On the Cover

The mixed-media graphic on the cover is a hand-colored linocut with monotype by Sandra Z. De Visser. Entitled "Mythical," this print reflects a fusion of the artist's lifelong interests. Ms. De Visser uses the cultural styles of various historical eras as the thematic inspiration for her mixed-media images. The artist is an adjunct lecturer at SUNY Institute of Technology at Utica/Rome, currently teaching History 307 and Art 340-11. In addition, Ms. De Visser is on the adjunct faculties of Utica College of Syracuse University, Mohawk Valley Community College, Munson-Williams-Proctor Institute School of Art, and Rome Art & Community Center.

The artist exhibits regularly in the area's regional exhibitions, frequently receiving award recognition. In March 1993 Ms. De Visser participated in a three-artist show at the Rome Art & Community Center. She is anticipating a solo show in the SUNY Institute of Technology Gannett Gallery in October. Her work is included in corporate collections, including the Rome Sentinel and Ethan Allen, Inc., as well as numerous private collections.

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Publisher

Research and Creative Expression is published annually by the Office of the Executive Vice President for Academic Affairs at the State University of New York Institute of Technology at Utica/Rome.

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The articles in this issue were selected to provide a cross section of the scholarship and creativity of our full- and part-time faculty. I am especially pleased to call your attention to the cover of this issue. It reproduces a mixed-media graphic by Sandra De Visser, one of our adjunct instructors in art. For the first time in its history, the SUNY Institute of Technology is offering two art electives on campus, and we are happy to celebrate our modest venture into the fine arts by featuring Ms. De Visser's work on our cover.

Another important milestone for this publication is the formation of an Editorial Board. The board will work with the editor to oversee the direction and content of this publication. All articles accepted for publication must now be approved by members of the Editorial Board, and, in some cases, are also being read by other faculty specialists before they are accepted for publication.

Members of the college community are encouraged to submit articles for future issues and may obtain guidelines from the editor. We invite you to share this issue with friends and colleagues. Moreover, we always welcome your suggestions and comments. All remarks should be addressed to:

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The National Research and Education Network:
A New Tool For Research and Education

by
Russell L. Kahn

Overview

The growth of computer-based networks for administrators, teachers, and students has been changing the way educators address the important issues of restructuring the learning environment, site-based management, performance assessment, and practitioner isolation.

In her paper, "Statewide Telecommunications Networks: An Overview of the Current State and the Growth Potential" (December, 1990), Dr. Barbara Kurshan noted that "The growth of statewide telecommunications networks has been phenomenal during the past 18 months. Studies have found that virtually every state is currently implementing some form of state network for education [1]."

Nationally, there is an effort to develop a global network—the National Research and Education Network (NREN)—which will link most colleges, universities, and K-12 schools. Referred to as the "computer expressway of the future," NREN, which is federally funded under the High Performance Computing Act of 1991[2] will provide access to information systems (such as libraries) and data banks, as well as diverse scientific aids such as supercomputers, telescopes, and electron microscopes. What makes all this especially interesting is the fact that all universities in the SUNY system (including SUNY Institute of Technology) have access to the Internet, the precursor to NREN, and will be on the NREN itself, once it becomes functional. This paper looks at the history and mission of the NREN, both through a literature search, and by looking at the mission statements of the groups chartered to oversee the NREN, as well as testimony from Congressional hearings regarding the network. The paper looks at what networking provides educators both in research and teaching.
Generally speaking, networks provide academics with access to:

- Information, resources, applications, databases and bulletin boards.
- Peer-to-peer applications including shared lesson planning, software review and sharing, curriculum development and administrative site-base management support.
- Resources for classroom including data collection, shared writing, global explorations and access to other resources including higher education scholars, scientists and writers.
- Mentoring for interaction between teachers and teacher trainers, student teacher support, curriculum guidance and administrative contact.

The importance of getting relevant information quickly cannot be overstated, as Kenneth King, the President of EDUCOM testified at a Senate panel hearing on the NREN.

Studies have shown that productivity is proportional to access to information. By greatly reducing access time, networking is a critical element of the national competitiveness and productivity equation... Our vision of a national network would enable text, digitized sound, and pictures to be sent from one place to another in seconds rather than days. Scholars at colleges and universities, industrial laboratories, and government laboratories would be able to work simultaneously on a common body of knowledge. Thus the network will accelerate the transfer of research results to the private sector. The impact of this technology on scholarly productivity and national competitiveness will be profound[3].

An Overview of the NREN
Perhaps it is best to start a discussion of the NREN with a general definition. The following description, released in 1989 by the Federal Research Internet Coordinating Committee (FRIICC) in its NREN program plan, may be a useful starting point.

The NREN will provide high-speed communication access to over 1,300 institutions across the United States within five years. It will offer sufficient capacity, performance, and functionality so that the physical distance between institutions is no longer a barrier to effective collaboration. It will support access to high-performance computing facilities and services... and advanced information sharing and exchange, including national file systems and online libraries.... the NREN will evolve toward fully supported commercial facilities that support a broad range of applications and services[4].

The Office of Technology Assessment (OTA) report High Performance Computing Networking for Science, refers to the NREN as an information infrastructure for research[5] and includes among the networks and associated services connected with it:

- Mainframes
- Supercomputers
- On-line experiments
- Digital electronic libraries
- Workstations
- Electronic journals
- Electronic mail and bulletin boards
- Special purpose computers

The evolution to a single, national computer network began in the 1960s with the development, by the Defense Advanced Research Projects Agency, of the ARPAnet. Although supported by the Department of Defense, ARPAnet became a fairly open research network among national research centers. Interestingly, ARPAnet was initially justified on the basis of the need to share computing facilities. What evolved was a different style of interaction based on being able to send mail, transfer files, and hold public forums and conferences using the network’s electronic bulletin boards and computer conferencing capabilities. Similarly, although the NREN is often discussed as a way to access supercomputers easily and affordably, it may be its information dissemination and collaboration capabilities that may become its most significant component, particularly for educators and students[6].

The 1980’s saw the development of several related networks, including BITNET (a general file transfer and electronic mail network) and CSNET (Computer Science Network), which were mainly used by academic and industry professionals who were not served by ARPAnet. In recent years, the number of networks has grown exponentially, interconnected by phone systems, satellites, and optical cables. Many use “value added” carriers, such as Tymnet, TELENET, and Telnet, which lease transmission lines and provide improvements in line efficiency, capacity, and cost for computer data transmission.

A major breakthrough in networking occurred in the 1980’s when many of these networks were linked through the Internet. This government-supported network acted as a computer-based gateway, which translated the protocols of the different hardware and software communication systems into a commonly understood language. (Protocols are sets of technical standards that in a sense are the “languages” of the communications systems.) As a result, while individual networks remained sepa-
rate, they could still "talk" with each other through a process known as "handshaking." This division into small focused networks had the advantage of keeping network management close to its users. But the cost of maintenance and development and the inability of any one network to reach all interested parties called for a more centralized system. The Internet now provides computer connections between hundreds of universities, government laboratories, and industrial research organizations.

A first step toward a truly integrated national research network occurred with the development of the National Science Foundation supercomputer centers in February, 1985. The NSFNET was first developed to link these centers (at Cornell University, The University of California at San Diego, The University of Illinois at Urbana Champaign, the John Von Neumann Center in Princeton, and later the Pittsburgh Supercomputer Center). Currently, over 300 universities have access to this network, with nearly 1,000 individual subnetworks. The rate of growth is an impressive 20 per cent per month [7, 23]. In 1985, the Senate Commerce, Science and Transportation Committee began studying the possibility of a single, integrated network. The committee’s role was to develop a new advanced national research network by the year 2000[8]. In June 1986, Senator Albert Gore, chair of the Senate Science, Space, and Technology Subcommittee, introduced the Supercomputer Network Study Act of 1986, which was subsequently passed by Congress. Out of that act grew the Computer Network Study Planning Group, an inter-agency committee that held a series of meetings and released a position paper in August 1987. That paper recommended the following:

The US should undertake, as a national goal, the establishment of a National Research Network in a staged approach that supports the upgrade of current facilities, and development of needed new capabilities. Achievement of this goal would foster and enhance the US position of world leadership in computer networking.

As rapidly as feasible, the National Research Network should be designed, deployed and maintained as an advanced computer network. This network should interconnect substantially every academic, industrial, and government research establishment and unique scientific resource to encourage scientific collaboration unhindered by distance and to permit the sharing of unique research facilities and resources.

Presently, a comprehensive study of the best format for the NREN is being coordinated by Gordon Cook for the Office of Technology and Assessment. But several government study groups have already released working papers regarding possible directions for the network. In 1989, the Federal Coordinating Council for Science, Engineering and Technology (FCCSET) indicated that the national network should become commercial by the mid 1990's, although corporate sponsors have not yet come forward. Reviewing the plan set forth by the FCCSET, Gordon Bell has noted that, "A highly aggressive, imaginative industry could view the Network as the major, large scale, social experiment of this century—an experiment that could strategically position that industry for dynamic growth in the twenty-first century [2, 36]. FCCSET has projected, unofficially, that the NREN could serve over 1,000 institutions by the year 2000, when it might first be accessible to business; become available in all schools by the year 2005 and have over 1 million users by the year 2010 with additional links to businesses, homes, and schools[9, 23].

Networking as a New Paradigm for Teaching and Research

Networks can have profound effects on how educators do their jobs. For instance, when we think about gathering and disseminating of information, through publication or classroom use, it is natural for us to assume the paradigm of a static environment in which the researcher/professor, working with other writers and experts, and using traditional literature search methods, develops and writes up that research or creates a syllabus or lecture notes. The material is then distributed to the potential audience in printed form or in front of a classroom. But networks can provide that information and more right from our computer terminals.

Specifically, I have used networks for:

- Maintaining a running dialog with colleagues both within SUNYIT and throughout the country. This can be done by keeping track of e-mail addresses of acquaintances, joining bulletin boards of groups with similar interests, joining a moderated or unmoderated discussion group, or becoming a member of a public resource that maintains “white pages” of members with similar interests. It is also possible to use various UNIX commands to “run down” the e-mail address of individuals at this or other universities.

- Interacting with students outside of class. By sharing electronic mail (e-mail) addresses and setting up special online “interest groups” for a particular class or subject, students and teachers can interact much more
openly and often than is currently possible during class time or office hours. Students can often resolve problems with projects by interacting with the instructor or with other students in the class over the network. This type of learning is especially appealing to non-traditional students who have become a majority at most colleges: more than half of today's students are 25 and over and 70 percent work at least part-time[10, 10-16]. The networked computer offers the power to help teachers engage students in meaningful, critical discourse on current knowledge in a learning situation free from constraints of time, place, and physical handicap.

- Accessing information via databases, electronic journals and newsletters, bulletin board services, and by directly contacting experts through e-mail. I recently edited a journal article that was about to go to print by checking with sources in Albany and Syracuse, getting responses, integrating the information into the text and returning it to the journal editor in less than two days, using the Internet. Specifically, educators can access databases such as ERIC[11] over the network or check a citation using LIBTEL, which allows those on Internet to query the online catalogs of hundreds of libraries around the country. SUNY Institute of Technology faculty and staff can access our online library card catalog using the school's local area network.

- Acquiring shareware (free software) or viewing demonstrations of commercial applications. Using the various public archive sites around the country, networkers can access free software for their personal computers or for use in computer labs or in the classroom. Nearly all commercial software is available in "demonstration" format for testing while deciding whether or not to buy the software.

Computer-based information delivery systems (such as the NREN) present not just a new means for providing and receiving information but open up the possibility of a new model for communicating and learning. This comes at a time when many are calling for a change in the values and motivations of our current industrialized society. Harman noted this concern when he wrote, "The basic paradigm that has dominated the industrial era included an emphasis on individualism and free enterprise; material progress, social responsibility mainly the concern of government; few restraints on capital accumulation...[12,10-22]." But this process, he notes, has resulted in isolation, extreme division of labor, cybernation, stimulated consumption, and planned obsolescence and waste, all of which counteract human ends. As a social construct, computer networks can, in some ways, provide an excellent alternative to the present social system at least as it involves information development and exchange. Networks tend to be non-polluting, energy efficient, mind expanding, and in some applications, can tremendously enhance group interaction. They can drastically reduce the amount of paper needed for such things as manuals, memos, classroom handouts and letters.

Conclusion
Already the hardware and software is in place for high-speed links between academic and research institutions with plans in the works to extend it to K-12 schools and local and regional libraries. Networking may very well dominate the information industry in the next century as the 1990's see the introduction of much more powerful computer hardware and software and networking technology than is in place today. Continued advances in fiber optics and related technology will make computer networking more affordable, more useful, and more secure. Right now advanced workstations are being developed that will be capable of multimedia, voice, data, and image communication on very high speed network connections, like the NREN. Programmers are developing tools (sometimes called "knowbots") which will travel through networks seeking out answers to a user's query and delivering the answers in the format and order desired [13].

Clearly a national computer network, if properly implemented and used, can help us do a better job, improve our professional status, reduce our costs, improve our work environment, increase our resources, and decrease the time it takes to get our work done. However, much thought and discussion lies ahead as far as the best and proper uses for a national network. Among the policy issues that need a healthy and rigorous intellectual discussion are the following:

1. Patterns of collaboration, communication and information transfer via networks.

2. The problems related to the possible further alienation of certain segments of the community who do not have the financial or intellectual ability to be included in this new technology.

3. The concept of intellectual property as regards electronic media and the value and ownership of information that is disseminated over networks.
4. The question of cost and capitalization for large scale networks. To what extent is networking cost effective?

5. The concern about what information is appropriate for dissemination over a computer network.

6. A look at who is responsible for the activity that goes on a network—the author or those who run the system?

7. The problems that isolation caused by networking might cause and how they might be resolved.

Despite these concerns, computer-based networking technology will continue to become a rapidly developing field that has and will continue to have a direct and major impact on the research and teaching community. Networking provides access to colleagues, students, information, resources, applications, databases and bulletin boards. The Internet, and its successor, NREN, are expected to expand both the services available through networks, and the number of people, databases, and applications available on the network. Future plans for the NREN would make it accessible at every university, school, library, and home, making us truly a "global village" of ideas and resources.

Selected Networking Bibliography


Designing and Implementing Local Area Networks - Dimitris N. Chorafas, Computer Science Press, 1982.

Designing Data Networks - Robert L. Ellis, Prentice Hall, 1986


Many journals regularly write about the NREN, in particular, EDUCOM Review (which is devoted almost solely to the NREN), and Communications of the ACM.

Documentation about Internet is available in Zen and the Art of Internet, obtainable from the Help Desk. Understanding the Internet, which is a shorter overview of the network, including specific uses and a list of references, is available free of charge from the Institute for Academic Technology at 919-560-5031.


4. Federal Research Internet Coordination Committee, Program Plan for the NREN.


6. It should be noted that SUNYNet, SUNY’s gateway to the Internet, already provides supercomputing access to the facilities at the Cornell Theory Center.


11. The ERIC database contains abstracts of over 760 educational journals and numerous documents. Primarily the information is education, but it includes much information that makes it interdisciplinary. Library Science, Management, Health, Technology, and many other areas are covered in ERIC. It is available free via FTP from an archive at Syracuse University.


ABOUT THE AUTHOR

Russell L. Kahn is a faculty member teaching technical communication at the State University of New York Institute of Technology at Utica/Rome. He is working on a doctorate in Information Science at the State University of New York at Albany. His field of research includes computer-mediated discussion and computer based research, interaction, and dissemination. Before coming to the college, he worked at Lawrence Livermore and Los Alamos National Laboratories in computer documentation design and dissemination.
On Tap: A Profile With Gregory Hines

by
Mary Krenitsky Perrone

Tap dancing is an American art form which has enjoyed a substantial contribution by African-Americans. One contemporary contributor is the improvisational tap master Gregory Hines. He was born in New York City on February 14th, 1946 and, since an early age, has been a tap dancer and a vital force behind tap's recognition. In an interview conducted on December 20, 1991, Mr. Hines shared his thoughts on some of the contributions African-Americans have made.

Steered toward dance by his mother, six-year-old Gregory performed at the Apollo Theater with his brother, Maurice, in an act called The Hines Kids. There, he came under the tutelage of tappers "Sandman" Sims and Teddy Hale. In recalling the contribution to the dance made by some of these tap legends, Mr. Hines stated, "African-Americans have contributed to the growth of tap dancing by doing it, shaping it, changing it, and evolving with it. People like Bunny Briggs, the Nicholas Brothers, Coles and Atkins, the Step Brothers, Sandman Sims, Baby Lawrence, Teddy Hale, Cookie Cook, Bubba Gaines, Face Roberts, and on and on. What these people did is they created their own styles. They were individual artists as tap dancers and they accomplished so much for tap dancers by taking the art and shaping it in different ways. Like painters — Gauguin, Van Gogh, and Picasso — they've all contributed to art but in their own inimitable way."
When asked to articulate the distinct shapes contributed to tap dancing by some of these individuals, Mr. Hines responded, “Bunny Briggs tap dances almost like a saxophone player would play sixteenth-note solos — very tight, superior, close floor work.” Sandman Sims enhanced the idea of sand dancing and the sounds he could make by working his feet in the sand. Charles “Honi” Coles with his partner, Cholly Atkins, perfected “a tremendous tight unison tap dance, in terrific style, class. They were both very tall men, both six feet tall, and they had a special number they did. It was a very slow soft shoe but verrry slow and that was the centerpiece of their act.” “Cookie” Cook was a very lyrical dancer, listening to the music and trying “to interpret the lyrics with the tap dancing, trying to paint pictures with his feet.”

In 1954, the Hines boys were cast in the Broadway musical *The Girl in the Pink Tights.* Under the guidance of Broadway tap coach Henry Le Tang, they rapidly became an international attraction. When asked to comment on the contribution to tap made by Henry Le Tang, Mr. Hines responded, “Henry is a great teacher. At a very young age, Henry decided he was too short to be a Cotton Club boy; so he was gonna devote his career to teaching and choreography. In his teaching, he never used names or numbers for the steps. He just used to sing them. He’d do it and then he’d say, ‘So the step goes E-bop-de-bop-digga-digode-bow.’ And that would be the step.”

Upon reaching their teens, Gregory and Maurice called themselves The Hines Brothers and, during a brief period with the singer and pantomimist Johnny Brown — Hines, Hines, and Brown. In 1963, they became Hines, Hines, and Dad with Gregory playing comedian, Maurice playing straight man, and their father serving as percussionist. The trio guested on the Ed Sullivan Show, on the Tonight Show, and toured the United States and Europe.

In 1978, Gregory landed a tap-dancing part in a Broadway bound revue, *The Last Minstrel Show.* Later that year, the brothers both appeared in *Eubie!* (1978-79), the Broadway musical paying homage to the composer Eubie Blake, tap-choreographed by their former tap mentor, Henry Le Tang. Gregory won several awards for his performance including the Outer Critics’ Circle award and a Tony nomination for outstanding featured actor in a musical. In 1979-80, Gregory earned his second straight Tony nomination playing Scrooge in a Broadway musical version of *A Christmas Carol* entitled *Comin’ Uptown.*

In early 1980, he choreographed an Off-Broadway production *Blues in the Night.* In May, he participated in a salute to black musicals with Charles “Honi” Coles, John Bubbles, and Nell Carter called *Black Broadway.* Later that year, a pair of Gregory Hines tap shoes were placed on the “Wall of Fame” at the famous Manhattan dancehall, the Roseland, alongside those of Fred Astaire, Ruby Keeler, and other greats.

In 1981, Gregory earned a third Tony nomination for the Broadway production *Sophisticated Ladies* sharing the stage with dancer Judith Jamison. Additional show credits include *I Love Liberty* (1981-8) and *Twelfth Night* (1989). His fourth Tony was earned earlier this year for his starring role in *Jelly’s Last Jam.*

On screen, Gregory has been a tremendous advocate for the recognition of black dance. His dance film credits include: *The Cotton Club* (Orion, 1984) which earned him critical acclaim; *White Nights* (1985) where he challenge-dances a renowned Soviet emigre ballet dancer played by Mikhail Baryshnikov; and *Tap* (Tri-Star, 1989) where many of the African-American tap legends are given an opportunity to demonstrate their talents by challenging each other. In addition, Gregory Hines has made numerous public appearances to celebrate tap including the PBS documentary *Tappin’: The Making of Tap* (1989), *Tap Dance in America* (1989), and *Lincoln Centers Honors The Nicholas Brothers* (1991).

A label associated with Gregory Hines’ tap contribution or style is “improvography.” To elaborate on this expression, Mr. Hines said, “Improvography is just something that I came up with because I was dancing on film. I like to improvise but I have to do so many takes on film that it’s impossible to just improvise every take. Sometimes, I’d come up with steps in one take that I really liked and wanted to try to make sure it got into every take. So, I would improvise in the takes after that but I would also add that step. At that point, it’s choreography. I came up with the word “improvography” because I started to think about improvisation. There’s no such thing as pure improvisation. I think people improvise, they have moments where they are inspired, they get into a nice groove, new things are coming out but even they will use things that they know. Like in my case, steps that I know, I’ll use steps from my vocabulary of steps to help me out when I’m not inspired or I have nowhere to go, or I want to take a breather while I’m still dancing. I’ve heard solos that musicians have played where every now and then I’ll hear them play a familiar chop that they play in other solos. And it’s not an improvised solo, it’s im-
provisation but there's a little bit of chopistry in there too."


Musically, Gregory Hines danced to the bassist jamming of Stanley Clarke on If This Bass Could Only Talk (CBS, 1988), he sang on his own solo album entitled That Girl Wants to Dance with Me (Epic, 1988), and he experimented with the synthesized taptronics of Al Desio (1989). With the taptronics, Mr. Hines shoes were connected to a synthesizer; and, as he danced, his feet were triggering a range of sounds from the synthesizer as if they were working the keyboard. About this experience, Mr. Hines responded, "I just related to it as a gimmick. I think it was a nice thing to try and there are some people who still do it. The guy who invented it, Al Desio, does it all the time. He's good. I'm much more of a traditional acoustics tap dancer."

An acoustics tap dancer pays keen attention to the sounds the feet make much more than the style or configuration of the steps. The taps on the bottom of the shoes are tightened or loosened (tuned) to allow specific sounds. While the dancer's feet are moving, the ear of the dancer stays attuned to and attempts to manipulate the clicks, beats, and rhythms the feet produce upon a particular surface. For this reason, Mr. Hines is often seen with his head tipped slightly to one side as he dances because he's listening to his feet. When asked about surface preferences, Mr. Hines replied, "Wood, wood, Mary, wood. Oak. I like unfinished oak 2 1/4" tongue in groove. I just love it. I get a real good stomp, a good scrape sound, and a nice pure tap."

Gregory Hines' professional life has already allowed him to succeed in so many facets of the performing arts (dancer, stage and screen actor, singer, composer); yet, when asked to identify his profession, he humbly responded, "I would refer to myself as a tap dancer." Then, he affectionately described his affiliation with his fellow tap dancers. "I know that for myself the things that I've been able to say with my dancing have brought me a sense of satisfaction that I can't really put into words but it's a terrific feeling. And for me the greatest feeling of all is to be part of the community, part of the tap dancing community. I love that community, I love that family."

Community is an appropriate word to describe the African-American contribution to tap dancing. There is a substantial amount of mentoring associated with tap and close bonds or strong friendships between dancers are formed. Ironically, challenge has also been an integral part of tap's development. On this point, Mr. Hines commented, "Competition is such a strong part of the art form, yet the competitions are warm, giving. The art form has moved along that way. We teach one another. We steal steps from one another."

With regard to future projects, Mr. Hines owns the rights to the film biography of the legendary tap dancer and movie star, Bill "Bojangles" Robinson and he intends to make the film. This endeavor will serve as yet another reminder of the substantial contributions to tap that have been made by our African-American brothers.

ABOUT THE AUTHOR

Mary Krenitsky Perrone received her Master's from the Bread Loaf School of English of Middlebury College in Vermont. She is currently working on her Ph.D. at SUNY Albany. Serving as an Instructor in the Humanities and Communication Department at SUNY Institute of Technology at Utica/Rome, Mary teaches courses in Literature, Film, Technical Writing, and Oral Communication. Apart from campus activities, she has been actively involved with the performing arts as a participant, advocate, and theatre educator.
As the global marketplace assumes undeniable economic importance today, the issue of free trade has become a much discussed topic. However, not everyone agrees that it is worthwhile. Former President Bush considered free trade a vehicle for economic growth and a means to make America more globally competitive. President Clinton so far seems to share this opinion. But critics of free trade contend that the costs outweigh the benefits.

The economic potential of free trade is indisputable. A nation can improve its standard of living by efficiently utilizing its resources to produce a range of products, which it can then export in exchange for the items it must import. This process increases employment opportunities and earnings and allows the country to obtain products and technology that cannot be supplied domestically. The principle that explains the pattern of and the gains resulting from trade is known in economics as "the law of comparative advantage." Coined by David Ricardo in 1817 in his Principles of Political Economy and Taxation, it is still one of the most important and unchallenged laws of economics.
Relatively speaking trade is not as important for the United States as it is for small industrial nations and developing countries. Since the United States can produce most of the products it needs fairly efficiently, it could probably withdraw from world trade and still survive without a drastic decline in its standard of living. Nevertheless, interdependence for the United States and other nations has steadily increased since World War II. Since 1980, U.S. imports have remained at high levels, but U.S. exports have fallen sharply, resulting in huge trade deficits. These deficits have induced American industry and labor to demand protection of domestic markets and jobs against foreign competition.

The U.S. Government has attempted to reduce this trade deficit. Its latest initiative has been the North American Free Trade Agreement (NAFTA). The main purpose of NAFTA is to phase out barriers to trade in goods and services among North American countries, eliminate barriers to investment, and strengthen the protection of intellectual property rights. The expected results are to create a massive open market with more than 360 million consumers and over $50 trillion in annual output.

NAFTA Highlights:

NAFTA will eliminate barriers to agricultural, manufacturing, and service trade in North America. It will remove investment restrictions and protect intellectual property rights. Highlights of NAFTA include:

* **Tariffs:** Tariffs will be phased out over 15 years. However, the agreement allows Mexico more time before it faces free competition from the U.S. and Canada. Mexico will be allowed to export duty-free 84% of its products to the U.S. and 79% to Canada. The U.S. will be able to export duty-free 43%, and Canada 41%, of its products to Mexico.

* **Rule of Origin:** NAFTA includes two formulas to determine North American content in products that use raw materials from a different region. The first formula, known as "tariff jump," establishes that if the raw materials are sufficiently transformed in the NAFTA countries, then the product will be considered North American. The second formula is based on the actual content of local material. Content may be determined two ways: by calculating the "transaction value" or the "net cost."

* **Agriculture:** NAFTA will immediately eliminate Mexican import licenses and phase out remaining Mexican tariffs within 10-15 years.

* **Banking, Insurance, and Financial Services:** Mexico will open its banking, insurance, and financial services to American and Canadian subsidiaries. All restrictions will be eliminated by the year 2000.

* **Telecommunications:** All investment restrictions will be eliminated by 1995. U.S. companies will gain non-discriminatory access to Mexico's $6 billion market for telecommunications equipment and services.

* **Computers:** Mexico will reduce tariffs on computers and computer parts to conform to current U.S. and Canadian levels.

* **Transportation:** Mexico will permit U.S. trucking companies to carry international cargo to the Mexican states contiguous to the U.S. by 1995, and will give them cross-border access to all of Mexico by the end of 1999. U.S. land transportation companies will be permitted to invest in and operate land-side port services.

* **Government Contracts:** Mexico will increase access to government contracts. Contracts with domestic firms will reduce to 50 percent immediately; after eight years, reductions will reach 30 percent. Two years later no contracts will be excluded. NAFTA also includes provisions for reducing tariffs on motor vehicles and parts, reducing trade barriers for textile and apparel goods, and increasing access to the energy sector.

Potential Benefits From NAFTA

A recent poll conducted by the Roper Organization for The Wall Street Journal indicates that "most U.S. companies see themselves as winners in a North American Free Trade Agreement." In general, American executives expect U.S. telecommunications, banking, and high technology industries to benefit most from this agreement.

Administration officials maintain that NAFTA builds on recent gains in U.S. trade. They project that by the end of 1992, U.S. exports to Mexico will have tripled, from $12.4 billion in 1986 to nearly $44 billion, transforming our trade deficit of $5.7 billion in 1987 to a projected surplus in excess of $8 billion. Furthermore, NAFTA will ensure growth and stability in Mexico, provide a smooth transition for workers, and benefit the environment.

Potential Cost of NAFTA

Public Citizen, a consumer interest organization founded by
Ralph Nader, maintains in a recent report that "NAFTA does not measure up on the environment and consumer health and safety." NAFTA challenges numerous U.S. national and state consumer and environmental laws. It may impede progress in environmental protection and consumer health and safety, particularly in the areas of pesticide control, food labeling and inspection, and contaminant standards on additives and preservatives.

Public Citizen also maintains that NAFTA promotes environmentally detrimental investment. Although NAFTA contains provisions that will prevent the lowering of environmental standards to attract investments, these provisions are not enforceable.

Perhaps the strongest criticism against NAFTA is that it will be somewhat unfavorable for American workers. Mark Anderson, director of the AFL-CIO's trade task force, is wary of "the opportunism of the U.S. businesses and their ability to take advantage of poverty." In particular, he foresees a "classic pit of workers in one country against workers in another." Jack Sheinkman, President of the Amalgamated Clothing and Textile Workers Union, warns that if we do not pay attention to workers rights, "we are going to end up with lower wages in the U.S. and fewer jobs, and not necessarily higher wages in Mexico."

Impact on Our Area

The above information suggests that NAFTA will produce both winners and losers. However, the benefits seem to outweigh the costs, thus producing a net gain. Our area, with its increasingly service-oriented economy, may be a potential winner, particularly in the agricultural, financial services, banking, and insurance sectors. Firms producing computer, telecommunication, and insulation/doors/refrigeration equipment will also gain from this agreement. We must, however, increase our competitiveness.

Our standard of living will rise only to the extent that our firms are familiar with the basic aspects of exporting, such as global matters, methods of distribution, and methods and means of payment. Further, we must train our unskilled workers to use advanced equipment.

President Clinton has proposed an "immense $20 billion a year in public investment on infrastructure projects as a way to make private capital more productive." And he promises to spend heavily on training all workers, not just the dislocated and unemployed.

New York State government is actively trying to promote greater participation in export business. Government officials acknowledge that "an enormous potential exists in world trade" and they recognize "the need to focus economic programs in this direction."

Those seeking assistance can obtain counseling from the institutions of higher learning in our area. SUNY Institute of Technology at Utica/Rome provides this type of counseling. Its School of Business/Public Management and the Management Assistance Center offer one-on-one export counseling to firms currently exporting or anticipating future export activity.

References

ABOUT THE AUTHOR

Dr. Rafael Romero is an Assistant Professor of Finance at SUNY Institute of Technology at Utica/Rome. Dr. Romero holds a B.S. degree from the University of Costa Rica and MA and Ph.D. degrees from West Virginia University. He taught at St. Ambrose University and Mount St. Clare College before coming to the Institute of Technology. Dr. Romero has considerable business and academic experience in Latin America.
A Query Decomposition Algorithm for Distributed Relational Database Systems

by
Scott Spetka

Introduction

This article describes a generalized approach to query processing in relational database systems. The first section is a general introduction to query processing concepts. Section two describes query processing in a distributed database system, where parts of a query are processed in parallel in a network of computers. The second section also describes problems associated with current query processing algorithms that lead to the development of the new query decomposition technique described in this article. The third section presents the details of the new query decomposition algorithm by means of an example.
Section 1 - Query Processing Concepts

Relational databases store information that is needed by the applications that they support in tables (also called relations). Figure 1 shows the tables that might be needed to support a library system. The columns of each table describe its "attributes." The collection of tables serves as a model of the enterprise implementing the database. The loan relation would be updated each time a borrower borrows a book. Similarly, new books and members for the library would be represented by the addition of entries (tuples) to their corresponding relations. The model maintains enough information to allow simple questions, or queries, to be answered regarding the state of the enterprise.

![Figure 1 - Database Relations](image1.png)

A database management system (DBMS) implements a query language that allows the information in the database to be used productively by an organization. A simple query is shown in figure 2. The query uses two database relations to find the book numbers of each book borrowed by a library member and the name of the borrower. It is easy to imagine how such a query might be processed. The loan relation could be searched for each library member to see if a current loan existed. A database operation of this nature is called a join.

![A Database Query](image2.png)

Figure 3 shows a more complicated query which illustrates a join operation involving three database relations. Using three relations allows the query to produce the names of books which are on loan along with the name of the borrower who has borrowed each of them. In figure 3, the result from the query of figure 2 is used in further processing of the three relation join.

![Figure 2 - Simple Two Relation Join](image3.png)
A Database Query

Retrieve (Borrowers.Name, Books.Name)

<table>
<thead>
<tr>
<th>Temp</th>
<th>Books</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name</td>
<td>Book#</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Jones</td>
<td>115</td>
</tr>
<tr>
<td>Jones</td>
<td>019</td>
</tr>
<tr>
<td>Jones</td>
<td>411</td>
</tr>
<tr>
<td>Brown</td>
<td>772</td>
</tr>
<tr>
<td>Brown</td>
<td>019</td>
</tr>
</tbody>
</table>

Figure 3 - Three Relation Join

Section 2 - Parallel Processing

A distributed database management system performs the same operations that were described in section one, but applies multiple computers connected in a network to the problem. Although the total amount of work that must be done is the same, queries can be answered much more quickly when operations are performed in parallel on different computers. It is not surprising that this approach would improve performance since in essence the system is running on a larger computer.

Query decomposition [Wong 76] refers to the means by which a complex query is broken down into a sequence of simple operations that can be easily performed. Figure 4-a shows a simple means for operating on the query that was described in figure 3 above. After the join of borrowers and loans, the temporary output file replaces the two relations in the main query. The temporary result is then used as input to complete processing of the query.

Figure 4-a

Borrowers JOIN Loans
JOIN Books

Temp JOIN Books

Figure 4-b

Pipelined Join

Figure 4-b illustrates the "pipelining" approach to distributed query processing. The temporary result from the join of borrowers and loans is transmitted over the network to the computer where the join of the temporary result with the books relation is to take place. By the time that the first join completes, the second join will be near completion since it will be mostly processed in parallel.

Modern query processing techniques improve performance by partitioning relations into subsets according to key values and operating on key range partitions. These hash join techniques [DeWitt 84] lead to restrictions on the parallelism usually associated with pipelining. Figure 5 illustrates the problem. Processing
each partition in order, it would be convenient to process partition 1-5 of the Books relation along with partition A-C from the borrowers and Loans relations. However, the processing of partition 1-5 cannot complete until partitions Q-Z from the Borrowers and Loans relations have been processed. The problem is that, for example, Spetka could have a loan for book number 3. As a result, all tuples produced by the join of Borrowers and Loans must be output to disk to await further processing (Temp in figure 5), except those that correspond to the 1-5 partition of the Books relation. Figure 5 indicates that the 1-5 partition would not be output since that partition would be processed while the Temp relation is being produced.

\[
\begin{align*}
\text{Borrowers.Card#} & = \text{Loans.Card#} \\
\text{and Loans.Book#} & = \text{Books.Book#}
\end{align*}
\]

\[\text{Borrowers}\rightarrow\text{Loans}\rightarrow\text{Temp}\rightarrow\text{Books}\]

*Figure 5 - Restriction of Pipelining*

A new approach to decomposition [Spetka 92], shown in figure 6-a, detaches two subqueries with an overlapping variable (Loans) from the main query and executes them in parallel on two different computers (figure 6-b) in the first step of processing. The intuitive advantage that this new decomposition technique has over the pipelining approach is its ability to process the Books relation in parallel with the join of Borrowers and Loans.

\[\text{Borrowers}\ JOIN\ \text{Loans, JOIN Books}\]

\[\text{Temp1 JOIN Temp2}\]

*Figure 6-a Multiple Subquery Detachment*  

*Figure 6-b*

Figure 7 shows the results of an analytic model that confirms the new approach's advantage for decomposition. Figure 7-a shows that the new algorithm is most effective for very selective joins, where few result tuples are returned. It also shows that the technique is less effective than pipelining when the result size exceeds the size of the source relations (selectivity greater than one). Figure 7-b shows that queries involving larger relations can benefit more from the new technique. The increase in performance is linear with relations size.
Section 3 - Query Decomposition

The pipelined query decomposition technique is based on single subquery detachment. In each processing step, a single subquery is detached with its result substituted back into the main query. Figure 8 illustrates the operation of single subquery detachment. Figure 8-a shows how a subquery is detached from the main query for execution. Attributes from the subquery source relations are output as needed for further processing by the main query. Figure 8-b shows the subquery output substituted into the main query for further processing.

Each tuple in the subquery output relation represents a match that has occurred between the source relations involved in the detached subquery. Any remaining references to those relations in the main query can be modified to refer to the result relation from the first subquery. The new query, resulting from substitution of the temporary result into the main query can then be similarly processed. Each step in decomposition would produce one of the processes in a pipeline. Each step also results in a new main query with one less relation than the previous main query. Eventually, the remaining two variable query can be processed to produce the query result.
The multiple subquery detachment technique [Spetka 92] requires additional modification of the main query to accommodate the substitution of results from overlapping subqueries, that have a common source relation, back into the main query. It is similar to the pipelined approach except that some additional work is needed to prepare the main query for execution after the subqueries are detached and executed to completion. Although each of the tuples in the two temporary result relations shown below in figure 9-a must be related to some tuple from the overlapping relation, loan in this case, the resulting main query has no constraint to assure that tuples from the two resulting temporary relations resulted from comparison with the same tuples from the overlapping relation. To assure that this constraint holds for further processing, additional predicates must be added to the main query as shown in figure 9-b. The new main query can now be processed again in the same manner until only a two-relation query remains to be processed.

![Figure 9-a](Original Main Query)

**Multiple Subquery Detachment**

![Figure 9-b](New Main Query)

Figure 10-a shows that an erroneous result would be produced without the additional query modification required by the new algorithm. Figure 10-b shows that the query of figure 10-a can be corrected by adding appropriate predicates to the main query and adding the attributes needed by those predicates to the subquery target lists.

**Example Query**

Retrieve A.a2 Where A.a1 = B.b1 and A.a2 = C.c2 and B.b1 = C.c1

![Erroneous Result](Figure 10-a)

![Correct Result](Figure 10-b)
Figure 11 shows that a further generalization of decomposition can allow subqueries to execute in parallel even when they overlap on more than a single variable. The only requirement for additional modification of the main query in these cases is that predicates must be added to establish constraints on all pairs of result relations from subqueries that operate on overlapping relations. The additional predicates that are needed are shown in figure 11-b. Notice that attributes that will be used in further processing must be output by all subqueries in figure 11-a.

Conclusion

Multiple subquery detachment can be used for query processing when limitations on pipelining result in restricted parallelism. The examples given above illustrate the generality of the algorithm presented. Arbitrary subqueries can be detached from the main query and executed in parallel to match available processing resources and input data configurations. The algorithm provides improved opportunities for query optimization. It has been implemented in the SUNY Nodes, a network-oriented data engineering system, in a single site environment. It is currently being integrated into the distributed processing version of SUNY Nodes.

References


ABOUT THE AUTHOR

Scott Spetka joined the computer science faculty at the SUNY Institute of Technology in September 1989 after completing his work at UCLA for a Ph.D. in computer science. At UCLA, Scott was a member of the research group that developed the Locus distributed operating system. Prior to entering graduate school, Scott was head of programming and analysis and technical advisor to the computer center at the Administración Nacional de Telecomunicaciones in El Salvador. He was also an Instructor at the Universidad Centroamericana José Simeón Cañas. Scott received his A.A.S. degree in mathematical sciences from Onondaga Community College and his B.S. degree in mathematics with concentration in computer science from Denison University.
An Object-Oriented Approach to Modeling Generally Accepted Accounting Principles

by

Thomas Tribunella

I) Why Generally Accepted Accounting Principles Need to be Modeled

Financial accounting is an information system designed to provide decision makers with relevant and reliable information about how economic transactions are recorded within an organization. The organizations under analysis range in size from small proprietorships to multi-national corporations. They engage in a wide variety of activities, from providing services to selling merchandise, from manufacturing goods to mining raw materials. All of these activities take place in a rapidly changing economic environment. In addition, the decision makers who use the financial accounting information have varied needs and points of view. Hence, for financial accounting to be useful it must be flexible enough to adapt to each organization in different economic climates and to appeal to diverse groups of users.
How can an information system be flexible enough to adapt to a variety of situations without becoming too complex? For an information system to balance flexibility with complexity it must conform to a framework that is both adaptable and consistent. In other words, the system must be organized to allow its users to understand it no matter what the application. A system can achieve this if it is modeled properly. The model is not intended to replace the fundamental theories that lay at the foundation of the system; the model's purpose is to facilitate the user's understanding of the system and to make the system more useful. An ideal model enables its users to be systematic even when they are working with varied organizations in a changing economic environment.

Increased understanding of financial accounting information systems will facilitate the efficiency of managers, accountants, and auditors in compiling and analyzing information. Efficiency, in turn, will lead to more effective decision making which is the basic goal of accounting.

II) What is an Object-Oriented Modeling Approach?

Generally Accepted Accounting Principles (GAAP) are inherently complex. In addition, GAAP pronouncements are so voluminous that no individual can understand, remember, and apply all the information they contain. The Financial Accounting Standards Board has issued well over 100 Statements of Financial Accounting Standards to date.

Object-oriented modeling takes a complex information system such as GAAP and breaks it down into comprehensible pieces of information. Details of a system are identified and organized into a meaningful collection of objects that share a common structure. The objects are grouped into classes. A class represents an abstraction of the characteristics, that its member objects share. For example, a shark is an object that is a member of the fish class.

Each object is assigned a name and performs one or more services. The name identifies the object's classification within the system. The object's attributes identify the characteristics of all objects within the same class. The services encapsulated in an object define the purpose that the object serves within the system.

Increased understanding of financial accounting information systems will facilitate the efficiency of managers, accountants, and auditors in compiling and analyzing information. Efficiency, in turn, will lead to more effective decision making which is the basic goal of accounting.

Classes can also be grouped into superclasses that have well-defined attributes. Therefore, a system can be broken down into a hierarchy of subclasses and objects. Each object inherits the attributes of its class, and each class inherits the attributes of its superclass.

A good object-oriented system should be designed as a set of modules that can interface with each other. Each object and class is contained in one module that has a well-defined boundary. If a module is changed, it will not disable the rest of the system.

III) A Proposed Model for GAAP

At the highest level of the financial accounting hierarchy each subject is divided into two superclasses: theory and practice. The theory superclass contains objects that perform services related to analyzing GAAP. The practice superclass encapsulates objects that relate to complying with GAAP.

The theory branch of the hierarchy is further divided into three objects: objectives, principles, and references. “Objectives” contain objects with attributes that relate to analyzing the purposes of the GAAP theory under analysis. Objectives are a class of objects which answer the question: What economic events are being accounted for? “Principles” are a class of objects that pertain to accounting principles and answer the question: Why are these economic events being accounted for? References are a class of objects whose attributes function to identify the pronouncements and research being used as the theoretical basis for the objectives and principles. Reference objects contribute to the model by answering the question: Where is the authoritative pronouncement or theory that supports the objective and principle?

The practice branch of the hierarchy is also broken down into two classes: financial statement elements and methods of measurement. Financial statement elements are a class of objects that relate to recording the event (bookkeeping) and disclosing it on the financial statements. “Element” objects answer the question: How is this economic event recorded and disclosed? Methods of measurement objects relate to the calculation of recorded amounts and answer the question: How is the amount recorded being calculated?

IV) Summary and Conclusion

There are four major elements of a good object model: abstraction, encapsulation, modularity, and hierarchy (Booch, 1991). In addition, objects and classes of objects should have names, attributes, and services associated with them (Cook and Yourdon, 1991). Finally, classes of objects are self-contained with well-defined boundaries that nevertheless can interface and communicate with each other.

The financial performance of economic entities is directly related to the quality of its accounting system. For financial accounting to remain a useful information system it must be organized, or modeled, in a manner that facilitates its efficient
and effective use. Because GAAP is such a complex information system it could be easier to access if its data were organized in an object-oriented model.

Two hypotheses are being asserted in this paper. First, decision makers, accountants, and auditors will benefit from a better understanding of financial accounting. Second, understanding financial accounting is facilitated through the object-oriented modeling of GAAP. If these two hypotheses are true, then the model being presented in this paper can contribute to improved decision making through better understanding of financial information.

References


Introduction

The research in progress discussed in this article is one part of a five-year, four-phase program to provide descriptive and analytical data regarding the flow of scientific and technical information in various communication media. The goal is to investigate and assess information processing activities involving the use of computer-mediated communication (CMC)—specifically electronic mail—among individuals who have a variety of communication media available to them. The study draws its subjects from a population of research and development (R&D) personnel who work in highly-technical, information-intensive occupations, such as aerospace engineering. The focus of the research is an attempt to understand the use and importance of media, especially CMC, at the individual, organizational, and national levels. The study also extends to other types of communication strategies to analyze the influence of media use upon overall task performances involving the diffusion of technical information.

The research will analyze particular contextual (organization-specific) characteristics, organizational design variables, and the communication mechanisms that influence communication of technical information in R&D settings. The Information Processing (IP) model developed by Tushman & Nadler and Daft & Lengel constitutes the theoretical basis of the research.
Background

CMC systems were developed in the mid to late 1960s. Using electricity as the means of message transfer, CMC exhibits a dramatic increase in speed over slower, paper-based mail. Other than speed, CMC systems also offer several other advantages. While a message may be transmitted as rapidly as a telephone conversation, an advantage of CMC use as compared to a telephone conversation is that an accessible record of the communication exists after the exchange has terminated, and the exchange of information may be printed in hard copy if desired. Depending upon the sophistication of the particular CMC system, one also may perform search and find procedures on key words, names, or titles. Thus, CMC has the potential to act not only as a communication medium, but also to serve as a library of communications related to specific tasks and procedures. For those persons who work in organizational settings, another benefit is that incoming electronic mail messages tend not carry the disruptive effect upon the recipient in the way that personal visits or phone calls may do. Despite the benefits of such systems, however, there is not yet a clearly articulated program for understanding exactly how CMC is used in knowledge diffusion.

Rationale

Perrow defined technology as the characteristic of an organizational system that enables the coordination and control of work. Thus, virtually any group, organization, or business relies upon technology to some degree to accomplish its tasks and achieve its goals. As organizations become more diversified and increase their levels of technological complexity, the volume of communication also increases. What is not clearly understood, however, is how the newly-emergent CMC systems affect communication procedures, particularly when the organization processes information as its primary activity. Several years ago Miles and Snow discussed the tendency of organizations to diversify themselves with respect to several factors, such as location and communication media for information exchange related to work. They described "dynamic networks" of individuals who collaborate to achieve common goals by communicating with each other over electronic, computerized information highways. Therefore, this study of CMC use has much to offer for helping us to understand the impact of the new technologies on communication patterns and on job performance.

Theory

Information processing is defined in this research as the variable lack of knowledge necessary to operate successfully. Thus, an effective communication/information processing architecture is one which must fit the requirements of the organization's members, as summarized in the Tushman and Nadler Information Processing (IP) model (see Figure 1). The literature review of Information Processing (IP) theory suggests that several variables influence the effectiveness of organizational communication processes. The principal IP variables considered in this study are the following:

A) task uncertainty and equivocality;
B) task variety and analyzability;
C) information processing capability with respect to quantity, richness, and accuracy;
D) information processing requirements and coordination with respect to CMC as compared to printed documents, face-to-face conversations, and telephone calls.

Definitions

Uncertainty is defined as the difference that exists between the amount of information that is required and the amount of information that is possessed by individuals. It implies that explicit questions can be formulated and that specific answers exist somewhere in the organization.

Equivocality implies an unclear, messy field caused by ambiguity or the existence of multiple and conflicting interpretations resulting in confusion and lack of understanding. It differs from uncertainty in that no certain answers exist and perhaps the right questions have yet to be formulated.

Variety is defined as the measure of unique or unanticipated events or situations that individuals routinely encounter. High variety implies that there are frequently new problems occurring that require novel approaches to eliminate them. Low variety is characterized by few problems that may occur infrequently.

Analyzability is somewhat related to variety. To the extent that problems may be anticipated, solutions also may be planned to cope with the problems when they do occur. High analyzability refers to a high capacity to provide procedural methods to solve difficulties. Low analyzability means that methods may not be readily amenable to careful scrutiny to provide formal procedures to deal with problems when they do occur.

Richness is defined as the ability of information to change
understanding within a time interval; that is, communications that overcome frames of reference or clarify ambiguity in a timely manner are defined as rich.

Coordination mechanisms are the modes by which people exchange information. Modes are essentially the same as structural characteristics for reducing uncertainty or equivocality that Daft and Lengel described. The principal coordination mechanisms for reducing uncertainty or equivocality as adapted from the Daft and Lengel integration strategies consist of the following six-part continuum:

1) rules and regulations;
2) formal information systems;
3) special reports;
4) planning;
5) integrators (assigned to boundary-spanning within the organization); and,
6) group meetings.

However, for the sake of simplicity, these mechanisms are reduced to four principal components:

A) written matter, i.e., printed hard copies;
B) CMC;
C) telephone;
D) face-to-face communication.

Hypotheses

The communication mechanisms that are less information rich (A, B) are hypothesized to be better-suited for reducing uncertainty. As one progresses along the continuum, the communication messages (e.g., C & D) become increasingly information-rich and are hypothesized to be more effective in reducing equivocality. However, movement along the continuum away from the lower numbered mechanisms also becomes increasingly costly to the organization with respect to investments of individuals' time and commitment. It is therefore hypothesized that the most efficacious strategy would be to use the least-rich mode that accomplishes the communication task effectively. Survey items also will assess coordination mechanisms and corresponding measures of effectiveness as influenced by variety and analyzability.

Method

The population will be analyzed through two measures. First, a quantitative survey instrument will be sent to 2,000 people who have a variety of communication media available to them and work in information-intensive organizations. Specifically, the random sample is drawn from a population of United States scientists and engineers who belong to the American Institute of Aeronautics and Astronautics (AIAA). The survey instrument contains 120 questions that probe a variety of organizational and communication variables. The main areas to be studied are divided into eight sections: 1) the nature of the work performed; 2) the nature of the work environment; 3) interdepartmental activities; 4) work-related communication duties; 5) communication media and methods; 6) electronic (CMC) networks; 7) job performance and overall effectiveness; 8) demographic profiles.

The questions consist mainly of five-point Likert scales (for example, 1=Strongly Disagree; 2=Disagree; 3=Neutral; 4=Agree; 5=Strongly Agree) that request the subject to indicate the extent to which he or she agrees with statements, as the following three examples illustrate:

A) My department performs a variety of tasks that require the use of many skills.
B) Work information can be interpreted in several ways.
C) Using electronic computer networks is important in performing present professional duties.

Regression analysis will be used to test the results of the data against the hypothesized relationships among the variables. Overall effectiveness is the independent variable, and associated dependent variables will be analyzed using principal components factor analysis.

For triangulation purposes, qualitative data will be gathered by means of selected telephone surveys to a subset of the subjects. A triangulated approach has two principal advantages. For one thing, it can enable an assessment of convergent validation in so far as one may design the procedures in the attempt to obtain information about the same variables or concepts from more than one other procedure. Secondly, a triangulated methodology permits the researcher to employ one procedure to compensate for any limitations of another. In this case, the quantitative survey carries the benefit of facilitating collection of opinion from a larger sample more efficiently and additionally renders the data more easily amenable to statistical analyses. The disadvantage of the quantitative survey instrument, i.e., that it limits the responses that the subjects may give, can be offset by the interview. In this case, it provides subjects with the opportunity to voice opinions more freely and in greater detail.

However, the interview carries with it the disadvantages of taking more time to administer and analyze; thus, the sample size for interviews will be kept relatively small. It is hoped that by using both surveys and semi-directed interviews, the researcher will be able to accrue the advantages of both procedures and simultaneously compensate for the shortcomings of each.
Summary

This article on research in progress describes the background, theory, and methods of a communication research project that focuses on factors related to media use. The information processing (IP) literature claims that an effective communication architecture is a function of the fit between people's information processing requirements and organizational information processing capabilities. What seems to be needed at this point, however, is additional empirical evidence of the model's effectiveness in describing communication processes in information-based organizations, for example, R&D engineers and scientists. It also suggests a need for developing an effective approach to investigate communication processes of emerging organizational forms, e.g., those that use information as a commodity such as R&D units. This project and its ongoing research is an attempt to try to meet these needs. It is hoped that this research will provide important data to aid our understanding of the ways in which communication media affect the diffusion of information in the R&D process.

References


