# HARVARD
## Magazine

Anthony Oettinger, expert
on information technology

He's got the
whole wired world
in his hand

# The wired world
# of Anthony Oettinger

*Oettinger and his colleagues are out to improve the information
available about the information age and, thus, to reduce
the casualties of the post-industrial revolution*

Aiken 241 is getting noisy. Not surprising—
Harvard's Program on Information Re-
sources Policy has convened its weekly sem-
inar for program affiliates; the talk is politics
and money; the topic today is the restructuring of the
telecommunications industry.

Industry people and academics are sitting around a
white Formica table with a conference-call hookup and
a tape recorder in the middle. Richard Fazzone, Gen-
eral Electric's telecommunications counsel, in from
New York, has just presented a case for deregulating
AT&T on a market-by-market basis. Fazzone is eager
to see other companies give Ma Bell a run for his
money. His plan provokes immediate response from
someone who counters that full divestiture is the only
way. AT&T has outgrown the FCC's ability to oversee
market-by-market deregulation. Conversation heats
up.

Professor Anthony Oettinger, chairman of the pro-
gram, seems to revel in the intensity of the discussion.
He zings into the proceedings: "You can suggest full
divestiture, but there will be a dozen guys who jump
in and say, 'Now you've made a hydra-headed monster
worse, and, by the way, we ought to have even more
Draconian regulation.' No matter who looks at a par-
ticular scheme, somebody will say we can't do it that
way. By what miracle are we to engage in these matters
practically?"

Rhetoric aside, Oettinger obviously thinks the Pro-
gram on Information Resources Policy is one way. He
shares that conviction, of course, with the program's
other executives: John LeGates, director; Ben Com-
paine, who manages media research; Oswald Ganley,
director of research in the international arena; and John
McLaughlin, who pursues problems in postal policy
and in the area of national security. They, along with
a cadre of research fellows and students, are out to
improve the information available about the informa-
tion age and, by so doing, reduce the casualties and
damage of the post-industrial revolution. One way the
program's principals gather data and circulate infor-
mation is through seminars, and today's continues at
a lively pitch.

Someone despairs of Congress's ability to unravel
the telecommunications issue and says, in mock de-
spair, "Asking rational questions and pursuing them

rationally has not been sold in Washington." Oettinger,
who remembers the missionary work of the program's
early days, capitalizes on the comment immediately.
"That's why there's the private sector, a portion of
which is called academe, that gets paid to step back
and think about these things." Everyone laughs when
he adds, "Hey, I'm not going to apologize for being
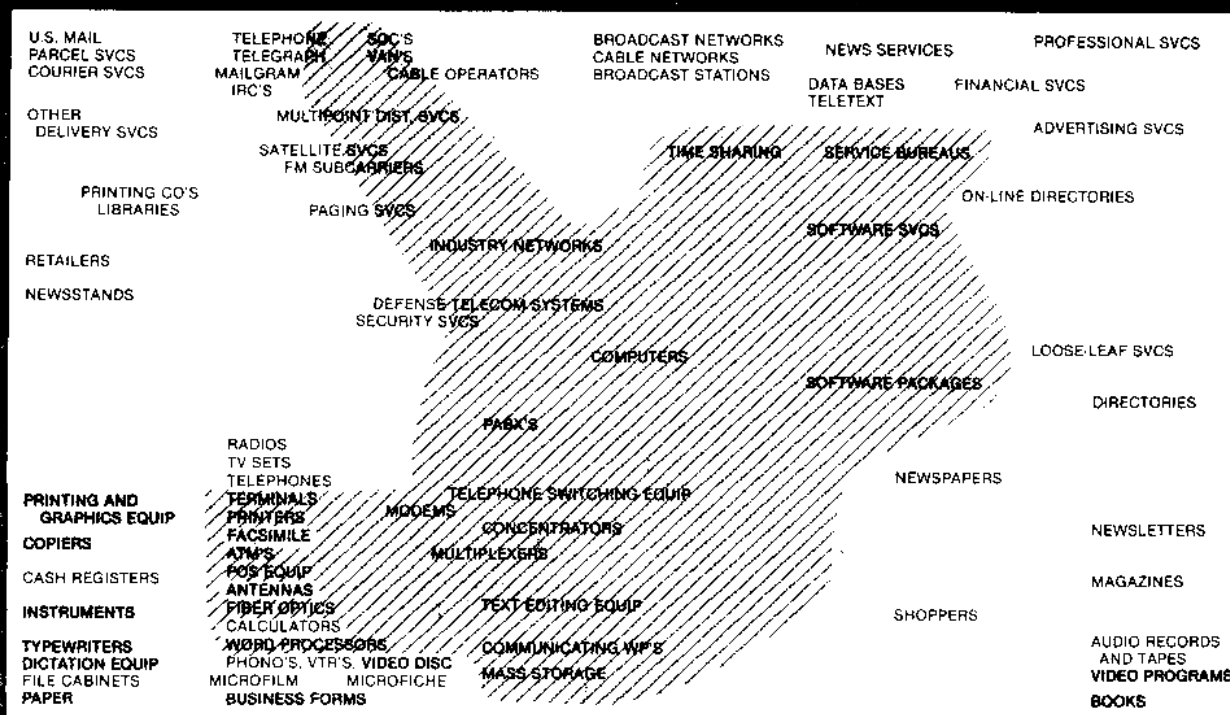academic within the precincts of Harvard University."

Kitty-corner from the seminar room is Oettinger's
office. A cigarette ad ("I'm a realist. I only smoke
Facts") is stuck on one side of the door; instructions
about what to do in the event of a nuclear attack ("Kiss
your ass goodbye") are posted on the other. Inside,
piles of papers, stacks of books, a nice view of the
Law School yard, and Oettinger's big desk.

On the edge of the desk, next to a sign that says Bull
Shipping Department (a present from his wife), is a
little standing acetate graph—a graph that outlines the
program's sprawling venue. Now widely reproduced
(this desk toy is an AT&T version), the "map" arranges
about eighty information businesses—newspapers,
telephones, computers, databases, multiplexers,
PABXs—in relation to each other on two axes, one
labeled "products/services," the other "content/con-
duit." Oettinger and his colleagues are in business to
gather information about all these information busi-
nesses, to provide impartial analyses of technical, po-
litical, and marketing developments with intent to im-
prove business planning and government policy making.

Sitting at his desk, chain-smoking Kents, Oettinger
explains the program's panoramic approach to under-
standing these developments. "We staked out every-
thing that has to do with the way information is gath-
ered, stored, manipulated, distributed, and used," he
says. "At one time, one could talk about computers
as a closed area. One could talk about newspapers or
TV or radio. One could talk about the post office in
isolation. In the last twenty years, because of tech-
nological change and changing perceptions of where
the markets are, the barriers among the traditional busi-
nesses are breaking down." So Oettinger's operation

*Opposite: Information specialists John LeGates, John
McLaughlin, Benjamin Compaine, and Anthony Oet-
tinger, standing in front of Howard Aiken's pioneer
computer, Mark I.*

U.S. MAIL
PARCEL SVCS
COURIER SVCS

TELEPHONE
TELEGRAPH
MAILGRAM
IRC'S

SOC'S
VANS
CABLE OPERATORS

BROADCAST NETWORKS
CABLE NETWORKS
BROADCAST STATIONS

NEWS SERVICES

PROFESSIONAL SVCS

OTHER
DELIVERY SVCS

MULTIPOINT DIST. SVCS

DATA BASES
TELETEXT

FINANCIAL SVCS

SATELLITE SVCS
FM SUBCARRIERS

TIME SHARING

SERVICE BUREAUS

ADVERTISING SVCS

PRINTING CO'S
LIBRARIES

PAGING SVCS

ON-LINE DIRECTORIES

SOFTWARE SVCS

RETAILERS

INDUSTRY NETWORKS

NEWSSTANDS

DEFENSE TELECOM SYSTEMS
SECURITY SVCS

LOOSE-LEAF SVCS

COMPUTERS

SOFTWARE PACKAGES

DIRECTORIES

PABX'S

RADIOS
TV SETS
TELEPHONES

NEWSPAPERS

PRINTING AND
GRAPHICS EQUIP

TERMINALS
PRINTERS
FACSIMILE
ATM'S
POS EQUIP
ANTENNAS
FIBER OPTICS
CALCULATORS
WORD PROCESSORS

TELEPHONE SWITCHING EQUIP

NEWSLETTERS

COPIERS

MODEMS

CONCENTRATORS

CASH REGISTERS

MULTIPLEXERS

MAGAZINES

INSTRUMENTS

TEXT EDITING EQUIP

SHOPPERS

TYPEWRITERS
DICTATION EQUIP
FILE CABINETS
PAPER

PHONO'S, VTR'S, VIDEO DISC
MICROFILM    MICROFICHE
BUSINESS FORMS

COMMUNICATING WP'S

MASS STORAGE

AUDIO RECORDS
AND TAPES
VIDEO PROGRAMS
BOOKS

*Like electronically based imperialists, AT&T and IBM are eyeing the same territory. Shown here, AT&T's potential deregulated activities and IBM's current operations (foreign and domestic, and joint ventures). This "map" is one way the program organizes the world of information businesses.*

looks at each industry with wide peripheral vision, in acknowledgment of merging technologies and merging markets. "Computers are a key ingredient of the change," he continues. "They are the solvent that has leached out the glue from the traditional institutions."

Institutions aren't the only things coming unglued in this unstable environment. Old political and economic arrangements are unraveling; business managers, planners, entrepreneurs, regulators, and legislators have all kinds of new things to worry about. Now that data processing is difficult to distinguish from telephone message-switching, the phone company finds itself competing with computer companies, and the FCC has to re-evaluate its ability to fulfill its regulatory functions. The look of the marketplace is changing; colleagues and competitors are coming from unexpected places. AT&T and Knight-Ridder Newspapers, Inc., formerly totally unrelated, link up for a home-information experiment in Coral Gables, Florida. Because of opposition from local newspapers, the phone company cancels a plan to provide information to TV viewers in Austin, Texas. The map on Oettinger's desk and the research done under program auspices are designed to help people figure out where in this complex world they are.

To do that, Oettinger and company have devised a unique intelligence-gathering scheme, one that is the key to looking at each industry with an eye on the others. For an issue under analysis, program researchers develop the big picture in great detail by putting together a composite of the views of people actually involved. Program proposals and projects—on telephone rates, on interstate banking practices, on postal pricing policies, on transborder data flow—are reviewed by authorities with pertinent expertise or experience. Some of these experts are program "affiliates." To date Oettinger has enlisted more than one hundred public and private organizations that provide state-of-the-art information, their own particular perspectives on the issue, and, not incidentally, "small doses of money." Oettinger is happy to elaborate: "We are dealing with sensitive political and economic issues, and we didn't want to fall into the hired-gun academic trap—become prisoners of the hand that feeds. We want to be free from pressure to see things one way or another in order to have our work accepted by people regardless of where they are on the political, ideological, or professional spectrum." And so AT&T comments on program research, as does MCI Communications, the FCC, Continental Telephone, and the Communications Workers of America. Program research circulates widely (through publication, lots of consultation with affiliates, in congressional hearings) and sometimes—as in the seminars—loudly.

"We're talking about areas in which there is a great deal of controversy and obscurity," Oettinger says. "That's why the insane-seeming breadth of the program. If you focus on one narrow area, you lose track of the fact that all of the action is *between* the classical areas. We've seen a lot of folks make terrible errors by failing to have peripheral vision."

Oettinger leans back in his chair and chooses a fa-

vorite example. "It's an accident of the English language that *newspaper* has the word *paper* in it. Other languages don't—*Zeitung, journal*. Newspaper is just the notion of delivering the news. Paper is incidental.

"Why is the newspaper the size it is? It reflects the fact that it was British policy to tax by the number of pages, so you had an incentive to make the page as large as you could to reduce your taxes. And the nineteenth-century rotary press couldn't accommodate anything bigger. That particular constellation of technological and political constraints on the newspaper has disappeared."

Researchers at the program looked at those setting stars and saw the future. Newspapers' "ancient technology" for delivering the news was subject to increasing costs: Paper had tripled in a decade, labor doubled, energy risen by 400 percent. The costs of electronic delivery were going down by a factor of two to ten, depending on which of the affiliates were consulted. Eventually, those two curves would cross, and at that point it would be appealing to get rid of newsprint and transmit information over the wires. But . . . newspapers in competition with the phone company?

"When we first articulated that notion, everybody thought we were crazy," Oettinger says with a smile. Then, two years ago, the Senate rewrite of the Communications Act of 1934 contained provisions that would have allowed AT&T to produce "electronic Yellow Pages," and compete with newspapers for critical advertising.

"Our phones started jangling," Oettinger remembers, with the excusable pride of a prophet who's come into a little honor. "We were invited to make lots of presentations." Which they did, including one to the board of the American Newspaper Publishers Association. The program also sponsored a weekend workshop on the future of newspapers. In accord with the program's wide-angled view of any problem, participants included publishers and editors as well as pres-

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idents of telecommunications businesses, congressmen, the Massachusetts commissioner of cable TV, and the postmaster general.

For all their expertise, Oettinger and his colleagues stay away from advocacy. "When everybody started coming to us saying, 'What in hell is going on?'" Oettinger says, "we were prepared, not with answers as to what they should do, but with a description of the terrain over which they were fighting their battles."

Oettinger's view of the world is coming into focus

for a lot of people now, although it hasn't always been so obvious. When he and Director John LeGates founded the program in 1972, "information resources" wasn't a buzz phrase, it was only "a notion that boggled people's minds." Nor was there much appreciation for the idea of merging technologies, and the political and economic upheavals that would ensue. Now, when AT&T, GTE, Exxon, IBM, Pitney Bowes, and Japan, Inc., are all in competition to automate your office (and are all, not incidentally, program affiliates), the panoramic approach seems essential. A colleague of Oettinger's speaks for several when he says, "For ten years Tony has been saying things about commercial and technological developments that everybody else is just now discovering. He really understands what's driving these things—all the way down to his fundamental grasp of what's going on in circuit design. As much as any scholar is able to say, 'I told you so,' Tony has been right on the button for a decade."

"I spent some time here in the Aiken computational labs my senior year," Oettinger says, hands behind his head. He speaks with no hint of an accent, although he was born in Nuremberg. He fled the Nazis with his family and arrived in the United States in 1941. After attending the Bronx High School of Science (where he got intrigued by calculating machines—"I did a science-fair project, a gizmo that electronically added and multiplied, built out of old gunsights"), he came to Harvard on a scholarship in 1947. Except for a postgraduate fellowship year at Cambridge and a sabbatical helping to design Apollo mission control in Houston, he's been at Harvard ever since.

Oettinger met Howard Aiken at a Phi Beta Kappa dinner during his junior year; Aiken (the Harvard mathematician who created Mark I, the pioneer computer that launched the age) had been elected an honorary member and Oettinger was first marshal "He'd had a few martinis and I'd had a few, and we were very convivial," Oettinger chuckles. Aiken, upon learning of Oettinger's interest in computing devices and his knowledge of Russian, mentioned a memo he'd received from a director at the Rockefeller Foundation, Warren Weaver. Weaver was pondering the possibilities of using computers to translate and Aiken thought Oettinger might be interested. "I remember sitting downstairs thinking about how one might use computers to translate languages. That ended up being my doctoral thesis."

It was also an early experience of the area where technology and economics collide. Putting words in simple dictionary relationship was technically possible, but, at the time, was "just too damn expensive to be useful." Actual translation wasn't possible at all. "We discovered ambiguities in language you don't suspect," Oettinger says. "To this day we don't know how the human brain takes an utterance like 'Fruit flies like a banana' to determine it must mean this or that, and certainly nobody has figured out how to get a computer to disambiguate things like that." He smiles and shrugs.

Oettinger received his Ph.D. in 1954, and Aiken and Joshua Whatmough, chairman of the linguistics department, "connived to have me appointed half an instructor of mathematics and half an instructor of lin-

guistics." (He continues to straddle departments; today he is Gordon McKay professor of applied mathematics and professor of information-resources policy.) During this time, enthusiasm for computer applications to education was high, and speculation ran far ahead of technical actualities. As Oettinger remembers it, "There was a notion that somehow you could stick every kid in front of a console and magic would happen. I looked at that and thought, Hey, wait a minute, this is nonsense." And said as much in a book called *Run*

> ## Access to the wired society's wires will determine a lot about who decides to offer what quality of which communications services to what markets where.

*Computer Run.* "That was one of the times I really appreciated the value of tenure," he says, remembering the unpopularity of his opinions. "We came under great pressure to suppress that book." He muses further. "When we were writing the book, we got wind of the fact that the Japanese were selling a small hand-held calculator for about $500. With twenty-twenty hindsight, I wish we'd had the guts to speculate about that. We made a fleeting reference to it in the back of the book, but . . . of course, that's what's really changed the whole ball game. Now every kid has one." Oettinger reaches for the little calculator in his briefcase and points to the one on his desk. "Anyway, it was then that computers were turning from a military-industrial capital expense to a consumer product."

And were moving higher up on the government's agenda. Fred Seitz, president of the National Academy of Sciences, asked Oettinger to create the Computer and Engineering Board, which he chaired from 1968 to 1973. While chairman, he oversaw a number of reports on information technology, including one for the FCC on a controversial topic: the effect of devices that "interconnect" with AT&T's network (phones supplied by non-Bell companies, for instance). A good deal of money was at stake, depending on the FCC's decision to permit interconnecting devices or not. "We were under pressure to push that study one way or another," Oettinger recalls. "I got very conscious of the problem of addressing questions of this kind—with a technico-political flavor—in an environment where one could look at them without being under pressure to call the shots one way or another. I was also getting more and more interested in what happens on the way from the laboratory to the real world. Clearly, it's something that's influenced not only by technological possibilities and economics—how much something costs—but there is also a great deal of political tugging and hauling." Soon after the FCC study, the board disbanded, but Oettinger carried the seeds of his experience with science and politics back to Harvard. "It was around this time that we conceived of what is now the Program on Information Resources Policy."

Oettinger and Oswald Ganley sit at the head of Ganley's seminar on information resources and foreign policy at the Kennedy School. They interrupt and challenge each other with the easy exchange that sometimes comes from long association. (Ganley, director of international research at the program, remembers meeting Oettinger in the late Sixties. Then assistant deputy secretary of state for science and technology, he recalls, "I needed some assistance on a very ticklish problem related to the export of computers to the Soviet Union—what was reasonable to sell, what was a threat? Frankly, we were pretty well lost on that subject. We needed some outside advice, and we turned to Tony.") For this class, Oettinger is reviewing an area only recently being explored by program researchers: the concept and techniques of "command, control, communication, and intelligence," or, in military parlance, $C^3I$. Oettinger and his colleagues are intrigued not only with the way the Army, Navy, and Air Force manage information but also with how E.F. Hutton, Citibank, and Sears do it. (This spring Oettinger is giving his own Kennedy School seminar on $C^3I$, for which he has imported strategic and tactical air commanders, defense undersecretaries, multinational managers, and a CIA director as guest lecturers.)

Oettinger's topic is how information technology has stretched and strained the notion of national security; his discussion, as usual, is laced with anecdotes and literary asides. He tells the assembly about the first Washington-Moscow hotline, established after the Cuban missile crisis. Very rudimentary: Part of it ran over open lines through Cape Cod; part of it ran underground through Finland and was once severed by a Finnish farmer's plow. "The fate of the world rests on odd things," Oettinger muses. Such as the Ayatollah Khomeini's engineering his revolution from Paris by astute use of long-distance direct dialing, cassettes, and copiers. "The struggle for democracy against autocracy via xerocracy" is what an Iranian friend of Oettinger's called it.

Consideration of the difficulty of controlling access in a day of direct dial prompts one student to comment on developing cryptographic equipment to make telephone lines (especially military lines) secure. Oettinger is delighted to respond: "Before, Ma Bell could have done that and buried it in everybody's phone bill. Now, with the prospect of a deregulated Bell, you cannot address the superencryption problem until you figure out who pays for it. This is a classic example of a simple technical problem that falls into policy cracks." And as such is not only right up the program's alley, but right into an area of particular concern to Oettinger.

For many years, Tony Oettinger has been concerned with the price of a phone call. Like the size and shape of a newspaper page, the costs and prices of telecommunications services reflect technical constraints and political accommodations. Unlike the newspaper page, the size and shape of the allocations and subsidies within the phone company's pricing structure aren't obvious. In the wake of new technologies (microwave and satellite competing with AT&T long-distance wires, for example), complex po-
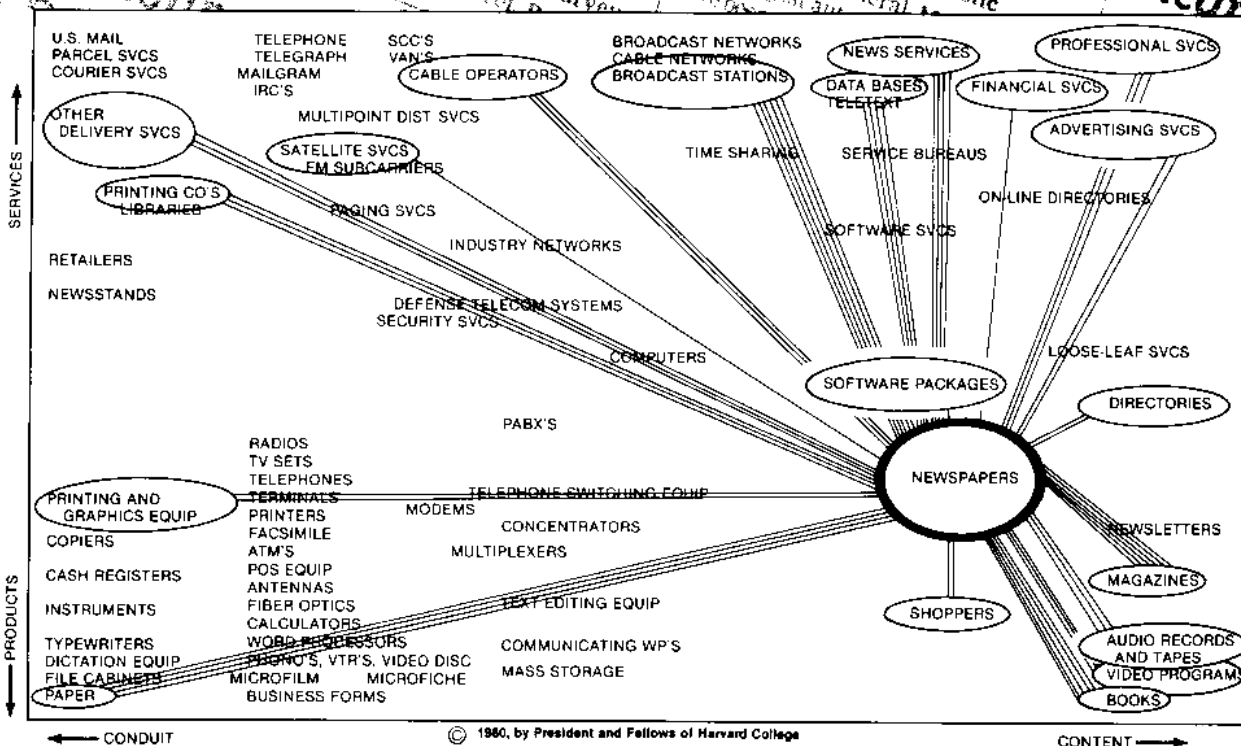
*Here's the news about the newspaper business. This scheme represents the expanding activities of seven companies generally considered to be newspaper publishers, including the Times Mirror Co., the Washington Post Co., and Harte-Hanks Communications.*

litical and economic adjustments are being made in Congress, the courts, the regulatory agencies, and the marketplace. Lately, the details of costs and prices have become very important.

"Transmission and switching facilities are a social infrastructure, like roads and electrical-power facilities," Oettinger wrote in one of his reports. "Many of the new competitive arenas depend on this infrastructure. The prices of transmission and switching services—long-haul, short-haul, or local—affect *every* business and *everyone's* life style." Access to the wired society's wires will determine a lot about who decides to offer what quality of which communications services to what markets where. "How everyone is ultimately affected is unlikely to be determined solely by some dramatic regulatory, judicial, or legislative act. The crucial battles over the costs and prices of compunications facilities [Oettinger's word for merging computer and communications technology] will be won or lost, as they have been in the past, in the trenches of detail and over many years of arduous negotiations."

Oettinger was among the first to start filling in the details of telecommunications pricing practices, and if the negotiations are still arduous, they should at least be based on better information. To date Oettinger has produced five volumes of *Basic Data on the Politics and Economics of the Information Evolution: Telecommunications Costs and Prices in the U.S.*

"It appears a very pedestrian kind of thing," Oettinger says of the problem of determining the cost of a phone call, "but you're talking about billions of dol-

lars and a situation that's unfamiliar to most economists. Much of the traditional economic analysis in this area has not been worth the powder to blow it to hell. It's ignored the political underpinnings of cost allocation and pricing practice which are at the heart of the matter.

"We've found that nobody has a clear understanding of how pricing's been done in the past, and now people are starting to argue about how to do it in the future. If you're going to get a sense of what will happen with a change—who's going to win and who's going to lose—you first have to have some sense of who's winning and losing now. When arguing a question of how to get from here to there, it's very important to get an idea of what's 'here.'"

In March, Oettinger went to Washington to give Representative Timothy Wirth and the House telecommunications subcommittee some sense of "here" for that body's deliberations on HR 5158, its version of the new "there" for the telecommunications industry.

Occasionally, the experts at the program have been asked to take a more active part in drafting legislation. "We refuse," says John LeGates, "on much the same grounds that we don't tell a company what to do. Our role is to inform people about what's going on and let them decide for themselves what they want to do about it. Writing legislation is not the knowledge business, it's the power business. We think those businesses are kind of mutually exclusive. If we had too much influence, we'd lose our impartiality and be useless as suppliers of information. We're very active in supplying

a knowledge base on which legislators make their decisions, but when they sit down in the back room and light their cigars, we're not there."

Twice a week, between seminars, consultations with affiliates, and trips to Washington and New York, Tony Oettinger meets with the dozen undergraduate and graduate students enrolled in Social Sciences 106. "Knowledge and Power" is a tour of the information industries by an authoritative guide.

Oettinger is an animated lecturer, in constant motion. He frequently uses his hands to tease subtle points out of the air. "We've been discussing content," he says. "Now we're going to be concerned with the invisible and less sexy part of the issue. The part that's totally buried in the technological bowels—process and format." *Content, process,* and *format* are terms program researchers use to describe information businesses. Content is, say, ads or news; process is telephone wires or computer memory; format is ink on paper, or, maybe, a video display terminal. Under the "liberating influence" of these terms, a newspaper's business is identified as providing content; the process by which that content is delivered—on newsprint or over the wires—should be seen as subject to change.

"Content is the remaining grin of a long-gone Cheshire cat," Oettinger says, smiling his own wide smile. "Now we're going to be concerned with the invisible stuff of process and format, which is where all the economic, entrepreneurial, legal, and regulatory activity is." Like an academic Till Eulenspiegel, Oettinger prepares to crash through a review of traditional economics before taking his students through the marketplace he knows, one which has to do with politics as much as economics. "Some of the technical details will be a little dry. There may be a tendency to develop the MEGO reaction—'my eyes glaze over,' " he says sympathetically. But these are the details on which rest decisions about the future of various information industries, and for congressmen on communications subcommittees, for bureaucrats at the FCC, for industry CEOs, and for students in Social Sciences 106, there are no shortcuts. Oettinger offers consolation: "I side with Aristotle when he told Alexander, 'There is no royal road to knowledge.' "

Oettinger gets up from his desk and crosses his office to the peg where his coat and bicycle helmet hang. He takes cigarettes from his coat pocket, comes back, sits down, lights up, and talks about the program's next several years.

"The struggles over who's going to pay what portion of the phone bill—that's one example of something we're likely to stay with. It's going to be of continuing importance long after the flurry of headlines. There will be at least another decade of arm-wrestling over who pays what share of the bill." But besides following through with that problem, Oettinger is already speculating about topics that are likely to get hot in the next few years.

"One thing we think will be of growing importance will be the long-term implications of a major shift in our notion of literacy." Earlier he's remarked on how slowly Harvard incorporated computer science into the curriculum, and then only at the insistence of the students. "You know, the people between the ages of 5 and 25 are a very different breed. At work, at play, they are using a lot of this new technology. Some of it is still in the entertainment phase—videogames and so forth—but aside from being a mammoth business, it's conditioning an awful lot of people to receive and use information on a screen, to manipulate keyboards and buttons.

"We're seeing the Eighties equivalent of the Fifties feeling of every American kid being born with a wrench in his hand. Now they're born with a microchip. In the next few decades, literacy may shift from competency with pen and paper, or figuring in your head, toward the electronic end."

When calculators are so cheap, Oettinger wonders whether the billions spent in schools on arithmetic drills might be better allocated for teaching deeper mathematical analysis. When more and more people punch keys rather than write, he asks if schools should concentrate on keyboard skills instead of penmanship. He's making sure his children are at home at a keyboard; he feels handicapped because he isn't.

"You know, the notion of the three Rs we live with now wasn't graven on tablets. It's only about a century old, a product of the technological, social, and economic conditions of the Industrial Revolution. With the shift now occurring in our technology and economy, we're going to see a rapid shift in what is considered literacy. Paper won't disappear, but there will be a very different balance."

Sanguine that educational standards won't decline, Oettinger is insistent that those standards—teaching people to think well, to understand the world they operate in—must be reinterpreted in light of new technology and an economy that already employs about seven million keyboard punchers.

"What we're doing right now," Oettinger says about program research on the literacy question, "is to run a vacuum cleaner over the data available about the number of people who are part of this group. There's a job ahead solidifying and quantifying surface impressions." Oettinger sees the future and then he wants to document it. Somewhere on the program's agenda will be research on how many people are actually using computers, on impending employment dislocations, perhaps on outlining options for the role of education.

"Where we put our other bets, I don't yet know." Oettinger grins, looking as though he savors that unpredictability. Randomness has worked out well for him in the past. "I got into this originally because I was attracted in high school to the notion of computers. At that time nobody figured this was going to become what it's become. It was an accident, but I ended up at the edge of what turned out to be a major wave, a frontiersman on a moving frontier. I don't expect it to stagnate during my lifetime, so I expect to keep having fun. It's marvelous to luck out in timing this way." □

*Gretchen Friesinger is copy editor of this magazine. For more about her, see page 3.*