the presentation Ilya remarked that he is “not planning to go to graduate school just yet.” Instead he will be venturing out into the “real world” to a job in the financial district, working with networks and system security.

— Melissa Whitney
Star Death in 3D

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There was a time not so long ago when 3D visualization was something of a specialist's technique and was used only in certain narrow areas in the sciences. Now, however, visualization is rapidly becoming a popular approach to a broad range of theoretical and experimental problems, especially where complex 3D structure plays a role.

3D Astrophysics
Probably the most familiar kind of visualization technique is that used by chemists and biologists to study models of large molecules. The constituent atoms or molecular sub-groups are represented by simple shapes like spheres, and their locations are supplied by theory or by empirical rules, so the typical task is to visualize and sometimes manipulate a structure composed of prescribed elements in a prescribed geometry. A very different kind of situation occurs when measurements provide a 'solid' image in a true 3D data cube. In these cases, aspects of real data such as the noise in the measurements may be important, and much of the 3D space may contain useful information, posing a challenging visualization problem. This article describes a recent encounter with a problem of this kind, which arose in my research on the evolution of stars.

3D data problems occur only rarely in astrophysics, not least because most of the objects are too far away to sample directly. The object discussed here is about three thousand trillion miles away. It is called the Helix nebula, and is one of about 50,000 planetary nebulae in our Milky Way galaxy. In spite of their name, planetary nebulae are unrelated to planets, they simply look round like planets in small telescopes. These nebulae signal the death of ordinary stars like the sun.

When an ordinary star dies, it performs the ultimate recycling act. It blasts a major part of itself out into interstellar space at supersonic speeds, leaving a dead (inert) core known as a white dwarf. The ejected gas forms an expanding nebula. Recently, my collaborators and I have shown that in many cases the ejected matter cools rapidly to low enough temperatures that the gas forms molecules. These can be readily detected using the techniques of radio astronomy, and provide a new tool to study the death process.

As the nearest example of this phenomenon, the Helix nebula is an obvious candidate for intensive study. The molecular gas has been mapped in detail by collaborator Ken Young using the 10 meter telescope of the Caltech Sub-millimeter observatory atop Mauna Kea, on the Big Island of Hawaii. The observations were made in a transition of the carbon monoxide molecule (CO), at a wavelength of 1.3 millimeters which corresponds to a frequency of 230 Gigahertz (much too high to tune in with your stereo receiver). In addition to a conventional 2-D map of the nebula, the exquisite frequency resolution available at millimeter wavelengths allows the Doppler shift of the radiation to be measured. Because the gas is expanding away from the center, the Doppler motions can be used to estimate the position of the gas along the line of sight, thus providing a 3D image of the gas distribution. The final
3D data cube has a total of about 200,000 cubic pixels, with about 60 pixels on each side.

**Visualization with AVS**

The aspect of the Helix data of primary interest to us was the connectivity of the ejected matter. A first look at the data showed that the distribution of molecules was too complex to yield to a simple approach of slicing the cube into a series of 2-D images. We therefore turned to the AVS (Advanced Visual Systems) package, running on the ACF Scivis cluster. AVS has powerful 3D visualization capabilities, and turns out to be fun and really easy to use. The main obstacle is to read the data in. Each discipline has its own 3D data formats, which are even more perplexing than those used in 2-D images. Astronomers use FITS (Flexible Image Transportation System). Once the data cube is in, AVS provides dozens of modules to process the data, such as rotators, filters, colorizers, and viewers. The modules have a Lego-like structure and are simply linked together to form a data processing pipeline using a graphical interface. The user controls the modules with buttons, spinners, sliders, and the like — no programming is involved!

To explore the connectivity of the nebula, I made a pipeline to construct and view an iso-density contour (like the surface of a sculpture) showing the 3D shape of the main distribution of molecular gas. AVS then allows the user to play stage director with stage-like lights, half a dozen movable cameras, depth cues, and the ability to manipulate or spin the data in real time.

Examples of the output of AVS are shown in the figures. The upper panel shows the front view of the iso-density contour of the Helix. The remnant star core lies exactly at the center of the nebula, but is not seen here because it contains no molecules. The image looks very much like a conventional map, but the lighting and the depth cuing begin to hint at the 3D structure. Much more complete 3D information is gotten by turning the data-cube. The middle panel shows a side view (left hand) of the Helix by turning it through 90 degrees, and the bottom panel shows a view of the Helix from below by rotating it upwards through 90 degrees. These views immediately reveal the complex global structure of gas. These views could never be directly seen from planet earth. It would take a spacecraft about 400 years traveling near the speed of light to maneuver into a position in space to see them, and another 400 years to beam the images back.

To an astronomer, the most striking aspect of the visualization of the Helix data is the point symmetry.
of the system. For each blob of gas ejected on one side of the star, there is a quite similar structure ejected on the opposite side. The situation resembles a double headed garden hose that squirts water out in two opposite rotating jets. The physical mechanism for this is in stars is unknown, but is strongly believed to be due to the effects of a binary system, where a nearby star affects the way in which its companion star dies.

What about us? How will our sun look when it dies in about 5 billion years time? Well, our sun is a single star, so there is a good chance that it will blow itself apart into a much simpler nebula than the example shown here.

New Priorities for the National Science Foundation Supercomputing Centers

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The National Science Foundation provides high-performance computing and high-speed networking connectivity for scientific applications at four national centers to qualified researchers and students. These centers are:
- Theory Center (TC) on the campus of Cornell University in Ithaca, New York (www.tc.cornell.edu)
- Pittsburgh Supercomputing Center (PSC) located between Carnegie-Mellon University and the University of Pittsburgh in Pittsburgh, Pennsylvania (www.psc.edu)
- San Diego Supercomputing Center (SDSC) on the campus of University of California, in San Diego, California (www.sdsc.edu)
- National Center for Supercomputing Applications (NCSA) located on the campus of the University of Illinois at Urbana-Champaign (www.ncsa.edu)

First Phase (1985-1991)
High-Performance Computing and Communications
In 1985, five NSF supercomputing centers were established following the guidelines of the Lax Report (See the September 1993 and January 1994 issues of this magazine). At that time supercomputer resources were expensive to acquire and maintain, requiring substantial resources and highly skilled staff. Many researchers at universities and smaller institutions were thus enabled via the Internet to gain access to computing resources and investigate problems that they only dreamed about. The centers also promoted the idea of scientific visualization — the use of advanced computer-based graphics to transform the output of the computations into visual forms easier to understand than very large streams of numbers.

Grand Challenge Problems and Metacenter
In 1991, after a review process, only the four centers listed above continued to receive funds from the NSF. Although the centers continued to provide performance computing to any qualified researcher, the focus shifted to supporting so-called Grand Challenge Problems of national and international interest. The Human Genome, Climate Modelling, Vision and Cognition are examples of Grand Challenges. Problems of this scale require the collab-
oration of teams of researchers and advanced students from many disciplines, at disparate locations. The teams not only use conventional means of communications and computing at their home institutions but also require the powerful specialized computing and visualization resources available only at the diverse NSF locations. The idea of an NSF Metacomputing Center emerged.

This virtual center was made up of the resources of the four centers and those of the National Center for Atmospheric Research, (NCAR) an NSF supported site in Boulder, Colorado. Over twenty supercomputers, interconnected via a very high speed backbone network service or vBNS, could be utilized by teams of researchers and support personnel to solve very large and complex problems.

In 1993 the NSF Blue Ribbon Panel on High Performance Computing, chaired by Lewis Branscomb, issued a report “From Desktop to Teraflop: Exploiting the US lead in High Performance Computing,” detailing challenges, visions and goals in pursuit of systems that could perform one trillion floating point operations per second or “teraflop.”

This report fostered research and development in the area of computing systems made up of very large numbers of powerful commodity processors. Starting in 1996, systems from Japan and the United States started to appear claiming near teraflop performance. Some of these were developed at universities, while others were sponsored and funded by government agencies. Most notable were systems made up of thousands of off-the-shelf Intel, Hewlett Packard, or DEC Alpha processors.

Third Phase (1997)
Partnerships, Alliances and Outreach
In March of this year the National Science Board announced that it has chosen two awardees for the National Science Foundation’s new Partnerships for Advanced Computational Infrastructure (PACI) program. The National Computational Science Alliance — led by NCSA — and the National Partnership for Advanced Computational Infrastructure (NPACI) — led by SDSC — have been chosen for awards.

The National Computational Science Alliance, lays out a vision for a distributed environment whose goal is to prototype a national information infrastructure that enables the best computational research in the country. The Alliance is organized into four major groups: Application Technologies Teams that drive technology development; Enabling Technologies Teams that convert computer science research into usable tools and infrastructure; Regional Partners with advanced and mid-level computing resources that help distribute the technology to sites throughout the United States; and Education, Outreach, and Training Teams that educate and promote the use of the technology to various sectors of society. In addition, the NCSA site will support a variety of advanced parallel systems and network architectures which will enable large-scale computation for scientists and engineers across the country.

The National Partnership for Advanced Computational Infrastructure proposal includes a national-scale metacomputing environment with diverse hardware at several distributed sites. In addition to supporting the large-scale computational needs of researchers across the country via a variety of advanced systems at SDSC, NPACI will foster the transfer of technologies and tools developed by computer scientists and software engineers for use by the computationally intense user. A major focus will include information rich computing, digital libraries, and large data set manipulation across many disciplines including engineering and the social sciences, and supported by many partners around the country. Outreach is focused in California and Texas, which represent twenty percent of the nation’s K-12 students.

Additionally, educational efforts will extend across both partnerships. The programs will focus on students at all levels, providing access to facilities, tools, training and curricula. The efforts will reach out to non-traditional high performance computing communities such as museums, libraries and social scientists, and will also have a particular aim of increasing the participation of women and minorities in computing. Educational efforts will be evaluated by the National Institute for Science Education.

NSF funding for the Theory Center at Cornell, and for the Pittsburgh Supercomputing Center will be phased out over a period of two years. The impact of the loss of these two centers on researchers and students at New York University will be cushioned by gaining access to the expanded resources of the two re-positioned centers. The ACF Scientific Computing Group will continue to provide advice, consultation and access to the com-
puting and communications resources both at NYU and at research establishments on the Internet, including SDSC and NCSA.

As a charter member of the Internet2 initiative, ACF is working with other universities and networking organizations in establishing a new very high-speed research network. Internet2 is expected to be 100 to 1000 times faster than the current Internet. Not only will it provide expanded capabilities but it will accommodate new applications particularly in the area of assured delivery of multiple and synchronized streams of information. The notion of “Quality of Service” or QoS, is especially important in several areas such as distance learning and training, metacomputing, reliable multi-media conferencing, and tele-medicine.

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**Scientific Computing and Visualization — Resources at ACF**

Hardware and software for Scientific Computing and Visualization at ACF are distributed amongst three clusters — SCIHPH, SCIVIS, and SCIRES

**SCIHP (Scientific High Performance Computing)**
This cluster is used for research and instruction in the development and testing of applications in a parallel computing environment. In addition some production level computing and compute-intensive imaging can be performed. To meet increased demand for high performance computing and parallel systems, we deployed several new DEC Alpha systems and added processors to the existing SGI Power Challenge systems, as well as additional memory and disks.

For more information, please visit the SCIHP web page at [http://sciweb.nyu.edu/scihpc](http://sciweb.nyu.edu/scihpc).

**SCIVIS (Scientific Visualization Computing)**
Scientific Visualization at ACF continues to focus on its goal of promoting the latest visualization systems to enhance research and instruction in the sciences. Visualization tools benefit from the availability of modern workstations with high performance, large amounts of memory and disks, and powerful graphics facilities. Leading edge visualization applications tend to require the most powerful system available, such as Silicon Graphics systems which offer substantial computation power coupled with high-speed 3D graphics.

ACF’s Science and Visualization Group has installed two new SGI O2 systems (napier and pauling) offering a new unified memory architecture that delivers a feature set and level of performance previously available only on much more expensive workstations. In addition, we installed an Origin 200 server that supports up to four CPUs, 4GB of shared memory, and more than 109GB of internal storage. As WINTEL charges into the computing market, Windows NT is quietly becoming a major force in computer graphics and computing. To keep abreast of this new technology, we have acquired a Dual Pentium Pro 200 MHz workstation running Windows NT 4.0 for exploring the future of computing and computer graphics on the WINTEL platform.

For more information on this cluster, visit the SCIVIS home page at [http://sciweb.nyu.edu/scivis](http://sciweb.nyu.edu/scivis).

**SCIRES (Scientific Research)**
This cluster is dedicated to support research activities such as manuscript preparation, lightweight computing, World Wide Web related activities, and scientific applications not requiring substantial computing, communications, resources, or storage utilization.

For more information please visit the SCIRES home page at [http://sciweb.nyu.edu/scires](http://sciweb.nyu.edu/scires).

To further enhance the Innovation Center laboratory we acquired the following useful peripherals.

- **UNIX Scanner Ricoh FS2 Full Color Image Scanner.** The clarity of its 1200 dpi resolution enables the FS2 to scan even the smallest details without losing any information.

- **Tektronix Phaser 550 1200DPI Color Laser Printer.** This printer offers fast print speeds and good output quality, with the most durable results.

The ACF also provides a broad range of software to support scientific computing and visualization. The programs are constantly evaluated for usefulness and currency.

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_Frances Bauer and Adel Hanna_

_ACF Science and Visualization Group_
Matlab 5: A Preliminary Review

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Matlab 5 by Mathworks is the latest release of the popular numerical mathematics software system. This version came out in December of 1996. Since major software upgrades of this kind often go through painful processes of testing, debugging and user adjustment, it is premature to give a comprehensive review. Therefore this article is just a preliminary examination of Matlab 5.

The key to the Matlab’s success has been the combination of a powerful computational engine and an elegantly simple but richly extensible programming environment. For this review, we stick to the basics and look at the changes that may affect this combination.

For performance, we ran the same benchmark programs that are provided with both Matlab 4.2c and Matlab 5.1 (beta) on our new SGI Origin 200 (4 180 MHZ CPUs with 512 MB of memory) and on a PentiumII (266 MHZ with 64 MB of memory, running Windows 95.) Here are the partial results, in seconds:

<table>
<thead>
<tr>
<th>Matlab Version and Platform</th>
<th>Loop (integer)</th>
<th>LU-Decomposition (floating point)</th>
<th>Sparse Matrix (mixed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Matlab4.2 on SGI</td>
<td>0.7559</td>
<td>0.9043</td>
<td>0.9064</td>
</tr>
<tr>
<td>Matlab5.1 on SGI</td>
<td>0.9157</td>
<td>0.4598</td>
<td>1.8034</td>
</tr>
<tr>
<td>Matlab5.1 on PentiumII</td>
<td>0.8300</td>
<td>0.6600</td>
<td>0.8200</td>
</tr>
</tbody>
</table>

The PentiumII seems to give the best overall performance of the systems that we tested. On the SGI Origin200, floating-point performance has greatly improved, while integer and mixed performance declined just as dramatically. Similar results were also obtained on several other SGI platforms. We don’t know whether this phenomenon is unique to the SGI systems or true on other UNIX platforms.

Several years ago, Mathworks decided that they would not make a coherent effort to develop a parallelized version of Matlab. The justifications given then were based on technical and business perspectives, and by now somewhat dated. Many matrix computations are intrinsically parallel. More importantly, much of the parallelization can be hidden in the built-in functions, thus becoming transparent to users. If Matlab is to be a tool for high performance computing now and in the future, parallelization should be the next logical step in its development.

The Matlab programming environment offers a wide range of possibilities. On one hand, it can be used as the path of least resistance to get at the heart of a problem, because Matlab is by far the easiest system to test proposed algorithms. On the other hand, one can also use Matlab’s whole spectrum of development tools to create efficient and polished application packages, known as toolboxes. Matlab5 comes with an impressive list of new features. Some of these features, such as multidimensional array, m-file performance profiler and visual debugger on PC and Mac, are easy to use and will significantly enhance the capability of the Matlab system. Other features such as GUI builders and user definable structures and classes make Matlab a full-fledged programming language and development environment.

A couple of trends have emerged with the current release of Matlab. The first is that Mathworks now puts a stronger emphasis on the Intel-NT systems. The second is the shift of Matlab as a package for scientific and engineering computing to a more general system for technical computing. Although these trends may be good things in themselves, we can only hope they will not come at the expense of Mathworks development effort on those aspects that have made Matlab so popular to scientists and engineers in the past.

Hua Chen is a system administrator for scientific computing and consultant on high performance computing at ACF. Additional information on the new features of Matlab 5 are available on his home page at http://sciweb.nyu.edu/staff/chen/CON/newfeatures.html.
Geographical Information Systems (GIS) use spatial technology to allow you to view, query, and analyze data based on locational context. At the most elementary level, user friendly GIS packages (MapInfo and ArcView) are used to create thematic maps, which use colors and symbols to convey information like population density. For example, colors on a scale from white to red might be used to shade counties, where white represents low population density, pink shows moderate density, and red shows high density.

Complex thematic maps show several data layers by combining colors, symbols and textures to convey information. Colors may show land usage: green is parks, grey is populated areas. Lines representing roads can indicate number of lanes by line thickness and road surface by line color. Three dimensional shading is used to indicate altitude. Shapes of symbols designate schools, hospitals and factories. Photomaps have advanced graphics features that allow the viewer to zoom in on a symbol to see a photograph of the facility represented by the symbol. Other advanced “smart” maps display a route between two points selected by the viewer’s mouse clicks. Other advanced functionalities of GIS include network analysis, spatial modeling, terrain analysis, parcel mapping, data management, raster data scanning, production cartography, data warehousing, Internet products, and CAD.

GIS data is of two types. The first type gives us the maps themselves, stored as raster images (points or pixels) or vector images (points, lines and polygons). The second type, attribute data, is information such as population, hydrology, or soil type that can be attributed to points or areas on the map. Attribute data is geocoded onto the map: it is stored with its associated location information.

There is a natural progression from basic database development to GIS and spatial analysis. Standard database queries include comparisons such as greater than and less than, and data fields such as income and production. If you take a database and add fields for latitude and longitude (point data) or for county and state (area data), then GIS comparisons using concepts like nearness to and inside of naturally follow.

**GIS Software at ACF**

The Social Science Group provides access to the following software packages for GIS applications:
- ArcView GIS version 3.0 for Windows, with Network Analyst and Spatial Analyst modules
- ArcInfo for PC version 3.5
- ArcInfo for Unix version 7.1.1
- ArcInfo for NT version 7.1.1
- ER Mapper demonstration version 5.5
- Grasslands for NT version 1.1
- IDRISI version 2
- MapInfo Professional version 4.0
- MapInfo Basic

The mapping software marked with an asterisk (*) is available for use on the Social Science Group workstations by appointment. The Unix GIS software is available when you obtain an ACF computer account on the requisite machine. MapInfo Professional is
available in the Tisch Hall and 14 Washington Place ACF labs. For details, or to reserve time on a workstation, call Frank LoPresti at 998-3398.

**ESRI's ArcInfo and ArcView**

ESRI is one of the premier GIS providers worldwide. For many years, ESRI has worked with all levels of governmental departments to develop mapping applications specific to their needs. Water authorities responsible for river basins spanning several states, fire fighting organizations in areas with reoccurring large scale fires, and government agencies responsible for infrastructure management have worked with ESRI to develop complex spatial databases combined with event modeling to allow them to more effectively deal with floods, fires and to administer public works. Data warehousing with its open standards and client/server implementation is a core component of ArcInfo. Modules also exist to allow Internet access to data and mapping without specialized software. ArcView, ESRI's beginner package, has more limited functionality than the high-end Arclnfo package. An online ArcInfo demonstration is available at http://maps.esri.com/ESRI/esri.htm. ACF has many ArcInfo and ArcView modules on various platforms.

University research and course development is presently taking place with some of these tools. The ACF Statistics and Social Science group itself has been involved for several years in a demonstration project for corridor selection for oil pipelines. See the Summer 1996 issue of Connect for more on this project.

**ER mapper**

ER mapper provides high-end technology and functionality for advanced mapping applications. It is a single product with no additional modules. Map editing, image processing tasks and mapping functions are simple click-and-drag functions.

**Grasslands**

GRASS (Geographic Resources Analysis Support System) command language was a powerful early GIS application developed by the US Army Construction Engineering Research Laboratory (CERL) in 1981. Grasslands makes the spatial analysis capabilities of GRASS available on personal computers and adds a user-friendly interface. Grassland is useful for reading almost any geodata file format, including DIGEST (VRF, DTED, ADRG), Grass, DXF, and ArcInfo. For more information, see http://www.las.com/grassland.

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**Social Science Data at Bobst Library**

The Business and Social Science Documents Center on the sixth floor of Bobst Library offers access to a wealth of primary social science data. Though most requests for large data sets are referred to the Academic Computing Facility, the sixth floor reference collection is an excellent starting point for students and faculty who are looking for quick answers to simple data questions. The Center contains print reference resources to data in all areas of the social sciences, including a United Nations Documents Depository, and a United States Documents Depository. The U.S. Depository has strengths in Census and Health and Human Services data. Much of the Depository material is available in CD-ROM format for use in the Library. Users may also obtain government data through the Center's new U.S. Government Documents Internet Workstation.

— David Hellman

U.S. Government Documents Librarian
david.hellman@nyu.edu

**Idrisi**

The IDRISI Project is a non-profit project founded by Geography Professor Ron Eastman within the Graduate School of Geography at Clark University. Inexpensive and easy to use, this raster-based geographic analysis package is designed for a worldwide audience, with 16,000 registered users in over 130 countries. The United Nations has been involved with its funding and distribution.

No expensive graphics cards or peripheral devices are required to make full use of the analytical power of IDRISI for DOS. IDRISI for Windows, first released in 1995, adds a graphical user interface. The program is named for the cartographer and geographer, Idrisi. He headed a collaborative effort commissioned by King Roger of Sicily in the medieval period to prepare a geographical survey of the world. For more information on IDRISI see http://www.idrisi.clarku.edu.

**MapInfo**

MapInfo has been used successfully in courses at NYU for several years. Though it has limited functionality, it does allow for geocoding and thematic map preparation. It is available on ACF servers. Individual licenses cost about $300. More information is available at http://www.mapinfo.com.
New Statistics Media Machine Handles Everything But Punched Cards (Almost)

Social-science data archives have evolved over the last century from the physical to the ethereal. At the turn of the century, even before computers, information was stored on paper cards, punched with patterns representing the data. These punched cards were invented by Herman Hollerith for use in the 1890 Census. Punched cards were adapted for storing and tabulating world-wide weather data to create wind predictions. A 1934 WPA Depression project resulted in two million ocean climate observations being translated to punched cards and then summarized into an atlas.

World War II spurred mammoth data collection activities. These projects funded advances in computation machines and data storage, such as IBM's punched card sorting ('accounting') machines, developed to summarize and analyze these large data sets. With the war's end, governmental and non-governmental data archival groups proliferated. NYU was a founding member of the Inter-university Consortium for Political and Social Research (ICPSR) at that time and systematic methods were developed for providing academic access to data.

In the sixties came computers and with them reel-to-reel tapes that could be copied and shared. IBM computers first started using 0.5 inch magnetic tapes for data storage in the 1950s. Data entry was done with punched cards until the late 1970s, when video terminals and full screen editors became widely used, allowing accurate keyboard entry. The most recent development has been the availability of data sets over the Internet as invisible, infinitely reproducible data packets.

As the means for storing and sharing social science data have evolved, the governmental and educational institutions who collect data have changed their distributions methods. From the 1970s up to 1995, ICPSR distributed census and other socio-economic data to its member universities by mailing out 0.5 inch tapes. Today, we download large and small ICPSR data sets over the Internet.

The Academic Computing Facility Social Science web page at http://www.nyu.edu/acf/socsci provides links to ICPSR's catalogue of over 10,000 data sets. Researchers can browse the ICPSR archive catalogue and then e-mail us a request for a specific data set. The data is deposited in our ftp site, along with any documentation available in electronic form. Researchers generally have use of the data on the same day. On a good day, a U.S Census five percent sample for New York (200 megabytes) can be sent to us in less than an hour.

Changes in data storage and distribution technology take time to be adopted, and legacy forms persist. A surprising number of government agencies (e.g. Department of Commerce, the New York City Board of Education) still distribute their data on old 0.5 inch tape. To accommodate data transfer among different storage media, the Statistics and Social Sciences Group of ACF has established a Statistics Media Machine named STATS2. The STATS2 computer is an NT dual processor Pentium Pro connected to NYU-NET, equipped with 0.5 inch and 4 mm tape and tape cartridge drives. It also has the capacity to read and write CDs, Zip 100 megabyte floppies, and 4mm DAT tapes, allowing researchers at NYU to move data from old media to new.

In addition to providing media transfer, STATS2 serves as a demonstration computer for new statistical and GIS software packages. Researchers interested in exploring these new applications are encouraged to call Frank LoPresti at 998-3398 for more information.

— Frank LoPresti
ACF Statistics & Social Science Group
The Perils of Insufficient Statistical Power
A Comparative Evaluation of Power and Sample Size Analysis Programs

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New statistical modules and packages for power and sample size analysis are making their appearance. Professors, researchers, and advanced graduate students interested in doing serious research and applying for grants need to know how to use these programs. For this reason, attention is directed to a few of the prominent and useful innovations in these tools of analysis. Three of these most needed of programs are Sample Power, by NYU Professor Jacob Cohen, Statpower, by Dr. James L. Bavery, and Power Analysis and Sample Size (PASS 6.0), by Jerry Hintze, all of which perform power and sample size analysis. The Statistics and Social Science Group at ACF has already acquired Statpower from Scientific Software, Inc. and is in the process of obtaining Sample Power, from SPSS, Inc.

Skating on Thin Statistical Ice
To help researchers and doctoral students avoid the disasters and catastrophes of insufficient data, power analysis is necessary to be sure that the sample size of a study is large enough so that the statistical tests can actually detect the differences that they purport to find. If the sample size is too low, the standard statistical tests will not have the statistical power to detect differences that really exist. What happens in these cases is that no significant difference is found, although in reality such a difference exists. With the decline in sample size, the probability of acceptance of a false null hypothesis, sometimes referred to as beta, increases under such circumstances.

False similarities plague the findings where differences in fact exist. This masking of differences is one of the reasons that studies with small sample sizes, lacking the proper preliminary power and sample size analysis, are treated with suspicion by statistical cognoscenti. If medical researchers are engaged in clinical trials of a drug, insufficient sample size that undermines assessment is criminal.

Moreover, this is the principal reason for which persons applying for large grants usually have to perform power and sample size analyzes for the statistical tests they are planning and show that they can detect small or medium effects with sufficient power (usually of 0.8). With a power of 0.8, the user has a 20% chance of making a type II error — obtaining a false negative result (in other words, the failure to detect a real difference when it exists) from insufficient sample size. For these reasons, it is important for researchers to understand the concept of statistical power and to know how and when to apply it.

Criminal Negligence and Wasting Resources
If the sample size of the study is too large, then the monetary, temporal, and scheduling costs of gathering the data may be so formidable that only the resourceful can do the research. If, however, students and researchers manage to muster the time and funds necessary to collect the data, they may develop much more power than they need. If the study is a clinical trial involving the random assignment of patients to an experimental group during the toxicity testing phase, then placing more subjects at risk than necessary, even though they might have given informed consent, is criminal. As the sample size increases, the size of the standard error decreases and power increases, for a given level of probability of alpha, the Type I error.

A Type I error, rejection of a null hypothesis where there should have been no rejection, is in inverse proportion to the power. Too large a sample size means the waste of valuable resources in the process of the data collection. The key questions are how much sample size is enough, how much safety margin is needed, and how much is too much. In short, what is the optimal sample size?
**Purpose of the Pilot Study**

Standard social science research procedure involves a pilot study. From the pilot study, the researchers learn the cooperation rate in the target population. They glean a preliminary assessment of the prevalence rate of a trait, characteristic, or disease. From the power and sample size analysis, the researchers ascertain the needed sample size. By multiplying the prevalence rate by the cooperation rate and dividing this product into the needed sample size, the researchers can calculate how many persons they have to target for interviews or questionnaire administration to procure the proper sample size for their analysis. From their margin of error, they can determine how much of a safety margin they should allow in their calculations.

**Sample Power, PASS, and StatPower**

Sample Power, developed from the older Power Analysis program by Michael Borenstein and Jacob Cohen and marketed by SPSS, Inc., is a user-friendly and delightfully simple program that handles much of the bread and butter basic statistics that undergraduates and some graduates need to do. This program computes sample size needed for a desired level of power or, alternatively, it calculates the power from a given sample size. The user is sometimes asked to include additional parameters explaining the nature of the analysis. For example, suppose the analyst wishes to compute the power of a chi-square test. The analyst specifies the alpha level, the number of degrees of freedom for the test, and the noncentrality parameter, whereupon the computer program computes the power. If the user does not know how to compute the noncentrality parameter, he may invoke the analysis assistant, which will compute the noncentrality parameter from the user specified effect size, sample size, and number of rows and columns in the table. From the noncentrality parameter calculation, the power will be computed for a given alpha level.

Similarly, Sample Power calculates power and sample size for a variety of basic t, proportions, and crosstabulation tests. For a number of t-tests, it tests whether the t=0 or t=specific value. It does this for one sample t-tests, two sample t-tests with the same variance, two sample t-tests with different variances, and paired t-tests. The program computes power for a number of tests of proportions as well. The program will test whether a proportion equals 0.5 or a specific value. It will test 2x2 independent samples chi-square or Fisher’s exact tests, as will Jerry Hintze’s Power Analysis and Sample Size Program (PASS 6.0), distributed by NCSS. Paired proportions power is tested for McNemar’s test. The sign test power can be calculated as well. A table comes up for each of the tests allowing the user to input specific sample sizes for different cells and then to request a graph of power as a function of number of cases for the given effect size, alpha level, and number of tails for the statistical test under consideration.

For correlation and regression analysis, Sample Power assesses power for different sample sizes. For correlation analysis, the power analysis program will test the power for specific sample sizes, alpha levels, one- or two-tailed tests for a correlation that is equal to zero, equal to a specific value, or equal to each other. For regression analysis, StatPower has almost the least capability. It can handle multiple correlation with and without partialling. PASS 6.0 is slightly better and can handle one or two set regression analysis, with the first set consisting of covariates. Sample Power, which has even greater flexibility, will handle one set of independent variables; a model with a set of covariates and a set of independent predictors; a model with a set of covariates, a set of independent variables, plus a set of interactions; a polynomial regression; and a model with covariates and dummy variables. The user merely has to indicate the number of independent variables, the r square of the respective set of independent variables, and the sample size, after which the program will compute the power for each set.

For ANOVA designs, Sample Power and PASS 6.0 are very good for basic cross-sectional analysis. These two programs as well as StatPower, the Statistical Design Analysis System, developed by James L. Bavry, Ph.D and distributed by Scientific Software, perform the one-, two-, and three-way fixed effects analysis on randomized block anova and a repeated measures design with one between and one within subjects effect. The advanced psychology researcher might prefer StatPower which performs power and sample size analyzes for one- and two-way fixed effects, one- and two-way random effects, and gen-
NYU was named among America's 100 Most Wired Colleges by Yahoo! Internet Life. Dina Gan writes in the May issue of Yahoo!: "College is supposed to prepare you for the real world, and let's face it: the future is wired." So is NYU.

More than sixty percent of NYU students own their own computers. Every student has an e-mail account created for them on arrival; all they have to do is activate the account. They get complete online access to the university's library catalogs through BobCatPlus, and unlimited World Wide Web access, along with space for publishing their own web pages.

NYU continues to get even more wired. Students can now get a list of their course books online, complete with prices, from the NYU Book Centers' web site (http://www.bookc.nyu.edu/). More and more courses maintain class-specific home pages with round-the-clock access to syllabi, lecture notes, homework assignments and the ever-important e-mail addresses of the professor and T.A.s, for late night questions and explanations.

Beware the Type III Error
Which of these programs the analyst prefers depends on his needs. For the beginning student, Sample Power is probably the most useful. For the researcher more interested in experimental design, StatPower is probably the most useful. For the biostatistician, PASS 6.0 may be the most useful. Professor Robert Lee of Pace University and former chairperson of the New York Chapter of the American Association of Public Opinion Research (AAPOR), cautions against what he calls the Type III error, "the failure to ask the right questions in the first place." In this light, this author notes that Sample Power has no, and Statpower and PASS 6.0 have only limited, longitudinal capability.

In directions for future research and development, there will be a growing need for analysis of power and sample size of time series data with time series tests and sparse data with Exact tests. While Exact tests are robust to errors of the alpha level, they need a power and sample size analysis to indicate the magnitude of the problem of the Type II error. There needs to be more theoretical development and statistical package implementation in both of these areas. It is hoped that future research and development in this area will fill these gaps of knowledge and capability. For assistance with these matters please e-mail me at robert.yaffee@nyu.edu or phone me at the ACF Statistics and Social Science Group, 998-3402.

Further Reading:
The NYU-NET II Project has drawn to a successful close, but work on our information infrastructure will never cease. For more on NYU-NET, see page 6.