Chapter 4

Impact of Technology on Enforcement of Intellectual Property Rights

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MAJOR FINDINGS

Technology is making it *cheaper* to copy, transfer, and manipulate information and intellectual property. For example, devices such as optical disk storage systems may allow the average person to collect entire libraries of copyrighted textual, musical, and visual works in his home. Decreasing prices and increasing capabilities of information systems will permit more people to make use of more works. Consequently, enforcement efforts will have to reckon with a much larger volume of potential infringements than exists today.

Technology is allowing the copy, transfer, and manipulation of information and intellectual property to occur *more quickly*. For example, fiber optic technology is currently capable, under laboratory conditions, of transferring 100 average-length novels over a distance of 100 miles in 1 second. These capabilities may soon be available in offices and homes. As a result of this and many similar developments, owners of rights may have less marketplace "cushion' in which to realize a return on their creative and financial investments. Thus, they may have less incentive to produce works.

Technology is making the copying, transfer, and manipulation of information and intellectual works *more private.* For example, personal computers can store, process, and communicate the contents of large commercial databases without the knowledge or consent of the compilers of such works. As a result, owners of rights face greater difficulty detecting, proving, and stopping infringements. Thus, they may have less incentive to make their works generally available.

Together, improvements in the cost, speed, and capabilities of information technologies are **making** traditional proprietor-initiated (civil) enforcement largely ineffective in securing reasonable control over public distribution of intellectual works. The effect might be to make investors reluctant to fund the creation of intellectual works. More likely, proprietors of intellectual property will be more hesitant to distribute their works in forms over which they have little physical control.

The technology itself is providing proprietors with ways to more tightly control the distribution of their works. Private, computerized, electronic systems can provide them with the means to enforce control by limiting and monitoring access. Policy makers may have to weigh the benefits of such control against the potential social costs of restricting public access and monitoring private citizens information use.

As technology makes the enforcement of intellectual property rights more difficult, public support for these rights becomes all the more critical. At present, however, the public has little knowledge of intellectual property rights as an issue. To the extent that citizens are aware of this issue, they draw clear distinctions between proprietors' rights to operate in the marketplace and their own rights to use information as they please in their own homes and businesses. Therefore, so long as proprietors' rights do not conflict with the public's sense of privacy and fairness, the public is likely to lend support to the intellectual property system.

INTRODUCTION

The granting of legal rights is based on the assumption that those rights can be enforced. Intellectual property law has been based on the premise that, by and large, rightholders will enforce their own rights by monitoring the use of their works and suing infringers. To do this, they must know of specific cases of infringement, and they must be able to collect enough evidence to prove in court that a particular person or corporation violated their rights.

Information technologies are impeding traditional enforcement mechanisms. They make the copy, transfer, and transformation of works cheaper, faster, and more private, and thus more prevalent and harder to detect and prove. Without effective enforcement of their rights, intellectual property owners may have less incentive to produce and disseminate intellectual works. This, in turn, could jeopardize the benefits society gains from the open dissemination of intellectual works. And, insofar as there are widespread, unimpeded infringements, the legitimacy of intellectual property law might itself be undermined.

The enforcement problem raises fundamental questions about the nature and efficacy of the intellectual property system as a whole. Many of these issues are covered elsewhere in this report. This chapter focuses on:

1. how advances in technology are reducing the effectiveness of the traditional means of enforcement;
2. some of the private initiatives that proprietors are adopting to protect their interests; and
3. public attitudes that bear on the enforcement of intellectual property law.

To understand how technology affects the enforcement of intellectual property rights, one must begin with a central problem: As the technologies for creating, distributing, and using information change, the very concepts and definitions that have traditionally defined intellectual property rights and their boundaries become ambiguous. This ambiguity makes it difficult to apply the law in a consistent fashion and in a way that is consonant with the goal of promoting "science and the useful arts. In particular, controversies arise about which particular uses of new technology cause damage to creators and copyright owners, and whether such damage significantly reduces incentives to produce and disseminate works.

This chapter divides intellectual property rights into three categories, which correspond to the kinds of rights that have traditionally attached to intellectual works: the right to copy, the right to publish and perform, and the right to make derivative works. These categories are used only to describe the new technologies in terms with which policy makers are familiar. Their use should not imply that these rights *should* be extended or enforced. In fact, one of the challenges that policy makers face is understanding whether traditional concepts can be employed in new technological contexts.

The impact of technological change is different for different intellectual property rights. This chapter examines trends in three categories of technology, each corresponding to a particular kind of right traditionally granted by copyright law. Changes in *storage technologies,* for example, affect the right of proprietors to control the copying of their works. Advances in *communication technologies* affect their right to control publication *and performance.* And new *information processing technologies* affect the proprietors' right to control the production of *derivative* works. Moreover, to demonstrate the effect of advancing technology on enforcement, this chapter will also look at how these technologies interact with each other in integrated computer- and telecommunications-based systems. In the long run, it is the convergence and interaction of these technologies that may prompt the most significant enforcement problems for the intellectual property system as a whole.

TRENDS IN STORAGE TECHNOLOGIES: IMPACTS ON THE RIGHT TO CONTROL THE REPRODUCTION OF COPYRIGHTED MATERIAL

Information storage technologies are devices and systems that fix and hold information in a reusable form. Storage technologies include paper and ink, photographs, vinyl disks for musical recordings, motion-picture film, audio and videocassette tapes, semiconductor memory chips, and optical disks, among others.

Two recent trends in storage technology are likely to affect the enforcement of intellectual property rights. First, as storage technologies become cheaper and capable of holding more information, it becomes harder to enforce proprietary rights; more people can use these technologies to copy works privately. Secondly, storage technologies are becoming less specialized to specific forms of information. They are often part of computerized systems that handle many forms of information-e. g., text, graphics, music, and video. Information in computerized, digital form is much harder to control than information in traditional formats. Together, these two changes transform copying into a problem of much greater scope for proprietors than it has ever been before.

Copyright Enforcement in the Early Print Environment

When first enacted, American copyright law protected expressions of information in the form of printed text and graphics: books, maps and charts.[1] Anyone seeking to fix or store these expressions for dissemination had to make a relatively large investment in capital goods: movable type, volumes of paper and ink, mechanical presses, and other equipment. They had to obtain skilled labor: typesetters, printers, draftsmen, and others. These activities were difficult to conceal. They also had to offer copies in the open marketplace. The public quality of these operations meant that copyright owners could detect and stop large-scale, economically damaging infringements, thus controlling the reproduction of their work with relative ease. Copying by hand for personal use and scholarship was not a major problem. It did not threaten proprietors because it was not a viable means of competing with copyright holders or of denying them sales revenues from their work.

Although technology changed through the 19th and early 20th centuries and provided new forms in which to fix expressions of information—photographs, lithographs, motion picture films—the capital and labor required for reproduction remained fairly high, and competitive infringing activities were still hard to conceal. Thus, these technologies posed only minor problems in copyright enforcement.

Impact of Reprography on Enforcement of Copyright

In the mid-20th century, photocopying, mimeograph, and xerography were developed, making it much cheaper and easier to reproduce printed materials. More people began to copy text and graphic images, making it harder for copyright holders to monitor such activities. As these technologies became more common, it became too costly and impractical for proprietors to try to authorize copying, collect royalties, and enforce their rights on a case-by-case basis, even if users were inclined to seek permission and pay for use.

It is difficult to estimate the economic impact of this unauthorized copying.[2] In general, while we know that xerographic reproduction causes some lost sales for copyright holders, it does not appear to be a serious threat to the economic viability of general-interest book, magazine, or newspaper publishing.[3] Publish-

[1] Chapter 1 15. Section 1, Statute 124, Act of 1790.

[2] By the term "unauthorized," this chapter means *those uses of copyrighted works that have not been specifically permitted by the copyright holder.* It does not seek to imply that these uses are, or should be, illegal.

[3] The number of titles published and the profits of publishers have remained high despite the introduction and spread of

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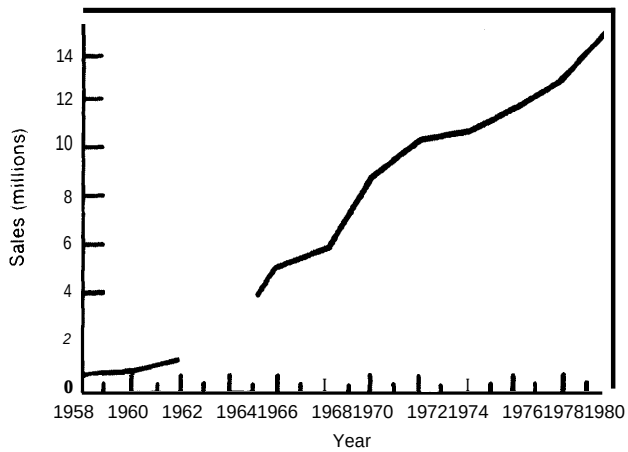
ers of very specialized periodicals with small circulations, such as scientific and technical journals, contend that disastrous losses of sales could result if corporations and libraries replace multiple subscriptions with photocopies. If such replacement were occurring on a large scale, one might expect a decline in subscriptions and an eventual reduction in the range of titles published. However, Copyright Office data from publishers on trends in the numbers of titles and subscriptions in this category of copyrighted works are inconclusive. They do not show that specialized scientific and technical publications are significantly more affected by photocopying than are general-interest periodicals.[4]

Impact of Audio and Video Taping on the Enforcement of Copyright

Just as reprography has led to unauthorized copying of text and graphics, the recent widespread availability of audio and video taping technologies has brought about more unauthorized reproduction of recorded music and motion pictures. Here, too, copyright holders are faced with the difficult problem of controlling copying while millions of people own machines that can reproduce their works in private, at fairly low cost and with little effort.

The level of use of audio and videotape technologies is high and rising. (See figures 4-1 and 4-2.) By 1982, 52 percent of Americans over the age of 13 had used audio tape machines within the previous 2 years to record phonograph records and other materials.[5] By the end of 1985, 37 percent of American homes had

Figure 4-1.—Audio Recorder Sales, 1958-80



SOURCE Data compiled from *Merchandising Weekly* by Michael Rogers Rubin and Mary Taylor Huber, The *Knowledge Industry in the United States, 1950-1980* (Princeton, NJ Princeton University Press, 1986), in press

videocassette recorders, up from 28 percent at the end of 1984.[6]

Consumers use video recording machines for "time shifting" — that is, recording television broadcasts to enjoy at a more convenient time.[7] They often use audio tape machines to record music to play in more than one location, for instance, in a car. Some tape machine owners use their machines to trade music or video programs with friends, and to build personal libraries.

These machines are also used for less casual purposes, such as the mass duplication of copyrighted works to sell in direct commercial competition with copyright holders. Many proprietors contend that *commercial piracy* of audio and video materials is widespread.[8]

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xerographic technology, which was first commercially available in 1960. See Michael Rogers Rubin and Mary Taylor Huber, *The Knowledge Industry in the United Stated: 1960-1980* (Princeton, NJ: Princeton University Press, 1986 (in press)). Between 1960 and 1980, industry sales increased from $1 to $4 billion. Paul M. Hirsch, "U.S. Cultural Productions: The Impact of Ownership," *Journal of Communication*, vol. 35, no. 3, Summer 1985, p. 117.

[4]Dennis D. McDonald and Colleen G. Bush, *Libraries, Publishers and Photocopying: Final Report of Surveys Conducted for the United States Copyright Office,* May 1982, table 4-6, p. 4-16.

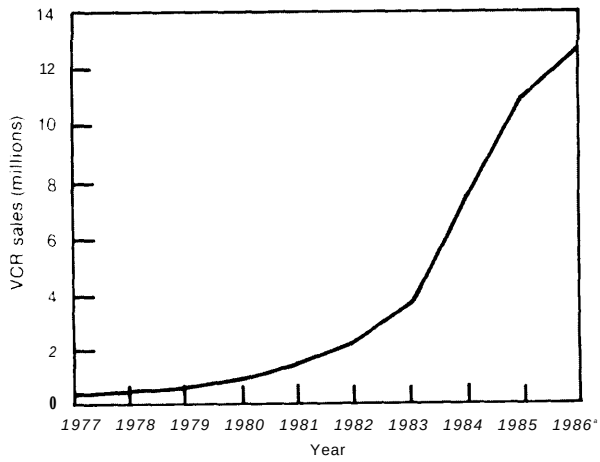
[5]Yankelovich, Skelly & White, Inc., *Why Americans Tape: A Survey of Home Audio Taping in the United States,* September 1982, p. 28.

[6]*Electronics,* Jan, 6, 1986, p. 50. Some industry analysts predict that 70 percent of U.S. households will have VCR equipment by the early 1990s. See Alex Ben Block, "Hard Dollars in Video Software," *Forbes,* June 17, 1985, pp. 128-131.

[7]The recording of commercially broadcast television for time-shift viewing was specifically found to be fair use by the Supreme Court. See Sony *Corp. v. Universal City Studios, 464* U.S. 417 (1984).

[8]The movie industry, through its trade association, the Motion Picture Association of America (MPAA), established a Film Security Office in 1975 to combat commercial piracy of films distributed by the major Hollywood studios. See table 4-1 for some of their recent enforcement statistics. The musical recording industry claims, on the basis of surveys conducted by the International Federation of Phonogram and Videogram Producers, that one out of four musical recordings sold worldwide is a pirate copy. In the United States, their data estimate 1 in 10 copies sold is illegitimate. (Reported in *Variety,* July 31,1985, pp. 1, 92.)

Figure 4-2.— Factory Sales of Videocassette Recorders, 1977-86



[a]Estimate

SOURCES 1977.79: U S Department of Commerce Bureau of the Census Statistical *Abstracts 1980. 1980-83.* Statistical *Abstracts 1985 1984-85:* Electronic *Industry Association Electronic Market Trends* March 1986 1986: Electronic Industry **Association** estimate.

Some owners of copyright in musical recordings and motion pictures have presented figures to support their claims of substantial economic losses from *consumers use of audio and video taping technologies.* In testimony before the Senate Judiciary Committee on October 25, 1983, Alan Greenspan presented evidence collected for the Recording Industry Association of America suggesting that in 1982 the industry sustained sales losses of more than $1.4 billion that were attributable to home taping of borrowed recordings and radio broadcasts.[9] Battelle Pacific Northwest Laboratories, in a study performed for the Motion Picture Association of America, estimated that, in 1982, motion picture copyright owners had lost more than $57 million in royalties because videocassette sales were displaced by home tape copying and off-air taping.[10]

These figures, however, are not definitive. As detailed in chapter 7, the question of whether a *particular* instance of copying actually displaced a sale of a copy is often impossible to answer definitively. Moreover, to the extent that the data are inadequate, or that the analyses are inappropriate, these studies may either grossly overestimate or underestimate the actual harm suffered by musical recording and motion picture copyright proprietors.[11] Some analysts have suggested that there are better methodologies for determining the economic losses from home taping. In deciding intellectual property policy, policy makers will most

[9]Statement of Alan Greenspan Re. S.31 Before the Subcommittee on Patents, Copyrights and Trademarks, Senate Committee on the Judiciary, Oct. 25, 1983, p. 7.

[10]F.J. Cronin, R.J. Ness, A.R. Wusterbarth, and J. I,. Eisenhauer, *An Analysis of the Economic Benefits and Harm From Videocassette Recorders and Related Products,* August 1983, as cited in *Economic Issues Relating to New Technologies and Intellectual Property,* by Stanley M. Besen (contract prepared for OTA, December 1984), p. 44,

[11]See Besen, op. cit., pp. 47-48.

Table 4-1.—Motion Picture Association of America Film Security Office Recent Criminal and Civil Cases

	Pending cases[a]		Cases where sentence passed	
	1984	Through June 1985	1984	Through June 1985
Criminal actions:				
Seizure incidents	28	39	24	1
Videocassettes seized	1,990	24,591	6,286	647
Films seized	500	210	100	0
Guilty pleas/convictions	2	9	38	11
indict merits/arrests/information	10	12	30	4
Civil *actions:*				
Cases recommended	34	24		
Seizures	7	9		
Videocassettes seized	534	2,601		
Films seized	0	0		

[a]Cases pending at end of the indicated time

SOURCE: Motion Picture Association of **America**

likely want to take these alternative analytical approaches into account.[12]

Impact of Computers and Digital Information on the Enforcement of Copyright

The growing use of computers to handle and store information could make it even harder for copyright holders to enforce their rights. In the case of the right to control reproduction, the computer poses three major problems for copyright proprietors that are distinct in kind as well as in *degree* from other technologies used to store or copy information.

First, copying digital information can be done at a fraction of the cost and in a fraction of the time that it takes with photocopying or analog audio or video taping. Second, the digit al nature of computer-mediated information means that an infinite number of perfect copies of material can be made. Possession of an *original* is not required to obtain subsequent copies of *original quality.* Thus, the information *content* of a work can be completely separated (or *unbundled)* from the medium that carries it.[13] Third, in the normal course of operations, a computer makes many copies of parts of works. Some copies exist for only a few millionths of a second. Other copies may be held until the machine is turned off or the material is written over. Some copies may be held in permanent form on magnetic disk or tape. [14]

Because of these characteristics, computers pose novel questions for enforcement. For example, how, aside from appeals to ethics, can proprietors convince consumers to buy originals when perfect copies are probably much cheaper? How can consumers tell whether they are purchasing originals or counterfeits? At what point is the proprietor's right to control copying violated within a user's computer system?[15] Similarly, how much of the material that resides in a computer can or should be recognized as part of the copyrighted work?

These problems are emerging at a time when monitoring and stopping the copying of works is becoming harder. The proprietors' right to control copying may thus be severely challenged by the growing scale and private nature of infringement made possible by increasingly powerful and widely used personal computers. Also, as discussed below, computers' processing capabilities may pose special problems with respect to proving infringement.

Currently, users receive a relatively small amount of copyrighted material in digital, computer-readable form–computer programs and a small but rapidly growing amount of material made available through *on-line databases.* But this is changing with other technological advances that simplify the conversion of printed text and graphics into machine-readable, digital format. *Optical character readers* for text input are growing in popularity in offices as prices fall and capabilities rise. Some analysts expect that these machines will be widely used by the end of the decade. And if price and capability trends continue in their current direction, the automatic conversion of printed or written text and graphics into computer-readable form may become a routine practice by the turn of the century.[16]

Once in a computer in digital form, text can be reproduced with a growing array of computer-driven printers. These range in price and

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"See Besen, op. cit., pp. 39-40. See also Stanley M. Besen, *Private Copying, Reproduction Costs, and the Supply of Intellectual Property* (prepared for the National Science Foundation, December 1984); and I.E. Novos and M. Waldman, "The Effects of Increased Copyright Protection: An Analytical Approach, ' 92 *Journal of Political Economy* 236 (1984).

' 'Users' ability to unbundle information may have a significant impact on the alternatives that proprietors pursue to protect their economic interests in intellectual property. See ch. 6, for further discussion on this point.

"In the case of *computer programs,* "a user is at least somewhat negligent if he does not make copies of his programs. [There are] two reasons [for this]: 1) one cannot see by visual inspection if a program is intact; and 2) operator error or program "glitches" can quickly destroy a program. Thus good programming practice and copyright regulations [may be] mutually exclusive. " Personal communication from Edward Conklin, FORTH, Inc., July 23, 1985.

"section 117 of Title 17 addresses this problem, but the language has yet to be widely tested by the courts.

"*Outlook for Office Automation Technologies 1985-2000,* report prepared for OTA by the Georgia Institute of Technology, J.D. Roessner, principal investigator, March 1985.

capability from the cheap, fairly slow, and low-quality *dot-matrix* and *thermal transfer* devices, to very fast and high-quality *laser* and *ink-jet* devices. As these technologies mature, as manufacturing techniques improve, and as economies of scale are realized, consumers will most likely be able to get faster, better printers for lower cost.[17]

Record companies are beginning to offer music to consumers in digital form by way of *compact disk players* and *laser-scan disks.* In their present form, compact disks are *read only,* which means that users cannot record on them, although one can record analog tapes from them with cassette or reel-to-reel tape machines. But manufacturers of laser disks are developing erasable and rerecordable media similar in storage capacity and durability to compact disks. With these, consumers may be able to reproduce the full, master recording quality of compact disks on home equipment.

Copying video in digital form is now limited by the fact that current television transmitters, receivers, and video recorders supply the material in analog form. International standards-making committees are discussing the establishment of digital television and video tape standards, so this situation could change very quickly.

The *digital optical disk,* a technology that uses lasers to record and read information off a disk that rotates at a high rate of speed, offers great. potential for storing very large volumes of digitized information. A single read-only optical disk, currently on the market, can easily store several hundred thousand pages of printed text, 6 hours of master recording quality music, or 2 hours of full-motion, television quality video. In some applications, many disks are collected in an automatic playback machine much like a jukebox. This is being done for the optical disk project at the Library of Congress in which old books, photographs, and etchings are being digitized and stored on optical disks. Thus, a very large volume of information can be made available on-line (by computer terminal) at very low cost for storage and access.

In their present form, optical disks can be written on only once, and then only using a relatively expensive high-power laser device to impress digital data on the disk. But several companies, both in the United States and abroad, are working intensively to develop optical media and supporting hardware that allow a disk to be recorded, erased, and rerecorded many times. [18] Their goal is to manufacture a device that the average consumer can use with his personal computer, stereo, and television equipment. This technical advance would make it even cheaper and easier to copy information, while increasing the speed at which a computer could access the large volume of information storable on optical disks.

In summary, advances in information storage technology have made the process of copying information cheaper, easier, and available to more people. These trends show every indication of continuing. The technologies are making the old definitions of "rights, "infringemerits, " and "fair use" ambiguous and largely obsolete. Because of technical advances and the blurring of definitions, the traditional copyright enforcement mechanism, whereby proprietors sue violators in civil proceedings, may no longer be effective in protecting the creative and economic interests of copyright owners,

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Paper will continue to be an important *temporary* storage medium because people tend to prefer the higher contrast, portability, and other characteristics of print that video screens lack, But electronic and optical media are becoming more attractive for permanent storage of information in many applications because storage volume is vastly reduced and cost and convenience of access can be superior to paper storage. Thus the trend, at least in repeated-use and interactive applications, is toward mass electronic and optical storage and on-demand *printing. E.C.* McIrvine at the OTA Workshop on Display, Printing, and Reprography, Mar, 13, 1985,

[18] B. Dumaine, "Here Comes the Erasable Laser Disk, ' *Fortune,* Mar. 5, 1985, p. 100,

TRENDS IN COMMUNICATION TECHNOLOGY: IMPACTS ON THE RIGHT TO CONTROL PUBLICATION AND PERFORMANCE

Communication technology is the term that encompasses the many devices and systems used to move information from place to place. These technologies evolved very slowly until the 1840s, when, after electronic telegraphy was developed, they rapidly grew in capability. Since then, innovations in telecommunication technology have quickly advanced the speed, distance covered, and scope of interconnection of people and places, all of which are still growing exponentially (see figure 4-3).

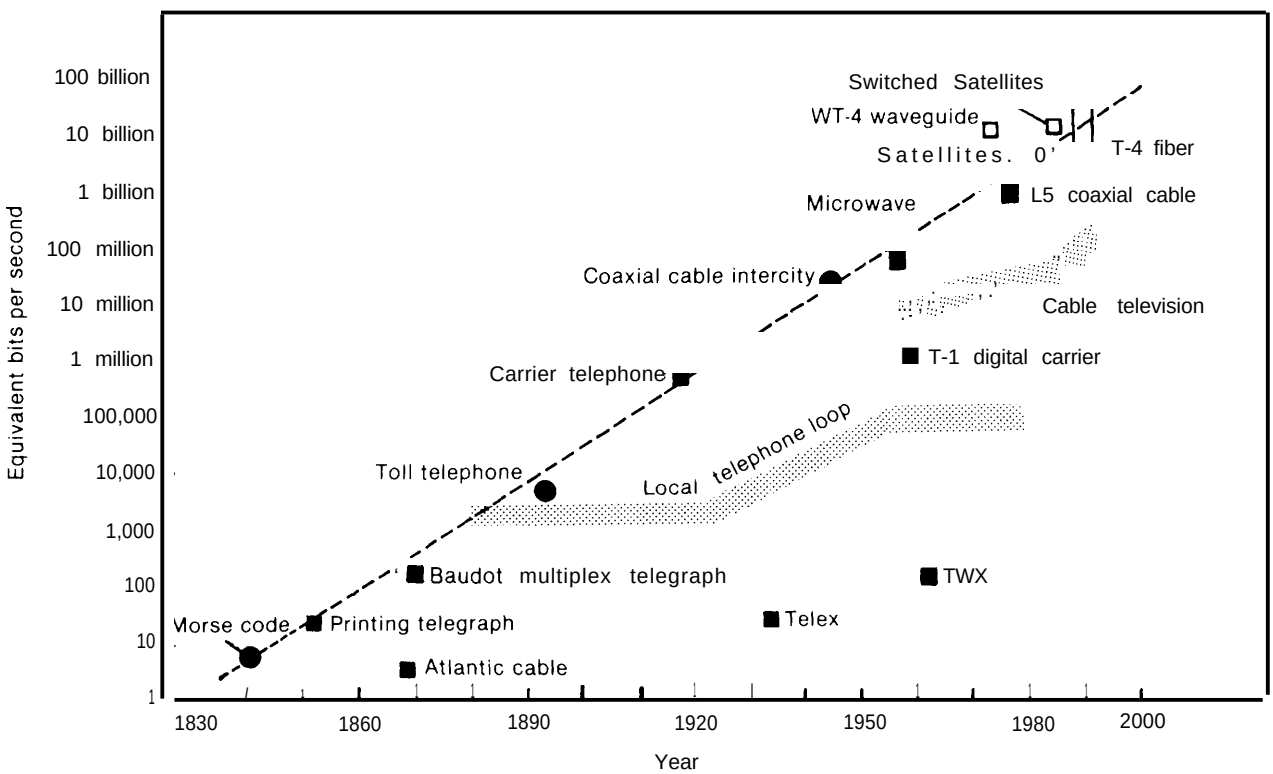
These technologies are now part of the basic infrastructure of society. We have come to rely, for example, on the telephone system, broadcast radio, and television to supply us with vital information about our family, friends, businesses, and government.

Increasingly, we also receive information products and services through telecommunication links that entertain, educate, and help us make decisions. Since many of these goods and services are protected by intellectual property law, advances in communication technologies will have a major impact on enforcement of intellectual property owners' right to control the *publication and performance* of their works over telecommunication facilities.

Print, Live Performance, and Copyright

Before the 1920s, communication technologies had very little affect on the enforcement of copyright, simply because copyrighted

Figure 4-3.—The Sequence of Inventions in Telecommunications, 1840-2000



SOURCE Richard J Solomon and John Ward, Massachusetts Institute of Technology Adapted from James Martin, *Future Developments In Telecommunications, 1976* 1980 Annenberg School of Communications Used with permission.

works were communicated by physically moving printed copies or by expressing the works in live stage performances. As the country expanded, there were undoubtedly many unauthorized performances of copyrighted dramatic and musical works, but the important markets for such uses were in large cities, so composers and dramatists found it possible to monitor enough of the uses of their work to protect their economic rights.

Impact of Radio and Television on the Enforcement of Copyright

Broadcasting changed this. Commercial radio broadcasting, initiated at KDKA radio in Pittsburgh in 1920, complicated copyright *en*forcement by dispersing a "performance" over a wide area. When the networks such as NBC were formed soon after, performances could be heard over virtually the entire nation. Thus, broadcast technology made "collecting at the door" from users of a performance of copyrighted music virtually impossible. To continue profiting from the use of their work, the owners of copyright in music and the broadcasters developed the system of advertiser support for the actual broadcast, and established contracts with collecting societies to monitor the use of copyrighted work and to pay composers' royalties. (See ch. 9 for details on collecting societies.)

The advent of broadcast television presented similar enforcement problems for copyright holders. To solve them, networks made similar arrangements to finance the cost of presenting "free" television to the public. This system of advertiser support and contracting with copyright proprietors for use of their work provided a viable and lucrative means of presenting and paying to broadcast musical entertainment.

Cable Television

Cable television originated as a means of providing television to remote areas by the reception of broadcasts with a tall antenna and retransmission of them by wire to subscribers. Subsequently, because of the way the courts and Congress have intervened in the relationship between copyright holders and cable broadcasters, it has become a technology with significant implications for copyright enforcement.

Cable television itself does not present intractable problems of detecting or proving infringement because most existing cable systems are public. " But cable television systems have had to contend with two other enforcement problems. One is *theft of service,* which is the deliberate unauthorized connection to a cable service. The other is the high transactions costs that multiple-channel cable companies face in identifying and negotiating royalty payments with the many copyright holders in television. Congress acknowledged the magnitude of the second problem by establishing the Copyright Royalty Tribunal to set cable retransmission royalty rates and to disperse funds collected by the Copyright Office.[20]

Subscription Television[21]

Some over-the-air television stations scramble their signals to prevent access unless the consumer has rented a décoder box and paid a subscription. The direct enforcement problem with *subscription television* (STV) is theft of service. Some users and commercial companies build illegal decoding equipment that allows users to receive subscription television signals without paying the station. In this event, the copyright holder may be undercompensated because his royalty payments are based on the size of the *paying* audience for a subscription television broadcast.

Television is also relayed to paying subscribers by microwave radio. This is called *Mul-*

[20] There are a growing number of private cable television operations, generally called Satellite Master Antenna Television (SMATV) that *may* present difficult enforcement problems. These systems will be discussed below,

[20] U.S. House of Representatives, 94th Cong., Report 94-1476, p. 88.

[21] Subscription television was originally (1964) a term applied to cable television in California, Erik Barnouw, *Tube of Plenty* (New York: Oxford University' Press, 1982), p. 350. Now it is usually applied to transmissions over VHF and UHF channels that are scrambled.

tipoint Distribution Service (MDS). In some areas, companies have set up several microwave channels for television delivery; these systems are called *Multichannel Multipoint Distribution Service* (MMDS). To receive these signals, consumers need a special device called a down converter and also a special antenna. Together, the converter and the antenna make the higher frequency microwave signal compatible with a standard television set. MDS companies rent these devices and charge a monthly fee for the program service. But the devices are widely available from sources other than MDS companies. Thus, like STV, the MDS enforcement problem generally involves theft of service. MDS is treated by the FCC as a common-carrier system; channel time is leased to program suppliers on a tariff basis. Copyright holders contract with MDS companies for transmission services and revenues are based on the size of the paying audience. Thus, program suppliers and transmitters are undercompensated to the extent that there are 'free riders.

Impact of Communication Satellites on the Enforcement of Copyright

Geosynchronous communication relay satellites affect the enforcement of copyright law because an increasing amount of copyrighted material is being transmitted by these systems. Currently, anyone who has a proper antenna 'dish' and a down converter can receive the material. Much of the copyrighted material transmitted by these satellites is intended for cable television "head-ends, or transmission facilities, or for broadcast stations affiliated with television networks. Many of the unauthorized users are home consumers who live far from VHF and UHF stations, have poor reception, and no cable service. For these people, satellite signals offer a wide selection of programming (more than 100 channels) with high signal quality for the one-time cost of the dish and the down converter. These systems are currently priced as low as $1,000, depending on dish size and its ability to aim the receiver at more than one satellite.[22]

Some hotels and other commercial establishments also use satellite-derived programming, capturing it with roof-top dish antennas and cabling it to their customers. Some apartment complexes install satellite reception gear and small, private cable distribution systems that compete directly with municipal cable operations. These are the SMATV systems mentioned earlier. Many of these uses of copyrighted programs are authorized by contract, but others may not be.

Other unauthorized users are in foreign countries that fortuitously fall within the "footprint" of one or more satellite signals. These foreign users often retransmit satellite-derived material over government or privately owned cable or over-the-air broadcast facilities without seeking the permission of, or making payment to, the copyright holders. As with other types of subscription-based television (STV, MDS, MMDS), if copyright royalty contracts are based on the size of the *paying* audience, these unauthorized uses deprive copyright holders of rightful compensation.

When revising the Communications Act in 1984, Congress, recognizing the already widespread use of satellite signals by home consumers, put the onus of enforcing property rights in these transmissions on the program providers and the satellite system operators. The revisions encouraged them to establish market mechanisms for payment, and to encrypt their signals. Congress struck a compromise between the interests of copyright holders and those of owners of satellite dishes, making it illegal for unauthorized users to intercept certain satellite signals. However, interception of satellite signals is *not* a violation if:

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[22] Michael Doan, "A Scramble To Break the Satellite Dish, ' *U.S. News and World Report,* Sept. 30, 1985, pp. 52-53. In 1985, over 1.4 million homes had satellite dishes, and some believe that this number could double in 1986. Sales are quite brisk, approaching 50,000 units per month. New York Times, July 8, 1985, pp. 1,C16.

(1) the programming involved is not encrypted: and
(2)(A) a marketing system is not established. . . [23]

At least one company, Home Box Office, Inc., has begun to encrypt its satellite transmissions to some cable companies.[24] At present, such encryption is expensive because all receivers must be provided with decoding equipment. It is not yet clear to what extent other program providers will see an advantage in employing encryption to protect satellite television transmissions.

A new use of satellite transmission to deliver copyrighted works could further complicate enforcement. A number of companies are trying to find a way to develop a profitable market to satisfy the growing demand for distribution of television programming by satellite. One possibility, *direct broadcast satellite* (DBS) technology, could provide consumers with a service that offers as many channels as cable television. The service would sell or rent satellite dishes and down converters to home video consumers, and transmit television signals directly to them.

DBS could complicate enforcement of current theft-of-service and illegal signal interception laws if some DBS program providers offer free services, or if program providers cannot agree to encrypt all satellite television signals. In either case, the mere possession of a backyard dish and special microwave reception equipment would not be sufficient evidence to prove unauthorized use. " Indeed, unauthorized use could be very difficult to stop.

> To demand payment from a user, program owners must prove that the user actually snatched and watched a program. Short of staking out the farmhouse with electronic eavesdropping equipment and then storming it with a search warrant, how can program owners prove a farmer ripped them off?[26]

Impact of Facsimile on the Enforcement of Copyright

Facsimile is a communication technology with potentially significant implications for copyright enforcement. Facsimile machines work by scanning a document and digitizing its *image*. This is distinct from optical character recognition (OCR), which scans a document and digitizes the individual characters so that the text can be manipulated in a computer system. OCR can be thought of as a further processing step beyond that employed in facsimile.

Because the present cost of facsimile is high compared to mail delivery, for which it substitutes, its current impact on copyright is probably small. But as seen in figure 4-4, the volume of information communicated by facsimile has risen sharply over the past two decades, and it is becoming more and more *attractive* as a means of moving documents.

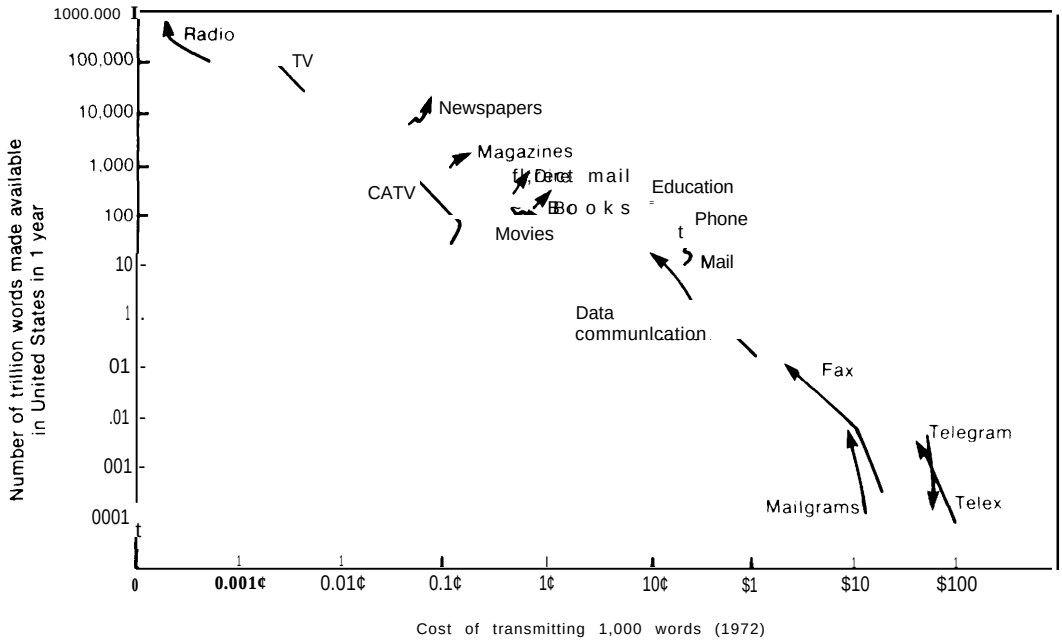
Normally, a facsimile document is transmitted over telephone lines to a facsimile decoder and a xerographic copier. The document is communicated in digital form. Therefore, copyright problems could arise if the cost of transmitting information this way drops significantly for, as with data communications, the transmission of information by facsimile technology is highly covert.

Data Communications and the Enforcement of Copyright

Data communications is the term used to describe computer-to-computer transfer of digital information. The copyright enforcement problems associated with data communications result from their growing scope, scale, and speed combined with the covertness with which people can take advantage of these advances. In practical terms, this means that, as more and more copyrighted material is avail-

[23] 47 U, S.C., Section *705, 318* (1984).
[24] *U.S. News and World Report,* Sept. 30, 1985, p. *52.*
[25] In the case of MDS receiving equipment, the courts have found that the manufacture and sale of down converters and antennas without authorization from program providers *is* a violation of the Communications Act and FCC regulations. See United States v. Stone, U. S. D, C., Southern District of Texas, Houston Division, Aug. 11, 1982; and Movie Systems, Inc. v. Heller, U.S. Court of Appeals, Eight Circuit, decided June 30, 1983.
[26] "Alex Ben Block, "An Eye in the Sky, " *Forbes,* November 1984, p. 196,

Figure 4-4.–Trends From 1960 to 1980: Volume and Costs of Communication by Media: USA (plotted on log by log scales)



While the cost trends for print media remain steady, electronic media costs have dropped dramatically in the past two decades,

SOURCE Ithiel de Sola Pool, Hiroshi Inose, Nozomu Takasaki, and Roger Hurwitz, *Communication Flows* (Tokyo University of Tokyo Press or New York: Elsevier, 1984) Reprinted with permission

able in computer-mediated form, people will be able to transfer it widely and quickly without the knowledge or consent of copyright holders.

Scope, in this context, refers to the number of terminal points that are connected by communication networks. For instance, the scope of mail delivery and telephone networks are both very high. Data communication techniques use devices called *modems,* which convert digital computer information into analog form compatible with telephone voice transmission lines, to take advantage of the scope of the telephone network for computer-to-computer transmissions. The development of an Integrated Services Digital Network (see below) will eliminate the need for these devices and will further increase the scope of data communications.

The use of data communications is expanding rapidly for several reasons. First, scientists and engineers have made great technical advances in moving information electronically. Satellite communications and fiber optic technology are both fruits of this progress. Second, costs of manufacturing, installing, operating, and maintaining the transmitters, receivers, switching equipment, and other components are falling as economies of scale affect microelectronics technology. Third, the use of computers is increasing people's ability to receive and handle information automatically. For instance, on-line database systems can watch for information that is of particular interest to an individual, and alert that person when new information pertaining to the subject enters the database.

The scale of communications, the second factor in enforcement problems, refers to the volume of information that is moved. There is no precise measure of information volume that can be applied across all forms of information.[27]

[27] "The measure of information volume is complicated by the multiplicity of forms in which information exists (words, numbers, mathematical formulae, graphics, moving pictures, etc.), as well as by the range of media that communicate information (e.g., printed pages, -television broadcasts, motion picture film).

(continued on next page)

Nevertheless, it is clear that electronic media in general, and data communications in particular, are fostering an enormous increase in the volume of information transported. This increase is due to the same factors that account for increasing scope. But the scale of data communications is also growing because information is a highly efficient means of affecting the control of processes from a distance. Thus, data communications can substitute for human observation and action.

The volume of information that passes through data communication networks is still small compared with the amount of printed material distributed through traditional channels. But, as seen in figure 4-4, data communication volume increased approximately 1,000-fold between 1960 and 1980. The personal computer and the modem will undoubtedly increase this further, and technological advances such as optical character recognition, voice recognition, and optical disks will make data communications an even more attractive way to transfer many kinds of information, some of it in copyrighted form.

The speed of electronic communications is the third factor that affects copyright enforcement, and it too is increasing at a dizzying pace. (See figure 4-3.) Not only have new inventions allowed faster communications, but R&D laboratories are continually advancing the speed of established communication devices and media. For example, the achievable speed of data communications over standard copper wire pairs, such as the wires that run to home telephones, have increased 100-fold since 1970. The channel capacity of coaxial cable, the standard cable television medium, has increased from 12 to 54 channels since 1975, and the newer systems have potential for transmitting 72 simultaneous full-motion television channels over one coaxial cable. Geosynchronous communication satellites have increased in capacity since the 240 voice channel (or one TV channel) "Early Bird" Intelsat I was launched in 1965. The Intelsat V series, first launched in 1980, averages 12,000 voice circuits and two TV channels. The capacity of fiber optics technology has improved more than 100-fold since its commercial introduction in 1977. Recent laboratory tests of new fiber optic systems demonstrate the ability to transmit 300,000 telephone conversations, or the contents of 100 average-length novels, a distance of nearly 100 miles in 1 second. [28]

A characteristic of data communications with important implications for intellectual property enforcement is that digital transmission can usually be conducted with a high degree of secrecy. Thus, unless significant changes are made in the operation of public telecommunication networks, the increasing volume of data communications will make it essentially impossible for proprietors to trace the subsequent movements of their works once they are captured by users' computer and data communication systems. This raises the issue of whether proprietors should, and in practical terms can, control the transfer of their works after users first receive them,

Databases

Computer databases are collections of facts, statistics, bibliographic citations, and other information, including complete texts of some copyrighted works. Many of these collections are offered over telephone lines to users who have data communication terminals *or* personal computers. The user pays a fee to search through the database for the particular information that he needs. The database proprietor can obtain a copyright on the database. Thus certain uses of the information that a user obtains will be illegal.

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This protean quality has so far defied the development of a universally applicable unit of measurement. As more and more information is transmitted by data communications, the digital bit–electronic ones and zeros–may become a gross measure. But the relationship between the number of bits in a communication and the quantity of useful information or knowledge contained in them is very complex. "One longs, indeed, for a unit of knowledge, which perhaps might be called a ''wit analogous to the ''hit' as used in information theory; but up to now no practical unit has emerged. " Kenneth Boulding, ''The Economics of Knowledge and the Knowledge of Economics, *Economics of Information and Knowledge,* D.M.Lamberton (cd.) (Baltimore: Penguin Books, 1971).

[28] *Telephony,* Oct. 21, 1985, p. 24.

One unauthorized use about which proprietors are particularly concerned is when competitors employ large storage capacity computers to download large portions of their databases." This permits unscrupulous information service entrepreneurs to avoid risking much of the investment that is required to compile a database.

Advancing technology could make the practice more common. The large-scale downloading of database information is becoming cheaper and easier with improvements in cost and capacity of computer storage media, faster telecommunication networks, and wider access to computer power. Infringers may increasingly use computer power to reprocess information and make it appear original. Thus, proprietors may find it increasingly difficult to know when a competitor is using their downloaded material.

Computer Bulletin Boards

A growing number of personal-computer enthusiasts are keeping in touch with each other and exchanging information using computer bulletin boards.[30] As the name implies, a computer bulletin board is a computerized storage space offered by a computer owner that serves as a place to post messages. There are two important differences between a computer bulletin board and the more familiar variety. First, a computer can offer a very large space in which to post messages. Thus, many computer users can post copies of their favorite software programs, such as computer games. Some of these programs are in the public domain; others are copyrighted. Second, the telephone network can be employed by users of computer bulletin boards to build a community that is not confined to a physical neighborhood. Thus, some computer enthusiasts use bulletin boards to keep each other informed about the latest software releases and maintain a sense of community of interests among widely dispersed colleagues and friends. Bulletin boards are also used illegally to trade credit card numbers, long-distance access codes, and the instructions to disable the copy protection of computer software packages. In this way, the unscrupulous help others steal goods and services .31

Bulletin boards are an especially thorny intellectual property enforcement problem because they can be used to very quickly spread copyrighted works throughout the community of computer hobbyists. Bulletin boards are an informal publication mechanism. Because access is generally not restricted, proprietors may monitor the contents of bulletin boards to detect unauthorized trading of their works. But, as their numbers proliferate, these informal community communications media may defy systematic surveillance and control. Moreover, it is not clear whether a bulletin board operator can be held liable for messages posted anonymously on his system.[32]

Local Area Networks

Local area networks (LANs) are data communication facilities that connect computers in a geographically restricted area, such as an office suite, a building, or an industrial park. These networks range in size from the very small to ones that have thousands of users. The expanding market for office automation technology, particularly personal computers and professional work stations for word processing, document management, and data analysis, is encouraging the development and deployment of network facilities that allow workers to communicate with one another. LANs allow users to transfer large files of information very quickly among personal computers, work stations, and large mainframe computers that can store and process corporate or institutional databases. LANs can also give many users access to computer software programs from a central repository.

"Interview with Eugene Garfield, Institute for Scientific Information, Mar. 11, 1985.

[30]There are thousands of computer bulletin boards now in use, A. Pollack, "Free-Speech Issues Surround Computer Bulletin Board Use, " New York Times, Nov. **12, 1984, p. 1,D4.**

[31] Ric M arming, "Policing the Boards, " *Popular Computing,* **July 1985, pp. 37-39.**

"New York Times, Nov. 12, 1984, op. cit.

Copyright infringements can occur in these circumstances when computer programs, information downloaded from commercial databases, or other copyrighted materials are made available and shared in these systems. Many software license agreements and database subscription contracts specifically prohibit the use of licensed material in multiuser settings. Other contracts provide for "site licenses" to allow multiple uses of software. Enforcement of such contract provisions can be difficult because of the private nature of local area networks. Often, evidence of contract abrogation or copyright infringement must be obtained from disgruntled employees of the infringing institution or from paid infiltrators.

Integrated Services Digital Network

In its present structure, much of the national and international telecommunication network uses equipment that transmits analog signals. This is particularly true for local "final-mile" connections. Voice communication, still the largest category of telephone usage, is efficiently handled by analog transmission. But the volume of data transmitted by telephone is growing. This growth is encouraging local and long-distance companies to convert more and more of the telephone network plant to digital transmission. If efforts to set standards are successful, the end stage of this conversion process will bean Integrated Services Digital Network or ISDN– "an integrated national net work that can connect any information provider with all its potential customers and any user with all the range of information resources available."[33] Planners envision that users will access such a network through a standard connection resembling an electric power plug-in receptical, available in virtually every building.

As more and more of the telecommunications infrastructure is converted to digital transmission facilities, the issue of copyright enforcement will be contested on a much larger scale. On the one hand, digital transmission can be a significant threat to enforcement because scope, scale, speed, and decentralization may make it very difficult to detect transfers of copyrighted works among private users. But because of the recordkeeping and processing power of digital communications switching technology, there may be opportunity for proprietors to monitor contact between data terminals. Telephone transaction records could provide evidence that a particular terminal accessed a particular store of copyrighted material at a particular time, and so aid enforcement. Alternatively, proprietors might embed digital "signatures" in their works to aid in their monitoring efforts.

The development of an Integrated Digital Services Network raises a basic question for intellectual property: To what extent will the enforcement of intellectual property law be a factor in the design, construction, and operation of future telecommunication facilities? This raises several corollary questions: Who, in our newly deregulated telecommunication environment, will decide to what extent and in what ways intellectual property enforcement will be implemented in telecommunication systems? What criteria will be used to decide which information will be collected about users of networks and who and under what circumstances access to that information can be obtained?[34]

[33] H.W. McGraw, Jr., "The Information Industry: The Principles That Endure," *Computers and People*, May-June 1983, p. 10

[34] "The policy implications of new electronic surveillance technologies have been reviewed in a recent OTA publication, Electronic *Surveillance and Civil Liberties*, OTA-CIT-293 (Washington, DC: U.S. Government Printing office, October 1985).

TRENDS IN PROCESSING TECHNOLOGY: IMPACTS ON THE RIGHT TO CONTROL THE MAKING OF DERIVATIVE WORKS

Information processing is the physical transformation and logical manipulation of symbols. It is an activity carried out by both people and computing machines. Information processing technology-computer hardware and software—has advanced rapidly since the initial devel-

opment of electronic computers in the late 1940s and early 1950s. It has been used to automate many tasks, improving the efficiency and speed of much of the information processing work that people formerly accomplished mentally or with the aid of mechanical devices such as paper and pencil. In the last 10 years, computing resources have become increasingly available to people in private homes and offices. They use this technology to transform and manipulate many kinds of information, including some types of copyrighted works.

Increasingly, people use information processing technology to prepare derivatives of protected works—to selectively modify them or take them apart and to reassemble the pieces into new, or apparently new, works. To a large extent, the intellectual property enforcement problems stemming from the use of processing technology are nascent, but current uses offer clues to the potential impact of these problems. A discussion of the current and potential effects of this technology on several different types of intellectual property illustrates the implications of information processing technology for enforcement. Integrated with storage and communication technologies into computerized, digital information systems, processing technologies promise some truly formidable problems for the enforcement of intellectual property rights,

Impact of Processing Technology on the Derivation of Text

Affecting the way that people prepare text, information processing technology is beginning to be used to make derivations of copyrighted textual works. Word-processing hardware and software are becoming commonplace technologies in offices. Integrated word-processing, database-management, and on-line information retrieval capabilities are also offered in personal computer software packages. These capabilities make it possible to build personal databases derived from the copyrighted works of CompuServ, The Source, and other on-line information retrieval companies. In fact, these companies design their databases with the intention of making it easy for users to make derivations. Users construct search statements that select a part of the database relevant to their needs.

Some people use these processing capabilities to extract portions of commercial databases and resell access to the information. In many cases, it is unclear whether infringements have occurred. Although containing the original information in some form, the derivation may look quite different, either because the format or other features have been changed to add value, or because of a deliberate attempt to disguise the source of the information. In other cases it is obvious that the derivative database stems from the original and may be in clear competition with it. The volume of both of these kinds of database derivation can be expected to rise as the amount of textual material available in computer-processible form increases, and as processing capability becomes better, cheaper, and more widespread. Hence, the enforcement of copyright in databases will become a larger problem, one described by some observers as insurmountable.

There are some text processing capabilities on the technological horizon that may have important, long-term impacts on the enforcement of copyright. Some of these are still experimental and others are merely speculative. *Automatic indexing, abstracting, and document preparation* systems that combine optical disk storage, high-speed digital communications, and perhaps novel computer architectures and intelligent text processing software may be common by the end of the decade. Such systems will be able to search a large body of machine-readable text, including many articles and books, select particular elements that are relevant to a given research question (much as current database systems do), prepare customized indexes and abstracts of relevant documents, and, most speculatively, prepare a report in proper English of specified length that summarizes the findings of the query. Should these capabilities be realized, they may require policymakers to rethink the question of what information processing activities are acceptable in relation to copyrighted materials. They

may also demand new approaches to monitoring and enjoining infringements of copyright in textual works.

Impact of Processing Technology on the Derivation of Music

Information processing technology is affecting the way people create music, and it is beginning to affect the ways in which they can prepare derivatives of copyrighted musical works. In the last 15 years, the decreasing cost of digital electronic processing technologies—logic and memory-have brought music synthesizing, audio editing, and dubbing technology out of the academic laboratories and sophisticated professional studios where systems were often custom designed and expensive to build and maintain. Now available off the shelf, these technologies are in the hands of disk jockeys, sound engineers in small studios, and aspiring professional and even amateur musicians. At the same time, the actual capabilities of these technologies have improved significantly. According to one OTA advisor, "There has been a quantum leap in terms of the sophistication of the kinds of information that you can produce on an off-the-shelf synthesizer."[35] Now, for the price of a grand piano, musicians can buy machines capable of analyzing and synthesizing sound wave forms and custom-designing sounds that have never been heard before.

Because these technologies are widely available, people are becoming accustomed to the freedom of using them to create, use, and reuse music. The groundwork is being laid for digital sound editing capability in the home. As mentioned earlier, compact disks already supply consumers with music in digital form. Within 3 years, digital audio tape may also be available.[36] A standard digital communication connection for music synthesizers and personal computers, the Musical Instrument Digital Interface (MIDI), is growing in popularity. And personal computers are now beginning to appear that have digital sound recording capability.[37]

Copyright enforcement problems are arising from digital music processing technologies because people can "disassemble" music when it is in digital form. This disassembly can occur vertically-that is snippets' of sound can easily be cut from a copyrighted work and incorporated in a derivation that may be nothing more than a collage of pieces of copyrighted works. Although it is more expensive, difficult to accomplish, and limited in application, disassembly can also occur *horizontally*. For instance, the bass line of a song maybe stripped off and used in a second work, creating what is, to some extent, a derivative work.[38]

Another intellectual property problem may arise from the use of sound *emulators* that can mimic complex sounds, including voices, with great precision. A question may arise about whether a singer can claim property rights in the sound of his voice.

These capabilities pose two questions relevant to intellectual property rights enforcement. First, how is a proprietor to recognize and prove infringement in this very dynamic musical environment? Second, what rights does or should an artist/copyright holder have to maintain the integrity of his work, and how can he enforce those rights?

Impact of Processing Technology on the Derivation of Video

Information processing technology is also affecting how people create visual works, and how they can use copyrighted visual works as raw material for other works. Digital, computer-assisted retouching of photographs has

[35] Michael Kowalski at the OTA Workshop on Technologies for Information Creation, Dec. 6, 1984.

"Interview with Stan Cornyn, Apr. 4, 1985. For about $1,000, one can now buy an adapter device that allows a videocassette recorder to be used to record music digitally. Barry Fox, "optical Memories for Home Computers, " New Scientist, Apr. 11, 1985, pp. 17-20.

'-Scott Mace, ' 'Electronic Orchestras in Your Living Room, " *Infoworld*, Mar. 25, 1985, pp. 29-33.

[38] Michael Kowalski, Dec. 6, 1985. Mr. Kowalski actually played for the workshop two pieces of commercially recorded and released music that demonstrated the stripping and reuse of a bass line.

reached a level of sophistication where the images of people can be added or subtracted from pictures leaving little or no trace of tampering." The pace of progress of video tape editing technology is such that a new generation of equipment appears about every 4 years.[40] The television technical community is studying the establishment of a worldwide digital video tape standard. Such a standard would allow all studio-based production work, including editing, to be done in digital format.[41] Thus, some early steps are being taken in the world of video toward the kind of disassembling capability now possible with music. Combined with communication technologies-UHF and VHF broadcasting, direct broadcast satellite, cable television—and storage technologies—video tape, optical disk—video processing is revolutionizing the way visual works are made, disseminated, and reused. Thus, equally revolutionary questions may be posed regarding the enforcement of intellectual property rights in visual works.

Computer hardware and software are reaching a truly phenomenal level of sophistication in the generation of graphics. Some experts suggest that, within as few as 5 years, it will be possible to use the filmed image of John Wayne, for example, and produce a full-length motion picture with a synthesized "Duke' in the starring role.[42] Lucasfilm, Ltd., of San Rafael, California, has developed and is now marketing a machine, the EditDroid, that uses optical disk storage and computer processing to automate virtually the entire process of film editing, making the actual cutting of film unnecessary, except perhaps at the very last stage of producing a master print.[43] The marriage of optical disk storage and video processing equipment suggests the possibility of establishing "image banks' consisting of digitized images and standard algorithms to manipulate, transform, and link together video image frames, or even parts of frames, into new visual works derived from older, perhaps copyrighted, works.[44] The ownership management of such image banks could be complex.

Standards for digital television broadcasting and reception are being discussed in international standards forums.[45] Digital television promises to lower the cost and improve the quality of pictures produced by home television receivers, and could also make it possible for home users to store and reprocess television programs. Again, the enforcement of the intellectual property right to control the production of derivative works would be complicated by the private and potentially widespread technical capability to make new uses of copyrighted works.

Impact of Processing Technology on the Derivation of Computer Programs

Part of the research and development effort in computer technology goes into the creation of hardware and software *tools* that can be used to help create other computer programs.[46] These tools aid people in developing new and ever more sophisticated programs. Some tools can also be used to adapt existing software to new uses. Thus, if they are employed in the unauthorized production of derivative works, their use may violate intellectual property rights.

"Some people believe that, upon challenge, photographs may no longer be held as admissible evidence in court, S. Brand, K. Kelly, and J. Kenny, "Digital Retouching: The End of Photography as Evidence of Anything," *Whole Earth Review*, July 1985, pp. 42-49.

"'Interview with Humberto Rivera, Apr. 18, 1985.

"Richard Green at the OTA Workshop on Display, Printing, and Reprography, Mar. 13, 1985,

"Several states, including California, have recently passed laws that would require commercial users to obtain permission from the heirs of a deceased celebrity before they can use a likeness, thus treating the person's name and likeness as the property of the heirs, D. B. Moskowitz, "Celebrities' Ghosts Are Hanging Over Advertisers," ***Business Week,*** June 3, 1985, p. 108.

4'S. Gannes, "Lights, Cameras . Computers," *Discover,* August 1984, pp. 76-79.

"Jim St. Lawrence at the OTA Workshop on Technologies for Information Creation, Dec. 6, 1984,

"Richard Green, Mar. 13, 1985.

"'Examples of such tools include workstations, program editors, code debuggers, program generators, programming environments (integrated sets of tools), and, in the future, perhaps libraries of standard information processing modules that can be assembled to perform more complex functions and tasks. For a discussion of these technologies-the potential future and the current problems of *software engineering-the* reader is referred to the OTA report, *Information 7'echnology R&D: Critical Trends and Issues, OTA-CIT-268* (Washington, DC: U.S. Government Printing Office, February 1985), pp. 75-87.

The adaptation of computer programs to serve new or custom uses is, in many contexts, a well-accepted and widespread activity. Some computer languages and soft ware tools are designed specifically to aid in modifying programs that they help create. In particular, *operating systems* software is designed to help users tailor their programs and computing systems to serve special needs. " Some programmers and computer scientists believe that, because software is such a valuable resource, their creations should be in the public domain and under no circumstances restricted in their use as tools.[48]

The number of American homes with personal computers rose from zero in 1975 to 8 million by the end of 1983.[49] This technology has spread even more rapidly into offices. As personal computers become more widespread and the demand for more specialized software rises, the opportunity and the desire to manipulate copyrighted programs to serve particular purposes may also increase.

An especially relevant example of such manipulation is the use of programs designed to disable the copy-prevention schemes of many personal-computer programs, thereby allowing users to make multiple copies of these copyrighted works. Other currently available software tools— 'interpreters '— are used to translate a program from one computer language to another. Other tools aid in the "reverse engineering' of programs. Reverse engineering refers to the practice of analyzing a program to determine how it is arranged to accomplish its functions. A major goal is understanding the underlying algorithms used by the program designers. A very fuzzy line separates legitimate reverse engineering practices and violation of the copyright owner's right to control the production of derivative works.

Congress and the courts have not yet grappled with the question of what elements of computer programs copyright *should* protect. This issue is examined in detail in chapter 3 of this report. Here, it is important to note that much of the derivative uses of computer programs and their underlying processes and algorithms occurs in *private,* and as such presents proprietors with major obstacles in detecting and proving infringement of their rights, even given clear policy on what those rights include.

There is a widespread and growing research and development effort aimed at making computer software production easier. One goal of this effort is to develop extensive libraries of *standardized functional modules* of computer code. Some software module libraries already exist. These standard modules comprise computer program segments that represent the most efficient known formulation of how to accomplish a particular task, such as sorting records alphabetically. Libraries of modules may soon be organized so that they can be automatically selected and combined into programs on the basis of functional specifications. The use of standardized modules would help ameliorate the problem of low productivity in the currently labor-intensive software industry.

The establishment of large libraries of reusable software modules raises questions about ownership and the management of transactions in these resources. Difficulty is likely to arise in determining whether the copyright ownership of a module constitutes a restraint on the use of a function or an idea.

The nature of the computer is at the core of many copyright enforcement problems, including those that surround the unauthorized derivation of computer programs themselves. A truly revolutionary machine, the computer was recognized as such when the ideas governing its operation were first conceived. In the 1930s, Alan Turing suggested, by way of a mathematical model, that any computer can *simulate* the operation of any other computer, past, present, or future.'" The real limit on the use-

[48] Interview with Edward Conklin, FORTH, Inc., Apr. 19, 1985.

[49] Richard Stallman, "The GNU Manifesto," Dr. Dobb's *Journal,* March 1985, pp. 30-34.

[50] Walter S. Baer, "Information Technologies in the Home, " Information *Technologies and Social Transformation* (Washington: National Academy of Engineering, 1985), p. 124. In 1984, for the first time Americans spent more for machines in the "personal computer" category—i.e., those costing less than $10,000–than on mainframe computers or minicomputers,

[51] Alan Kay, "Computer Software, " *Scientific American,* September 1984, p. 53.

fulness of this simulation capability is the speed at which a given computer operates; and the speed of computers is widely projected to continue to rise at a breathtaking pace, at least for the remainder of the century." Thus, "It is clear that in shaping software [tool] kits the limitations on design are those of the creator and the user, not those of the medium."[52] The capabilities to manipulate and transform copyrighted computer programs into derivative works, to do so privately and without leaving a trace, are well within the limits of present computer systems. These capabilities confront legislators, courts, law enforcement agencies, and intellectual property owners with the question of what should or *can be* done to control the use of rapidly proliferating computer power in manipulating and transforming cop-y-righted works.

[52]See OTA, *Information Technology R&D: Critical 7'rends and Issues*, op. cit., pp. 324-331.
'Kay, ''Computer Software, ' p. 57

ADJUNCTS AND ALTERNATIVES TO TRADITIONAL ENFORCEMENT MECHANISMS

Faced with mounting difficulty in identifying, detecting, and prosecuting infringements of their traditional rights, intellectual property proprietors are pursuing three basic strategies to protect their economic and artistic interests, They are: implementing technological protections to prevent the unauthorized copy, publication, and use of their works; initiating public relations campaigns that appeal for citizens' moral support and respect for property rights; and lobbying for legislation that strengthens government enforcement efforts, or establishes alternative mechanisms for obtaining remuneration.

These strategies are not mutually exclusive, and do not apply uniformly across all situations. Proprietors see different enforcement problems arising from different technologies, which affect particular types of works in different contexts of use. Thus, a mix of strategies may be most appropriate to meet these different challenges. Although a given form of technological protection, for example, may effectively reduce copying of personal-computer software distributed on floppy disks, it may be totally ineffective if the software is distributed over telephone lines. Appeals to peoples sense of "fair play' may be quite useful in educational or corporate environments, but ineffective, or even offensive and counterproductive, when applied in the context of home use. The collection and distribution of royalties on the sale of blank media may be a workable solution when applied to cassette tapes for music or movies; but such a solution may be an administrative nightmare if applied to more versatile media such as magnetic or optical disks, where many more kinds of information products, and thus many more and varied interests, would have to be accommodated in distributing royalties.

TECHNOLOGICAL PROTECTION

Several varieties of technological protection are now used to prevent unauthorized use of intellectual works in the forms of computer software, broadcast video signals, and audio and video recordings. These technological approaches for securing intellectual property rights may be grouped into three categories: 1) security measures such as locks, scrambling, and encryption; 2) technological methods to monitor information flow; and 3) proprietary channels for the distribution of information. Each of these methods has advantages and disadvantages that make it appropriate for various uses.

Every technological approach to the protection of intellectual property requires a trade-off between the security of the property and its accessibility, marketability, cost, and quality. Furthermore, as was reiterated by *every* technical expert with whom OTA spoke, while any technological barrier may work in some cases by acting as a' 'stop sign warning against unauthorized use, no form of technological protection is 100 percent effective against determined opponents.

Software

Many present and proposed methods of using technology to protect intellectual property center on software, in part because it is the newest and most technologically sophisticated information-based product today. Further, software copying has three distinctive qualities that set it apart from the copying of other expressions of intellectual property, making protection a particularly critical issue, First, it is easier to copy software than other products, such as audio records or books, because the physical effort is minimal—as simple as pressing a single key. Second, a computer can copy software extremely fast compared to the length of time required to copy other materials. Finally, unlike a taped copy of an audio recording, the duplicate is typically an exact, perfect copy of the original software with no distortion of quality, Thus, the same technological qualities that make software useful also make it vulnerable to copying.

Software protection for mass-market, personal computer programs generally falls in the first category of technological approaches listed above: locks and encryption. Another alternative is the use of proprietary channels for the distribution of software.

Software embodied in disks maybe protected from copying in two basic ways. Either the protection mechanism can be built into the software, or it may be divided and coordinated between software and hardware. The essential distinction between the two methods is that the hardware-plus-software protection mechanisms are able to limit software to one computer or one user. In contrast, the software-only protection mechanisms cannot control use of the software, only the number of copies that exist. Software-only protection methods are currently in use, and implementation of more advanced and secure hardware-plus-software methods is being discussed. Some chip manufacturers are designing computer chips with machine-readable serial numbers and decryption circuits to help software makers more effectively control their products.[53] But, in general, hardware companies have little incentive to help prevent copying because the availability of "free" software makes their products more attractive and less expensive for the individual to use.

There are numerous other mechanisms that could prevent unauthorized copying, some requiring substantial changes in hardware, and others based on modified systems of distribution. One of the former involves providing software in read-only memory (ROM) and redesigning computers so they accept ROM modules or cartridges.[54] Taking the concept of software cartridges a step further, one can imagine computers being sold with many software programs built into the machine, residing in internal ROM chips. " A developer of especially useful software, fearing lost profits due to illegal copying, could market his software only in this form—inside a computer. Such a policy has many drawbacks. It would severely limit users of computers, who would be forced to buy an entire computer to get a useful piece of software. Even if computers were inexpensive, the waste would be great and the computer's util-

[53] "For example, "Software Protection Devices, Inc., is attempting to incorporate its Copyrighter software protection system into a microcomputer chip under joint development with The Western Design Center, " a Mesa, AR. microprocessor design firm. Edward Warner, "Few Takers for Embedded Protection, " *Computerworld*, Mar. 12, 1984, p. 109.

[54] "Computers that accept software in ROM have thus far met with mixed success. For example, the Texas Instruments 99 and the IBM PCjr accept software in ROM cartridges.

[55] The trend toward building software into computers is, by and large, currently motivated by the desire for small, lightweight computers, not to prevent copying. For example, the Hewlett Packard Portable computer has its operating system software and two applications programs, Lotus 1-2-3™, and a text editor, provided by internal ROM to eliminate the size and weight of disk drives.

ity as a "universal machine, or a device that can imitate any other device, would be lost. Such computers would be special-purpose machines only.

Another form of technological protection permits developers of programs (as distinct from suppliers of data) to keep their programs in their own computers, rather than distributing their software on the market. People who want to use the program are required to connect to the developer's computer, upload the data they want processed, and pay an on-line use fee. The disadvantages of this scheme are losses in flexibility-users are not able to link their programs to remote, protected ones easily—and communication costs for the on-line link.

One still-theoretical solution would be to link software access to a unique personal identifier. A computer terminal would be equipped with a hardware device that accepted sensory input, such as a person's appearance, fingerprints, hand geometry, voiceprint, or retinal pattern. Software could be designed to permit only the person whose appearance or prints matched to log onto the computer or to use a piece of software.[56]

Broadcast Signals

Because broadcast signals-television and radio transmissions—are not contained in a tangible medium or transmitted over wires, they cannot be locked like software or distributed through proprietary channels. They may be protected in only two ways: directly by scrambling or encryption, or indirectly by monitoring techniques.

Scrambling or encryption techniques alter the signals so that they are unintelligible unless the proper decoding device is used at the reception end of the transmission. Typically, the signal for a network television show has a long route to the viewer—e.g., from the network to a satellite to the affiliate station and finally to the home viewer—and so is vulnerable to unauthorized pickup at many different points, Broadcasters need to ensure that these transmissions are not accessed until the end of the process, after the local affiliate station has added local advertisements. Thus, the networks may scramble the signals so that only the affiliate station, using a decoder, has access to the satellite transmissions.[57]

Monitoring techniques to verify unauthorized viewing or listening have been applied in some cases, particularly by some subscription television and MDS companies. So far, the courts have upheld this form of electronic surveillance, but privacy concerns remain. In any case, monitoring individual residences for theft of service is very expensive and therefore of limited value to proprietors, except perhaps as a deterrent.

Audio and Video Recordings

In ways similar to those used for computer software, audio and video recordings may be copy protected by a mechanism built into the recording itself, or by a scheme coordinated between the recording and the playback/copying machine.

Musical recordings have traditionally included no mechanism to prevent copying. All known copy-preventer systems tend to degrade the quality of sound reproduction. Recently, there is renewed interest in protecting musical recordings because digital CD/ROM records are potentially infinitely copyable in high quality. Manufacturers of compact disk recordings are, therefore, embedding a unique "signature' in their products to serve as evidence of unauthorized copying or manipulation.[58]

One company now offers protection for videocassette tapes in a system that "confuses the automatic gain control of VCRs, causing them to make copies that have dim, weak pictures that are marred by video 'noise.' "[59] This sys-

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'<John Koehring, "Automatic Identity Verification," *Information Age*, April 1984, pp. 103-110.

"'interview with David Poltrack, CBS, Inc., June 10, 1985.

[58]Interview with Al McPherson, Warner Records, Inc., Apr. 19, 1985.

[59]"Homevid 'Club' Has Surprise for Pirates," *Variety*, Apr. 24, 1985. Consumer electronics catalogs feature devices that claim to defeat these automatic-gain-control-based protection schemes.

tern could also be used for broadcast signals, so that a work taped from an on-air performance and protected in this fashion would yield a very poor copy.

CBS Inc. recently announced a system to prevent copying of records, tapes, and compact disks that will be coordinated between a device in consumers' home-recording equipment and a coded signal on the purchased recordings."[1] Record distributors would likely offer two versions of recordings, one copy protected and the other not, and charge different prices for them. Industry spokesmen acknowledge that it will probably take decades for this scheme to significantly affect consumer copying, because people will be able to copy protected recordings with their existing equipment. Also, equipment manufacturers are likely to continue to offer equipment that does not include the copy-protection device, unless the law requires such devices.

Effectiveness

The ability of technological protection to prevent illegal copying or access depends on the medium and the type of protection, but a few absolutes can be stated. Any form of technological protection will prevent some unauthorized use; no form of technological protection will stop all unauthorized use. Some systems are relatively easy to defeat, others more difficult. And it is conceivable that new forms of technology will alter the effectiveness of these devices.

Another factor is the level of technological literacy in society. Today, many children have early and frequent exposure to the new computer technologies, and so will be better equipped to use—or misuse—technology. The higher the level of society's computing skill, the more difficult the job of technological protection becomes-at least for computer-based intellectual property.

For technological protection to work on a large scale, the challenge is to find a level high enough to reduce unauthorized use to a manageable level, but low enough so that consumers would not find the protection mechanism so distasteful that they would refuse to purchase and use protected materials.[61] The marketplace will tend to set an equilibrium of acceptable protection. But given the uncertainties of technological change and shifting consumer preferences, industry will have to monitor the market carefully to assess the effectiveness of protection and to gauge consumer reaction to protection mechanisms.

Advantages and Disadvantages of Technological Protection

Some analysts believe that proprietors' reliance on technological protection is a natural and reasonable process. They argue that using such protection is like building fences to protect real estate. Thus, improvements in technologies for copying and manipulating intellectual property will probably result in better technologies to prevent these activities, just as the opening of western lands was followed by the invention of barbed wire.[62]

However, from the point of view of public policy, technological protection may be a poor way to protect intellectual property rights because it ignores part of the constitutional compromise between the public welfare and the profit-making of intellectual creators. Technological bars may block dissemination of and access to intellectual property.

One result of this loss of access could be redundancy in spending for research and development. Since technological protection bypasses intellectual property law, software producers, for example, might decide not to disclose the contents of their software, depriving competitors, experimenters, and researchers of the benefits of their work. Thus, some software research and development would repeat previous, but undisclosed, work. This duplication and waste of resources is precisely

[1] Martha M. Hamilton, "Record Industry Unveils Device to Block Copying," *The Washington Post*, Mar. 26, 1986, p. G3.

[61] Christopher Weaver, OTA Workshop on Storage and Database Technologies, Jan. 11, 1985.

[62] Personal communication from Fred Smith, (competitive Enterprise Institute, January 1986.

what patent law strives to avoid. Moreover, technological protection of software does not expire after a set period of time, as other intellectual property rights do. The creator of software could, in effect, have a perpetual monopoly on his work.

Technological protection in and of itself does not *necessitate* changes in intellectual property law, but it could *precipitate* changes by weakening the distinctions between different types of intellectual property—patents, trade secrets, trademarks, and copyrights. If technological protection were effective, intellectual creators would not have to observe the formalities required for legal protection, e.g., submitting to the lengthy and expensive patent process, or disclosing works to the Copyright Office. They might still choose to do so for additional protection if technological protection fails, but there would be less reason. Technological protection, if applied indiscriminately to any or all kinds of intellectual property, could blur the legal distinctions among these forms of protection. In reflecting what might become a widely accepted public practice, the law itself could likewise cloud the differences.[63]

Widespread technological protection could make intellectual property law more effective in one important way: it would alert consumers who attempt to copy that they are breaking the law. This would not necessarily stop them, but by forcing them to take elaborate steps to make copies, it would at least make the act less convenient and emphasize its illegality.

Widespread use of technological protection could generate a need for new, related laws or regulations. In addition to the potential need for standards legislation, laws that proscribe the manufacture, sale, distribution, or use of devices or program software intended to defeat technological protection mechanisms may be necessary to ensure effectiveness. This type of legislation has two drawbacks. The first is that there are some legal uses of duplicated materials, which would make it necessary to outlaw devices with legitimate uses. The second drawback, closely related to the first, is that it would be necessary to define and characterize devices and methods used for defeating technological protection. Those definitions and characterizations would cover specific applications of technology, and would themselves exist in a changing technological environment. The law would require making the precise technological definitions necessary to prevent defeat of protection mechanisms, while at the same time allowing the use of related technologies.

Another kind of legislation, similar to control of copying methods, could be enacted that would outlaw the intentional defeat of, or tampering with, technological protection mechanisms, regardless of any violation of intellectual property rights. Or, perhaps, ordinary violations of intellectual property law might still be treated as they are now, but violations that involved the intentional defeat of technological protection mechanisms could carry additional penalties.

Public Relations Strategies

Even with safeguards against unauthorized use, today's information technologies provide users greater potential access to intellectual property, and the means to reproduce, store, transfer, and manipulate works. Responding to this probable increase in uses of technology, many proprietors have tried to inform the public about intellectual property rights and persuade them to respect those rights.

To influence public attitudes, business leaders have followed three basic strategies. First, they have tried to alert the public to the idea that copying is illegal and will be prosecuted. Second, they have tried to convince users that they have a stake in assuring the fair compensation of artists, publishers, and distributors. Third, they have sought to educate the public about copyright, appealing to them as citizens

[63] John Hersey, in the final report (1978) of the National Commission on New Technological Uses of Copyrighted Works (CONTU), worries about the "subtle dehumanizing danger" of blurring the distinction between types of intellectual property. He opposes extending copyright to computer programs at 'the moment at which the program ceases to communicate with human beings and is made capable of communicating with machines." CONTU, p. 33.

who will obey the law once they understand it. These strategies have met with varying levels of success.

When the law clearly defines infringement, it becomes easier to inform the public and build awareness about the issue. For instance, the Motion Picture Association of America (MPAA) emphasizes the protections provided by law in its posters, brochures, articles, and manuals for enforcement officers. They tell the public that video piracy is a Federal crime, and that offenders will be prosecuted. Newspapers and magazines are sent press releases about successful prosecutions to spread the word that the film industry is enforcing its rights. Similarly, when the recording industry uncovers large-scale piracy, the ensuing publicity alerts the public to the problem. The industry hopes that the public, aware of counterfeit tapes and records, will be less likely to buy them.

Book publishers, too, launched a major public awareness campaign after Congress passed the 1976 Copyright Act, seeking support for new provisions that defined fair use. The target audience included librarians, educators, representatives of industries that use copyrighted works, and the general public. Book publishers distributed printed materials and held sessions at professional meetings and public forums. Many publishers believe that these efforts produced only very limited results.

Book publishers point to the inherent limitations of the copyright notices on books, articles, and copying machines.[64] If the industry is serious about reducing unauthorized photocopying, many believe that this intention must be made clear through well-publicized litigation. As the President of the Association of American Publishers, Townsend Hoopes, said in announcing a lawsuit against Texaco for unauthorized photocopying:

> Major businesses that either make no effort to obtain clearance for their photocopying . . . or like Texaco. make only token payments must under-stand that publishers will not remain silent regarding violations of their copyrights.[65]

Similarly, the computer software industry has undertaken an aggressive public-relations campaign. Because software copying is technically so difficult to prevent, many in the software industry argue that public relations is essential to an overall strategy of copyright enforcement. Through its trade association, ADAPSO, the software industry has brought some major legal cases[66] and has developed and widely distributed a brochure that states:

> People who would never walk into a store and shoplift a software product think nothing of making several copies of the same software. The results are the **same.** The act is just as wrong.[67]

The industry has taken out advertisements in computer magazines that make the same point.

Public Attitudes and the Legitimacy of Intellectual Property Law

Neither the threat of legal action, nor the education of users about cop}' right may be enough to change public attitudes and behavior. Only if the public perceives copyright rules as fair and reasonable will they voluntarily respect the law.

OTA commissioned a public opinion survey to identify current public attitudes on intellectual property. The major findings were as follows:[68]

- At the present time, " Intellectual Property Rights' is not an issue the public feels

[64]The 1982 King Research report on photocopying in libraries found that 85 percent of photocopy machines in all libraries, 93 percent of the coin-operated photocopy machines in all libraries, and 100 percent of coin-operated photocopy machines in academic libraries bear a copyright warning notice. I). McDonald, Libraries, *Publishers and Photocopying,* pp. 2-16

[65]Press release from the Association of American Publishers, Inc., Washington, DC, May 6, 1985,

[66]"(See, for example, "ADAPSO Suit Alleges Piracy, *Computerworld,* Jan. 21, 1985; "Micropro and ADA PSO Sue American Brands, Allege Software Piracy, *Download,* February 1985.

[67]*Thou Shalt Not Dupe* (Washington, DC: AI) APSO, 1984) This brochure was mailed to 5,000 colleges and universities, 22,000 school districts, and 17,000 corporate counsels in the United States.

[68]*Public Perceptions of the Intellectual Property Rights Issue* (prepared for OTA by The Policy Planning Group, Yankelovich, Skelly & White, Inc., Februrary 1985).

it knows a great deal about. It is also not an issue they perceive effects them.

- The vast majority of the public finds acceptable—such that they would be willing to do it—some form[s] of unauthorized copying of copyrighted material.
- Surprisingly, willingness on the part of the public to engage in behaviors that infringe on intellectual property rights is not affected by awareness of the issue or experience, in general, with home technologies.
- Conversely, several specific attitude sets appear to be related to the acceptance of copying behaviors. Among them are:
  —a tolerance of "gray area' behaviors,
  –belief in the benefits of sharing information, and
  –pragmatic responses such as the acceptance of copying copyrighted material while acknowledging that it is probably wrong,
- The public draws the line at behaviors that infringe on intellectual property rights when they involve the obvious or active circumvention of payment, when they are done for sale or profit, or on behalf of business or in a corporate setting.
- At the moment, the public perceives the intellectual property-rights-issue to be a marketplace problem whose solution should come from the industries and companies affected.

OTA also commissioned a survey of the attitudes of small business executives toward intellectual property. The major findings were as follows:[69]

- Small business executives appear to be more sensitive to the problem of intellectual property rights than the general public.
- They are more likely to agree with statements that emphasize the need to preserve the proprietary nature of information. As producers, many of their products are protected by copyright, patent, or trademark laws. Thus, these executives are supporters of the law.
- Because of definitions used in the sample selection, the small business executives studied are owners of, or have access to, computers. Their attitudes show that they are technology oriented—believing that more technology is better. They are strong supporters of actions that will promote and ensure the availability of future technologies.
- Small business executives appear *less* likely than the general public to find copying behaviors acceptable.
  – While they find almost all copying behaviors unacceptable, they make an exception for the one behavior they would be most likely to engage in: the making of copies of computer programs.
  –As is the case with the general public, there is consensus that any sort of copying for sale is totally unacceptable, whereas copying for personal use is more acceptable.
- Small business executives emphasize nongovernmental solutions to intellectual property rights problems. When given a choice, they prefer solutions that involve technologies that physically prevent copying. Further, they believe that the clarification of ambiguities about which copying behaviors are or are not permissible would be helpful.
  –However, as is the case with the general public, the intellectual property issue is of low salience among small business executives, and there is little demand for solutions at present.
- Small business executives see themselves as potentially part of the process of finding solutions to intellectual property problems. Within their own companies, they are willing to set rules and guidelines against conduct that violates intellectual property rights. However, they will only go as far as setting standards. They feel that they cannot and will not accept responsibility for actual enforcement of rules or laws designed to prevent behaviors such as copying.

[69] *The Intellectual Property Rights Issue: The Small Businessman's Perspective* (prepared for OTA by The Policy Planning Group, Yankelovich, Skelly & White, Inc., August 1985).

From these surveys of the general public and executives of small businesses, and discussions with students and educators, OTA found that public relations strategies are likely to be most effective if they focus not on the rights of copyright holders, but on the relationship between the copyright holder and the users of the work. Messages about unauthorized copying may be more effective if they emphasize the value of an ongoing partnership between creators and users.