Information Resources: Knowledge and Power in the 21st Century

Anthony G. Oettinger

Summary. Every society is an information society and every organization an information organization. Hence information is a basic resource like materials and energy. The need to ask "Who has a resource? Who wants it? How can you get it? and What are the terms of trade?" links any resource to political or economic power. For information resources, traditional answers are now inadequate owing to the growing abundance and versatility of the fruits of our unprecedented engineering mastery over the microscopic information processes embodied in devices such as large-scale integrated circuits and microcomputers. Illustrative of the evolution of new answers and of their import are the consequences of competition within and between the computer and telecommunications industries, of our reliance on satellites and other technical means for both the prevention and the conduct of war, of the growth of information occupations relative to other jobs, and of domestic and international struggles over freedom of information versus control over it.

By widening the range of possible social "nervous systems" the continuing growth of information resources is upsetting the world order just as the Industrial Revolution upset it by widening the range of physical modes of production. Where this will lead is as hard to foretell as predicting today's world when the steam engine was invented. However, the timeless truth that knowledge is power once again needs reinterpretation because of newly abundant, varied, and versatile modes of gathering, storing, processing, transmitting, and exploiting information that contrast with ever scarcer and costlier materials and energy. Why this is so is illustrated first by showing how changing prices of the services delivered by the computer-and-communications (compunications) infrastructure have almost literally changed the shape of the United States. I next describe information resources in generic terms that permit comparing specific modes of information resources in terms of the key questions asked about any resource: who has it, who wants it, how can you get it, and what are the terms of trade? Vignettes of information resources in peace and war, in employment and productivity, in freedom and control depict how contemporary answers to these perennial questions are changing.

The Changing "Compunications" Infrastructure

Nineteen seventy-six marked the centennial of the telephone; the telegraph is a generation older. The births of radio early in the 20th century and of television in midcentury are other notable milestones in the evolution of the electronic communications technologies. Computer and other digital electronic information technologies flowered during and after World War II.

Wholly unprecedented is our still rapidly developing engineering mastery over the microscopic information processes embodied in devices such as large-scale integrated (LSI) circuits and microcomputers. The digital technologies underlying such devices are a merger of computer and communications technologies into a common stream that I have called compunications technologies.

Coincident with the unfolding of compunications technologies, political decisions began to be made in the late 1960's that awoke competition in the telecommunications industry where it had been dormant for half a century; in the same period the boundary between the telecommunications and computer industries grew blurry. The resulting price changes almost literally changed the shape of the United States. Figure 1a is a familiar geographic map of the United States marked with distances from Jefferson City, a place at about the center of Missouri. The less familiar maps of Fig. 1, b to d, are telephonic maps. Whereas the geographic map shows actual shapes with the circles showing miles, the telephonic maps show costs, not distances from Jefferson City.

Similar politico-economic-technological changes in our perceptions of distance—and of time—will continue globally over the next decade along with domestic and international battles over how the resulting benefits and burdens are to be shared among advanced or developing nations, big or little businesses, urban or rural households, and different types of uses such as the traditional and still dominant voice services from mouths to ears or the new and growing digital transmission services to and from compunications terminals at work or at home.

Concomitant changes in industrial organizations also can already be discerned behind a still stable facade of traditional labels. To help visualize these changes, John McLaughlin (*1*) has diagramed (Fig. 2) the operating spheres of two of today's industrial giants (AT&T and IBM) on scales independent of traditional industrial categories. Figure 2 shows that even today these spheres overlap more than might be suggested by AT&T's obsolescing "telecommunications" label and IBM's obsolescing "computers" label. But AT&T's and IBM's common reliance on common compunications technologies makes possible the still greater overlap shown as it has been derived from the ebb and flow of acquisitions or divestitures, business plans announced or withdrawn, regulatory petitions granted or denied, and legislation passed or tabled that accompanies a period of intense turmoil in turf definition.

What comes of that turmoil clearly matters to the numerous protagonists—such as AT&T, IBM or IT&T, the U.S. Postal Service, RCA, Exxon, Chase Manhattan, Dun and Bradstreet, McGraw-Hill, the Washington *Post*, and numerous other enterprises, large and small, public and private—in the United States and abroad who are redefining themselves and their missions in the light of technological changes that have lifted the traditional barriers among themselves and among their markets.

Beyond the stakes of particular corporations, some see the changing patterns

The author is chairman of the Program on Information Resources Policy, Harvard University, Cambridge, Massachusetts 02138.

0036-8075/80/0704-0191$00.50/0

of prices of information and of access to information as likely to entail pervasive and profound social transformation, just as the advent of mechanized industry and the subsequent rise of the bourgeoisie transformed Western societies once before. Hence such labels as the "information revolution," the "information society," or the "post-industrial society" (*2*).

It is generally recognized how significant changing modes of transportation are in commercial terms of access to raw materials, energy, labor, and markets or in terms of the projection of military power. Since it is less widely understood, the significance of changing modes of information resources is next described in similar terms.

Information Resources and Post-Industrial Society

Every society is an information society and every organization an information organization, just as every organism is an information organism. Information is necessary to organize and to run everything from a cell to General Motors or the Pentagon. Large organizations get information and use it through formalized functions that military commanders call intelligence and command-and-control and that civilian managers refer to as staff assimilation of information for line management. If an organism is taken as a metaphor for a group, corporation, military service, country, or society then, metaphorically, intelligence is the function of the outward senses and command-and-control encompasses all other functions of the nervous system, including inward senses. In organizations as in organisms the scope of these functions and the means for executing them range from the rudimentary to the highly elaborate.

Motor functions, those of muscles, weapons systems, or assembly lines, are, of course, essential to doing anything; they depend on materials and energy, and without materials there is nothing and without energy nothing happens. But without information, nothing has meaning: materials are formless, motion is aimless. Contrasting an information society to an industrial society therefore does not imply, as is often mistakenly supposed, that the intrinsic importance of motor functions is diminishing. It merely shifts focus from motor functions or physical actions to the nervous systems that direct the senses, thought, and physical action. The contrast also reflects a proportion of information-related activities greater in modern societies than before.

Nowadays major and rapidly growing industries either produce, distribute, store, or process information as their main product or else supply others with the means for doing so (Table 1). Almost half of the U.S. labor force is already engaged in information occupations (Fig. 3). Although highly visible institutions, most notably public libraries and commercial television, continue to foster the illusion that information is a free good, information resources do in fact cost something. They are also essential for planning, directing, and monitoring the purposive activities of organisms and organizations.

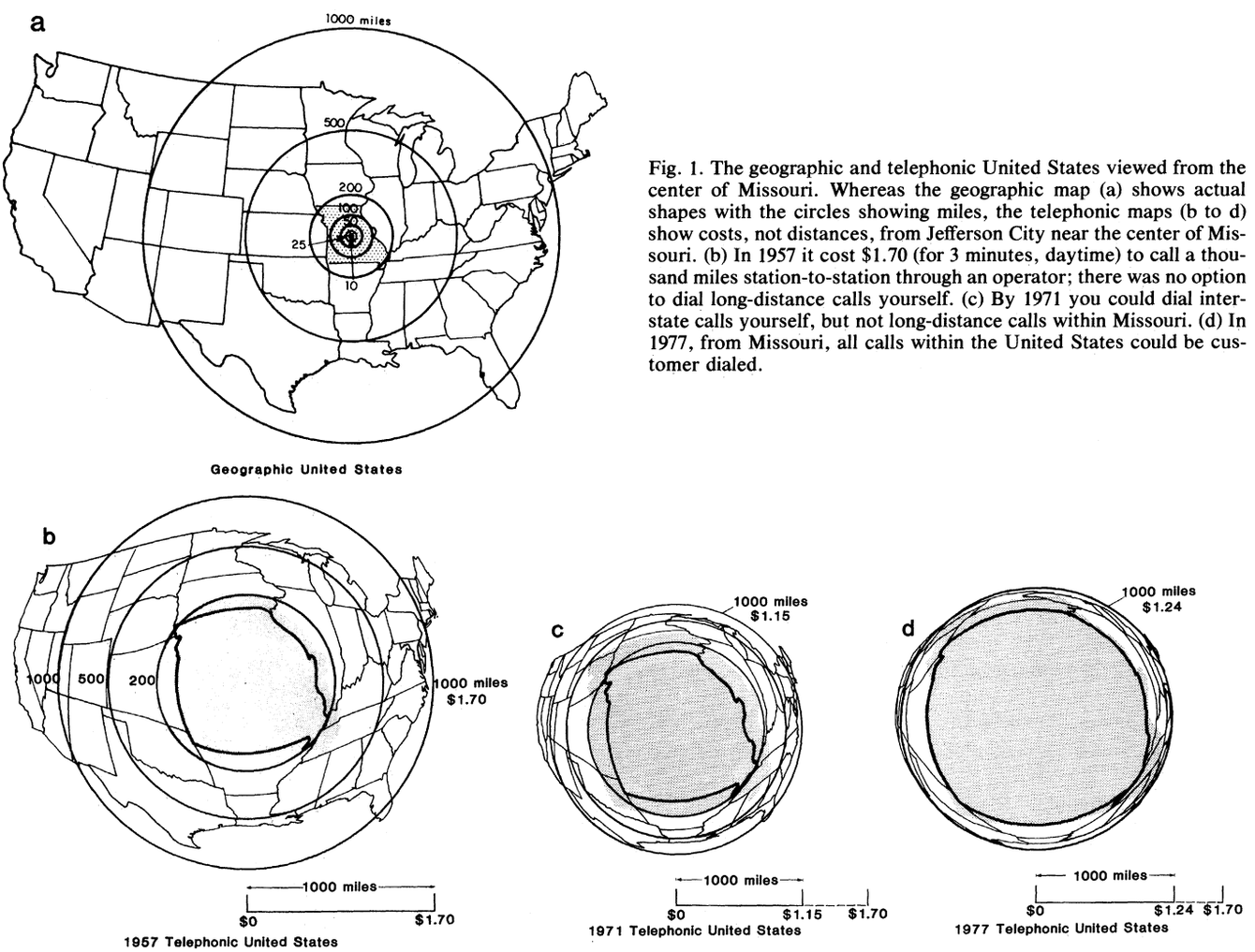

Fig. 1. The geographic and telephonic United States viewed from the center of Missouri. Whereas the geographic map (a) shows actual shapes with the circles showing miles, the telephonic maps (b to d) show costs, not distances, from Jefferson City near the center of Missouri. (b) In 1957 it cost $1.70 (for 3 minutes, daytime) to call a thousand miles station-to-station through an operator; there was no option to dial long-distance calls yourself. (c) By 1971 you could dial interstate calls yourself, but not long-distance calls within Missouri. (d) In 1977, from Missouri, all calls within the United States could be customer dialed.

Like materials and energy then, information is a basic resource and the critical questions about any resource also apply to information: who has it, who wants it, how can you get it, and what are the terms of trade? These questions are timeless; changing information technologies are changing only the answers.

Signs of the increasingly abundant fruits of modern information technologies are now all around us; witness, for instance, the many new and relatively cheap consumer products that *Time* magazine saw as evidence that America was becoming a "computer society" (Fig. 4).

The growing variety and versatility of information resources is masked by lingering traditional ties between specific kinds or purposes of information and specific means of dealing with them. Stereotypically, for example, news went with ink-on-paper and legmen, rewrite men, heroic editors with green eyeshades, massive presses, and little merchants staggering around the block under a Sunday's load. Mass entertainment was live hoofers on sawdust stages in the 1920's, silver halide images on celluloid projecting motion onto the screens of Art Deco movie palaces in the 1930's and 1940's, and phosphorescent images with commercials on the tubes in "home entertainment centers" since the 1950's. Personal communication for many still means ink, paper, envelopes, licking stamps, and the ring of the postman; for others, it's now mainly a finger in the dial or on the beeping buttons, the ring of the telephone and a voice at the other end. Dickens' Bob Cratchit and Uriah Heep are ancestors both of the keypunchers of yesterday's clerical warrens in banks and insurance companies and of the word processors sought in today's want ads. Digital compunications technologies already are versatile enough to discharge all of the above functions, certainly in part, perhaps entirely: all the different kinds of information can be represented in digital format, processed by computers, and transmitted electronically.

The term "information" appears to cover too much that seems distinctive: knowledge, data, information in a narrow sense that some treat as synonymous with data, news, intelligence, and numerous other colloquial and specialized denotations and connotations. However, the distinctions implied by oppositions such as observations/theories, data/knowledge, raw intelligence/finished intelligence, accounting details/management information are secondary, not fundamental in characterizing information resources. They reflect only relative judgments. For instance, one person's knowledge is often another's raw data. What a vice president for marketing, production, or finance thinks he knows is just data to the chief executive officer's staff. What a scientist thinks he knows about the merits of a flu vaccine or the safety of a nuclear reactor is just data for presidential policy and politics. Data or knowledge are just types of information content—of greater or lesser value, of greater or lesser cost.

Furthermore, information content comes to us in many readily interchangeable forms—pictures, words, speech, writing. These forms are representations of information content, as in the spoken representations of the word "car" in southern or in Yankee dialects, or the representations of "car" in cursive or block letters or in Morse code. And then there are formats of information content, the physical tokens that embody it: toe marks traced in the sand, gouges chiseled in stone, ink marks on paper, glowing phosphor patterns on television screens, electrical currents in

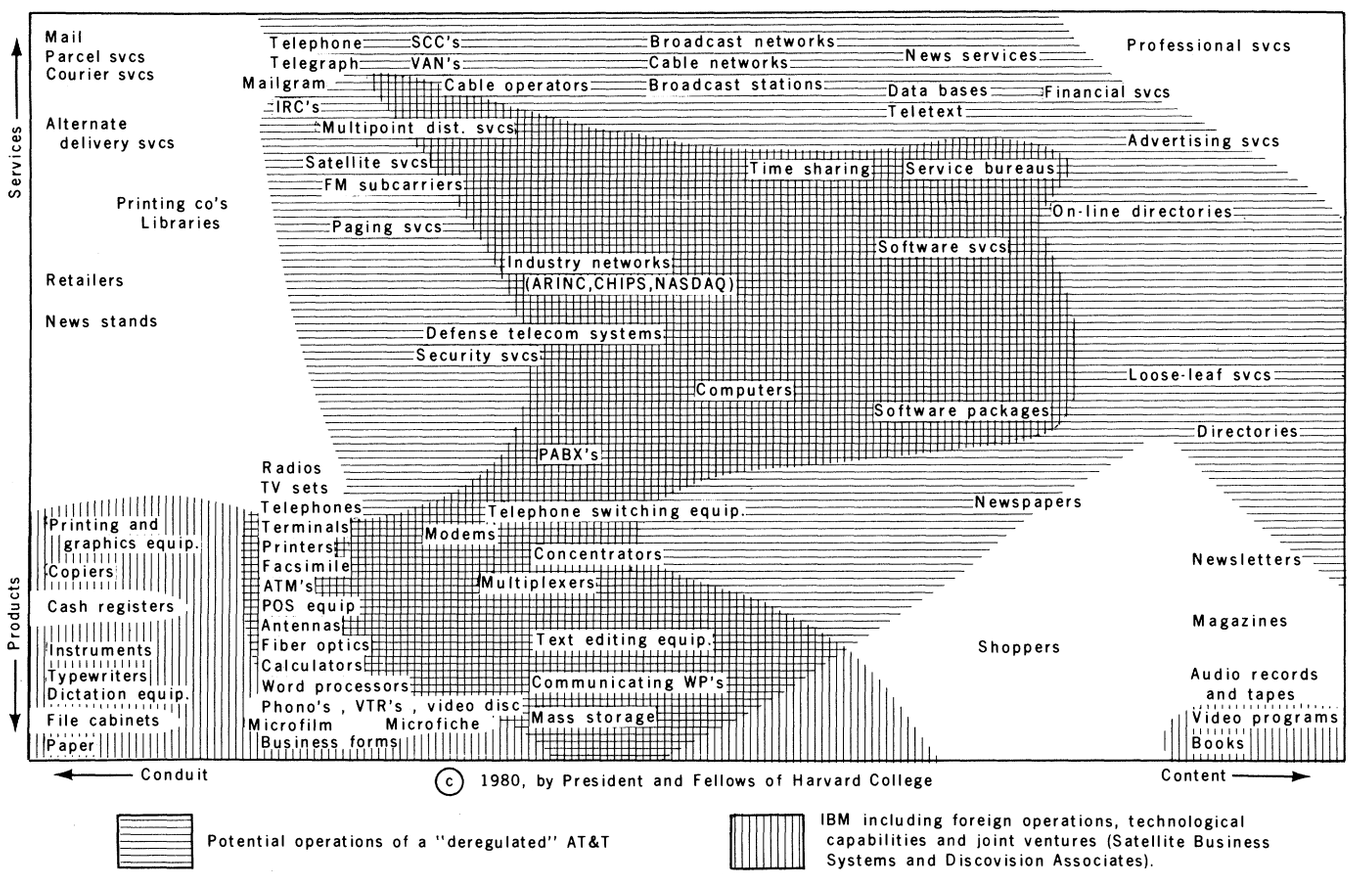

Fig. 2. The operating spheres at AT&T and IBM. The diagram includes domestic and foreign activities of IBM and those of its Satellite Business Systems and Discovision subsidiaries; it also includes AT&T's planned Advanced Communications Service. [From McLaughlin (*1*)]

telegraph or telephone wires, electromagnetic waves from satellites to Earth stations, magnetic bubbles in computer memories, laser beams in glass fibers. The processes of gathering, storing, manipulating, transmitting, evaluating, and using information content in various formats are mediated by physical processors such as pen and paper, printing presses, computers, and human brains.

It is only tradition that associates specific kinds of information content or purpose with specific representations, formats, and processors. In contrast, the generic concept of information resources encompasses any information content represented in any way, embodied in any format and handled by any physical processor. It encompasses any information processor for any content in any representation and any format, run within any public or private organizational structure. Adopting this generic concept enables us, as indicated above, to ask about information resources the same basic questions we ask about any other resource. It also enables us, as with other generic resources, to select specific modes for greatest effectiveness, efficiency, esthetic value, or any other criterion in order to get the most out of the potential of the vast panoply of information technologies now at our disposal.

The exploitation of diverse modes of information resources in the Iranian revolution of 1979 and the Iranian-American confrontation of 1979–1980 provides a pointed illustration.

Table 1. Annual gross revenues of the major information industries. Symbols: a, government statistics are routinely compiled for this industry but were not yet available for this year; b, industry statistics consistent with those for the following years are not available; c, major league sports are as intimately linked to the television industry as motion picture production and therefore qualify for inclusion. The organizations are, however, generally privately held and, except for a rare special study, data about them are not available; d, statistics are routinely compiled for only some types of libraries; e, figures are not normally released by the government but became available for prior years through congressional hearings.

Information industries	Approximate gross revenue (in billions of dollars)				
	1970	1974	1975	1976	1977
Telephone	18.2	28.3	31.3	35.6	40.8
Telegraph	0.4	0.5	0.5	0.5	0.6
Specialized common carriers	0.0	0.0	0.0	0.1*	0.2*
Satellite carriers	0.1	0.1	0.1	0.2	0.2
Mobile radio systems	2.0	2.9	3.2	3.5	a
Postal service	6.3	9.0	10.0	11.2	13.0
Private information delivery services	0.7†	1.3†	1.6†	1.7†	2.4†
Pulp, paper, and board	13.0†	17.1†	a	a	a
Photographic equipment and supplies	3.9†	6.0†	a	a	a
Radio, TV, and communication equipment	12.8†	16.8†	a	a	a
Electronic components and accessories	12.8†	20.3†	a	a	a
Computer systems manufacturers	b	16.6	18.8	21.1	23.8
Computer software and service suppliers	1.6	3.2	3.8	4.5	5.3
Broadcast television	2.8	3.8	4.1	5.2	5.9
Cable television	0.3	0.6	0.7	1.0	a
Broadcast radio	1.1	1.6	1.7	2.0	a
Motion pictures	3.8	5.5	5.4	a	a
Organized sports, arenas	1.0*†	c	c	c	c
Theaters	1.5	2.5	2.7	a	a
Newspapers and wire services	7.0	9.6	10.5	11.7*	13.4*
Periodicals (including newsletters)	3.2	4.1	4.4	5.0*	5.6*
Business consulting services	0.9	1.7	1.8	a	a
Advertising	7.9	9.7	10.0	a	a
Brokerage industries	40.6	64.0	69.1	a	a
Book publishing and printing	3.4	4.5	4.8	5.2*	5.6*
Libraries	2.1	d	d	d	d
Schooling	70.1	97.7	110.8	121.4	130.6*
Research and development	25.9	32.7	35.1	38.5	42.7*
Federal information institutions					
Census Bureau	0.1	0.1	0.1	0.1	0.1
National intelligence community	4.0*†	7.0*	10.0*†	6.0*†	e
NTIS‡	0.0	0.0	0.0	0.0	0.0
Social Security Administration	1.0	1.9	2.2	2.6	2.7
County agents, government	0.3	0.4	0.4	0.5	0.5
Banking and credit	61.1	136.2	132.7	a	a
Insurance	92.6	133.1	148.8	a	a
Legal services	8.5	13.7	14.8	a	a

*Estimated. †Lower bound. ‡National Technical Information Service.

Abundance and Variety: Iranian and American Experiences

Shortly after Ayatollah Khomeini's people took over from the Shah of Iran early in 1979, the Washington *Post* reported that they had cut off international direct dialing, requiring all international calls to go through operators instead. Apparently the Khomeini regime did not wish to be done to as it had done to the Shah, namely be leveraged out of power with command-and-control coordinated locally and abroad through the domestic and international automatic telephone network and other channels.

Indeed, the dog did not bark before the Shah's ouster early in 1979: the takeover of the main radio and television stations, that hallmark of the stereotypical coup, did not take place. There was no need for it. The Shah was in control of the best of traditional media to a degree that Roosevelt, Churchill, Hitler, Mussolini, or Stalin might have envied. But these media no longer mattered as much to national communications as in their heyday when alternatives were far more limited. Khomeini's people struggled, as one wag put it, "against autocracy, for democracy, by means of xerocracy" using abundant and accessible modern and ancient consumer media, not the scarce and inaccessible mass media ascendant in the 1930's through the 1960's. Khomeini's messages went from France to Iran and within Iran by direct dial telephone and by mail or courier. Audio cassettes of the Ayatollah's exhortations were widely disseminated for use on relatively cheap, hence widespread, common cassette players. In addition, their contents were transcribed and widely photocopied on, by then, common dry copiers. Word of mouth did the rest through imams in the mosques.

Toward the end of 1979, when Iranian "students" took over the American Embassy in Teheran and held its staff hostage, there was further evidence of eclectic fitting of modes to ends. The Iranians took advantage of the satellite tech-

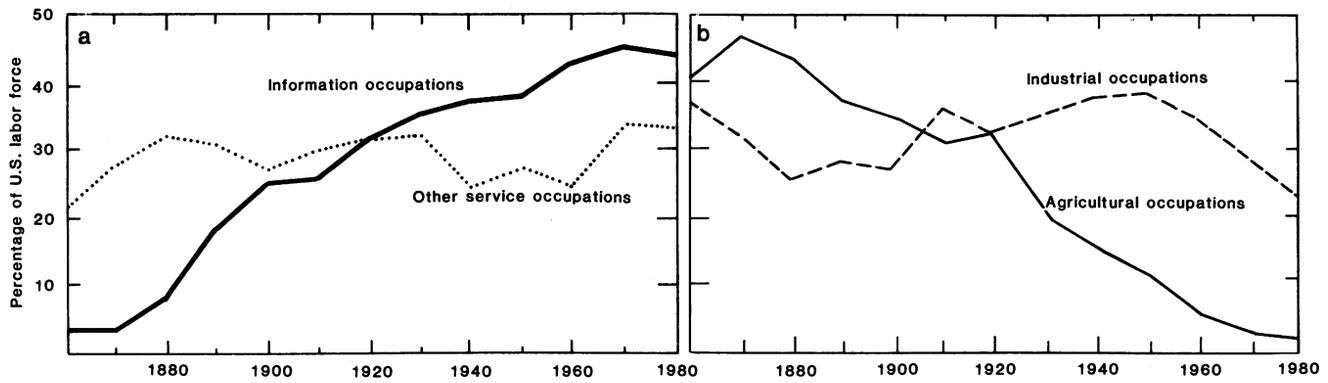

Fig. 3. Trends in the composition of the U.S. labor force. (a) Rising information occupations; (b) falling industrial and agricultural occupations. [From Porat (*14*)]

nologies and the open institutional traits of American television to stage for American consumption a running media event similar to domestic American events in the Vietnam and Watergate periods. Americans, on the other hand, took to the telephone network for contacts with Iranians and Americans in the embassy and engaged in massive exploitation of the old-fashioned mail system to shower Christmas cards on the hostages. And on Christmas Day, besides the imams in the mosques, there were clergymen in the embassy. With the muscle of naval task forces in the wings a large cast of ancient and modern information resources held center stage.

Eyes and Ears of Peace

In the early 1950's cloak-and-dagger intelligence-gathering and covert operations of World War II vintage were still in full bloom. Retrospectively far more significant, however, was the news in 1960 that the Soviet Union had captured Gary Powers and his U-2 reconnaissance aircraft. President Eisenhower's embarrassment was a bow to the old ways, but his proposal of an open skies policy presaged the new: information resources have since become a key element in averting the use of nuclear weapons from the Cold War to the present. The role of new information resources will continue to grow in strategic peace-keeping, in the command and control of military operations on any scale from local skirmish to global Armageddon, and in the management of peacetime crises like the oil embargo of 1973.

The *New York Times* in August 1979 reported that high-technology-based information systems "have given the American intelligence community an unsurpassed capacity to peel away the layers of secrecy that have traditionally surrounded the Soviet Union's military establishment" (*3*), and the *Times* illustrated its point with this vignette:

> A hundred miles above central Asia, an American satellite suddenly switches into operation. Although it is the dead of night, the spacecraft's camera takes hundreds of photographs of a suspicious construction site near a Soviet intercontinental ballistic missile complex. Minutes later as the satellite passes over Australia, the infrared photos are transmitted to an American-operated ground station and then relayed to the Central Intelligence Agency in Langley, Va.
>
> Examining the heat-sensitive images with the aid of computers using photo enhancement techniques developed in planetary exploration, C.I.A. analysts quickly note that the ground temperature of the construction site is substantially warmer than the surrounding terrain. The evidence appears conclusive: The Russians have secretly begun building an underground silo in which to house a new, multi-warhead missile.

Earlier, in 1972, overflights and other procedures such as had embarrassed Eisenhower had already begun to take the limelight. The treaty on the limitation of antiballistic missile (ABM) systems that emerged from SALT I provided that

Fig. 4. Consumer products. [Reproduced by courtesy of Time Inc.]

"each party shall use national technical means of verification at its disposal consistent with generally recognized principles of international law," that "each Party undertakes not to interfere with the national technical means of verification of the other Party," and that "each Party undertakes not to use deliberate concealment measures which impede verification by national technical means" (*4*).

The seminal character of these arrangements of 1972 is underscored by the use of similar language in the 1974 treaty limiting underground nuclear weapons tests and in the 1976 treaty on underground nuclear explosions for peaceful purposes, and by the elaboration of that language in the SALT II treaty on the limitation of strategic offensive arms as negotiated by mid-1979.

The biblical metaphor of beating swords into plowshares builds on homely muscle functions of biblical times. A future version might build on information functions. Agreements in 1973–1974 ending the Yom Kippur War between Israel and Egypt relied on a traditional territorial buffer zone with a United Nations Emergency Force stationed in it. By 1975, however, Secretary of State Kissinger's shuttle diplomacy had led to a new agreement wherein aerial reconnaissance and early warning and surveillance functions were entrusted to American civilian personnel and technical facilities.

At a time when American memories of Vietnam were still fresh, this innovative expedient may have had as its principal goal easy authorization by the Congress of an action that committed, not U.S. Armed Forces, but "United States civilian personnel to carry out specified noncombat functions" (*5*) as volunteers. By May 1978, however, Vice President Mondale's speech (*6*) to the United Nations generalized the experience in the following terms:

> Our experience in the Middle East has demonstrated that technical assistance with monitoring systems, such as aerial photography and ground detection devices, can help create the confidence necessary to make disengagement and stabilizing agreements work.
>
> Building on that experience, we are prepared to consider joint requests for these "eyes and ears of peace" from countries that want such monitoring services. Such requests should come preferably via regional organizations or the United Nations.

It is doubtful that national technical means or surveillance sensors have been significantly effective in slowing down the U.S.-Soviet arms race or, by themselves, in cooling down Egyptian-Israeli passions. However, the fact that the muscle functions embodied in nuclear weapons and their delivery vehicles have not been exercised in anger from Hiroshima to date and that orderly disengagement occurred in the Sinai may be attributed in substantial though far from exclusive measure to the stabilizing role of information resources in reducing the probability of accident or surprise.

Command and Control in War

Should muscles have to be exercised, their successful use likewise depends on the functioning of technical means of intelligence, command, and control. As a former President's Science Adviser, Edward E. David, Jr., put it in a *Science* editorial on SALT II (*7*), there is, for peacekeeping, a need for intelligence "that provides current, accurate information for the President and avoids putting him in a position where precipitate action based on presumptive information is needed to prevent loss of a military force under attack." There is also "the necessity for assured command and control of strategic forces" for, otherwise, "the President could lose control—the forces might not be launched or might be launched by a lesser authority."

Tensions will continue because of the close kinship among the technical means used for sometimes antithetical purposes—keeping peace or waging war, gathering intelligence or mapping agricultural and mineral resources, providing communications for trade or for military command and control. This is evident from the following testimony on the SALT II agreement by Secretary of Defense Harold Brown (*8*):

> To monitor Soviet compliance with the provisions of SALT II, we employ a set of intelligence capabilities known as "national technical means." This general term covers a variety of methods for monitoring Soviet military activities, including photographic satellites and other technical collection means. These systems enable us to monitor, for example, Soviet telemetry—technical data transmitted by radio signals from the Soviet missiles during tests—from outside Soviet territory. Other examples of national technical means include the ships, aircraft, and land-based radars used to monitor Soviet missile testing.
>
> This is not a complete list of the technical devices that constitute our national technical means. Still less is it a complete list of all U.S. intelligence resources. Many of our intelligence resources are very sensitive, and public acknowledgement of their capabilities would make it far easier for the Soviets to negate them. For that reason, public information about the details of our intelligence facilities and capabilities is quite limited. Although there have been a number of discussions in the media about our intelligence sources, it would not be in the nation's best interest to comment publicly on the accuracy of reported capabilities.

Eavesdropping and Privacy: Blurring Traditional Boundaries

In general, an increasingly widespread technological base has blurred many traditional ideological or organizational distinctions that once were justifiable by technological differences. For example, the age-old concern over privacy in many realms is once again conspicuous, partly because of the social and political milieu of the late 1960's and early 1970's but also because of the widespread availability of cheap and effective technical security measures—both intrusive and protective—based on digital communications technologies. The following is only one of many possible illustrations.

Traditionally encryption was mainly used by governments for diplomatic or military affairs, although techniques more rudimentary than what governments could afford were used by private parties, as in the communication of sensitive commercial or banking transactions. No longer. In what he called an unprecedented public address early in 1979 about his agency's responsibility for the "signals intelligence" and "communications security" functions of the U.S. government, Admiral B. R. Inman, the director of the National Security Agency (NSA), described the new climate as follows (*9*):

> . . . Concern for the protection of communications, which for many years was viewed as being of interest solely in reference to government national security information, has now expanded throughout the government and to various important segments of the private sector. In the process there has developed a new and unprecedented nongovernmental interest in cryptology and in communications security. Expanded telecommunications protection activity, both governmental and private, has in turn led to an encounter between the activities of NSA and those of other governmental and private entities and individuals that in many ways is novel.
>
> . . . There has been a growing public concern over the protection of data generated by or stored in computers. The public has become increasingly aware of the danger that automated data processing systems, if not adequately protected, can be exploited for fraudulent and illegal purposes. Moreover, the vast amounts of personal information stored in and handled by automated data systems, both private and governmental, has given rise to serious concerns about individual privacy.

The particular problems of protecting telecommunications and data banks, both private and governmental, illustrate the generic questions that arise when an issue crosses traditional boundaries. The organization of American government agencies tends to mirror certain distinctions that are deemed significant, if not semi-sacred: the distinction of the domestic from the foreign, the civilian from the military, and the private from the public. But, as Greg Lipscomb (*10*) suggests, modern interception technologies seem irreverent of these boundaries.

What is domestic and what is foreign? In 1970 NSA is reported to have picked up information about Korean government payments to members of Congress long before the payments became an issue in American domestic politics. The information, although of a domestic nature, was gathered while intercepting electronic cable traffic of the Korean government. Where does the domestic separate from the foreign here? Similarly, of what effect are domestic privacy laws if domestic long-distance communications, beamed through satellites, can be picked up by Cuban antennas or Soviet offshore ships, as they apparently can?

What is civilian and what is military? In 1977, according to news reports, NSA approached a private telecommunications company with an offer to "enter into a 'classified contract' under which the government . . . would assist the private company to improve its defenses against eavesdropping" (*10*, p. 14). This can be seen as reasonable for both parties. NSA, after all, is responsible for securing the government's communications and has possibly the most sophisticated telecommunications capability in the country. But NSA is also part of the Department of Defense and its move could also be said to violate traditional boundaries. In developing their response to Soviet electronic eavesdropping on the United States, Administration officials are reported to have stressed that they "didn't think it appropriate to have the Department of Defense controlling the private sector" (*10*, p. 14) and that "the agency's action was surprising and appeared to go beyond its normal range of concerns" (*10*, p. 14). The line between the civilian and the military seems to have grown thin in this instance.

What is public and what is private? The telecommunications industry in the United States is privately held. Moreover, competition and diversification have been encouraged within the last decade through decisions of the Federal Communications Commission (FCC). These decisions permit anyone to attach terminals to the common carrier network and also permit new and competing microwave or satellite networks, such as Satellite Business Systems (SBS), to enter the market. With such private diversity, who assumes responsibility for foreign intrusion, an essentially public problem? At what point does private information become so strategically significant that its availability to foreign powers could jeopardize national security? Who determines such a status and what, if anything, should be done about it? Should the umbrella of the government's uniform classification system be radically changed to include such information? By what means? By whom and by what criteria? Another traditional distinction, this one between the public and private sectors, seems to have grown blurred.

United States thinking about information resources nonetheless has generally remained channeled within traditional though no longer distinctive categories. In contrast, Canada has a more comprehensive approach that cuts across categories and is integrated into the mainstream of its political, economic, cultural, and legal thinking. Perhaps this is due to a keener perception of the importance of information resources to Canada's three main concerns as a nation: unity, economic viability, and cultural identity.

Employment and Productivity

To round out our picture of changing answers to the perennial questions about information resources, it is therefore helpful to draw on analyses, developed by Oswald H. Ganley (*11*), of the role of information resources in Canada and of their influence on U.S.-Canadian relationships.

The possibility of rapid, massive, and cheap flow of data across borders and the preeminence of the United States in compunications-based facilities and services has led other countries to worry about transborder data flows (TBDF). Western European governments justify these concerns in terms of individual privacy. Canadian government and industry recognize them as essentially economic, a matter of lost jobs, negative balance of payments, and lost top management opportunities. What restrictive or permissive legislation develops on this score around the world is expected to have an impact on worldwide job markets.

Domestically as well, there is concern over productivity in information occupations—that is, in jobs that are managerial, clerical, educational and the like as distinguished from plowing, metal-cutting, or other "muscle" occupations. Interpreted one way, Fig. 3 can justify attributing past gains in industrial and agricultural productivity to increasing use of information resources in order to do more with less of other labor and perhaps other capital resources. Interpreted another way, it suggests that information occupations are now the least productive, hence the ripest for displacement by more capital-intensive information resources based on the compunications technologies whose costs are dropping in the face of rising costs of all labor and of other capital goods. The possible implications are not perceived as dramatically in the United States as they are in Canada or in France. A 1978 report (*12*) to France's President Giscard d'Estaing states vaguely but portentously:

> Should France fail to develop an appropriate response to certain new and serious challenges, her domestic tensions will deprive her of the ability to control her destiny.
>
> The growing "informatization" of society is at the heart of the crisis. It can exacerbate it or contribute to resolving it. Depending on what policies will enfold it, it will bring forth the best or the worst; its effects are neither automatic nor inexorable. They will depend on how relations between government and society will evolve in the years to come.

Research and development in high-technology industries, microelectronics and computer software especially, has also been at issue, since the Canadian government has expressed displeasure over the low level of research and development performed by U.S. subsidiaries in Canada and the heavy U.S. ownership within the Canadian electronics industry, sentiments analogous to growing concerns of U.S. industries vis-à-vis Japan.

Information Freedom and Control

The Canadian government perceives Canada as being overwhelmed by American media content that robs Canada of its national identity. Directly, this mainly affects such American industries as publishing and broadcasting. But similar perceptions as expressed in Third World demands for a New World Information Order pit the restrictionist impulses of most of the world against an increasingly isolated American devotion to a principle of free flow of information. The resulting clashes have not only economic over-

tones, but also ideological themes. The Mass Media Declaration adopted by Unesco in 1978 failed to legitimize inclinations to exclude, control, or expel foreign journalists working within a nation's borders only because of strenuous U.S. objections.

The possibility of broadcasting directly to homes via satellites raises similar issues. Canada wants to have domestic television broadcasts direct from satellites as an economically attractive alternative to local transmitters spread throughout the sparsely populated land mass north of the band along the U.S. border where most Canadians live. But, along with other issues, this possibility raises the specter of importation to Canada of even more U.S.-made content than at present. Globally, many nations believe that direct television broadcasting by satellite from one country to another without the prior consent of the receiving state is a violation of national sovereignty. The resulting conflict between the principles of free flow of information and of national sovereignty is fueled by the fear, expressed by many states, that the United States would use its great technological advantage in this area for political, cultural, or commercial purposes. The commercial exploitation of Landsat satellites for agricultural and mineral resource mapping, already complicated by potential conflicts with intelligence interests and by questions of public versus private, monopolistic versus competitive ownership structures, is subject to similar fears.

Domestically, battles are shaping up over how to interpret the First Amendment as it applies to the numerous hybridized and competing forms of compunications-based services now offered under such labels as cable television, teletext, database publishers, and the like. Issues here are further complicated by the fact that, in this new era of abundant and versatile compunications, the traditional institutional media—newspapers, radio, television—no longer hold exclusive command over mass communications technologies. Any political candidate, for instance, may find a bank of telephones (with computerized rapid dialing) or a computerized mailing list to be a greater communications asset than editorial endorsement by a newspaper.

Consider the following hypothetical situation framed by William H. Read (*13*):

> The legislature of State X has before it an omnibus tax reform bill that, if enacted, would give individual taxpayers some relief while greatly increasing the tax burden of corporations. Suppose further that the entire business community, including local media corporations, oppose the bill because of the detrimental impact it would have on their post-tax profits.
>
> Do corporations have a First Amendment right to speak out against such a bill? Yes, said the Supreme Court in *First National Bank of Boston* v. *Bellotti*. But their rights differ. The corporation that owns the local newspaper can frequently and freely editorialize in that paper against the bill. The corporate broadcaster, however, cannot express himself over-the-air even once without triggering affirmative Fairness Doctrine obligations. But what about, say, the local telephone company? What if that corporation decides to put its views before the public by printing a political message on its customers' monthly bills, or more likely by inserting such a message in each billing envelope? As a matter of constitutional law, could the State's public utilities commission stop this practice? If not, could the state commission compel the phone company to distribute opposing views, too?

Under the 1978 decision in *First National Bank of Boston* a telephone company or any other corporation has First Amendment rights. But what is the scope of those rights? In the hypothetical situation posed is the corporate mailer free from right-of-reply requirements as newspapers are, or are phone companies, banks, and other businesses to be fitted into the broadcast mold? The answers to such questions will carry the relation of knowledge to power forward into the 21st century.

References

1. J. McLaughlin with A. Birinyi, *Mapping the Information Business* (Program on Information Resources Policy, W-79-8, Harvard University, Cambridge, Mass., December 1979).
2. D. Bell, *The Coming of Post-Industrial Society: A Venture in Social Forecasting* (Basic Books, New York, 1973); *Harv. Bus. Rev.* (May-June 1979), pp. 20–45.
3. *New York Times* (14 August 1979), p. C1.
4. U.S. Arms Control and Disarmament Agency, *Arms Control and Disarmament Agreements* (Washington, D.C., 1977), p. 134.
5. House Joint Resolution 683, 94th Congress, 1st Session (9 October 1975).
6. Department of State, *Bulletin* (June 1978), p. 34.
7. E. E. David, Jr., *Science* **206**, 1027 (1979).
8. *The SALT II Treaty, Hearings Before the Committee on Foreign Relations, U.S. Senate, 96th Congress, 1st Session* (1979), part 2, p. 240.
9. B. R. Inman, "The NSA perspective on telecommunications protection in the nongovernmental sector," speech made on 11 January 1979 at the annual meeting of the Armed Forces Communications and Electronics Association.
10. G. Lipscomb, *Private and Public Defenses Against Soviet Interception of U.S. Telecommunications: Problems and Policy Points* (Program on Information Resources Policy, P-79-3, Harvard University, Cambridge, Mass., July 1979).
11. O. H. Ganley, *The Role of Communications and Information Resources in Canada* (Program on Information Resources Policy, P-79-1, Harvard University, Cambridge, Mass., June 1979); *The United States-Canadian Communications and Information Resources Relationship and Its Possible Significance for Worldwide Diplomacy* (Program on Information Resources Policy, W-79-7, Harvard University, Cambridge, Mass., November 1979).
12. S. Nora and A. Minc, *L'Informatisation de la Société* (La Documentation Francaise, Paris, 1978), p. 9; English translation, with introduction by D. Bell, *The Computerization of Society* (MIT Press, Cambridge, Mass., 1980).
13. W. H. Read, *The First Amendment Meets the Second Revolution* (Program on Information Resources Policy, W-79-3, Harvard University, Cambridge, Mass., March 1979).
14. M. U. Porat, *The Information Economy: Definition and Measurement* (U.S. Department of Commerce, Office of Telecommunications, Washington, D.C., May 1977), vol. 1, figure 7.2, p. 121.