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TECHNOLOGICAL CHANGE

A Challenge for Universities, Students, and Communication Professionals

FRANCES FORDE PLUDE



IN THIS PAPER I analyze significant aspects of change in telecommunications—that is, unfolding technologies in use (not just as hardware) and their social and ethical implications. I set forth a number of concepts and issues that are challenging to the extent that they require interdisciplinary collaboration among all university faculty in both teaching and research. These are issues and concepts that, while shaped by the past, are defining our future. I hope these reflections will contribute to the task that all university faculty face: to meet these learning and teaching challenges in a meaningful and scholarly manner.

On any university campus, communication faculty can represent a valuable resource for the interpretation and analysis of changing communication and technology patterns. Thus, they can be a helpful resource in fulfilling the university's mission and its service to society. In addition, students need this communication dimension because they will grow intellectually and work in a world permeated by media.

This analysis presumes that faculty from varied disciplines *can* collaborate to meet these challenges. It is not fruitful to fret about which faculty group is the most scholarly. All of us must sharpen our pedagogy and our analytical tools; we must institutionalize teamwork and task-force approaches, making interdisciplinary cooperative efforts habitual. Only in this collaborative way will we meet the enormous challenge of a globe recycling itself into an information society.

The communication technology of a society determines who can speak to whom; this is the heart of social organization. Likewise, the organization and culture of a society are defined by the messages that are transmitted in institutionalized patterns. As Edwin B. Parker put it: "Both the problem and the resolution of social effects of technology lie in the way our social institutions are structured instead of in technology per se. A time of technological change provides opportunity for institutional change."¹

These realities propelled me from a professional role in television (as producer and TV program host) to doctoral studies at Harvard University and MIT. Discussions with professional colleagues had convinced me that new technologies would alter forever the communication field. The article by Melvin DeFleur in this volume illustrates the many ways this has taken

1. E. B. Parker, "Technology Assessment or Institutional Change?" in *Communications Technology and Social Policy: Understanding the New "Cultural Revolution,"* ed. G. Gerbner, L. P. Gross, and W. H. Melody (New York: John Wiley, 1973), 545.

place in the past. To prepare myself for the changes ahead and to participate actively in the technological decision making, I began the systematic study of conceptual issues. Now, as a university professor, I have this same commitment to *concepts* and require my students to deal with contextual issues—not just with the “gee whiz” aspect of technological tools.

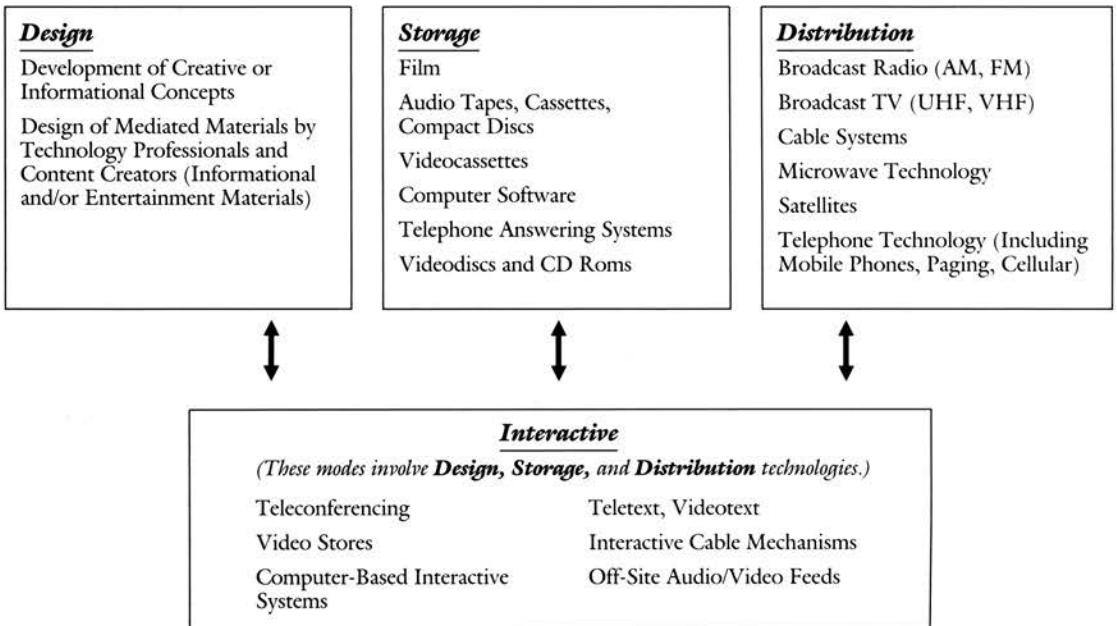
I explore four broad topics that relate to new technological challenges facing those who teach communication in colleges and universities and who serve varied constituencies. These four themes (expanded on throughout my discussion) do not exhaust the possibilities, but they give insights into the task: (1) components of new communication or information technologies; (2) the development of high-definition television and direct broadcast satellites as a specific (and fluid) case study; (3) appropriate goals in serving students, the university, the communication field, and the wider public; and (4) specific issues to be resolved. Thus, this essay covers central aspects of both teaching and learning about new communication technologies. In discussions of the communication curriculum and its respectability on the university campus, these ideas may help to provide a broader vision of what departments and schools of communication can offer—to the university and to society. This vision should help inspire the collaboration called for in my introductory paragraphs.

TECHNOLOGY COMPONENTS

It will be helpful to begin with a simple overview of relevant technologies. I have developed a model to clarify relationships among components

Figure 1

INFORMATION TECHNOLOGIES



2. These concepts have been differentiated in my thinking for a number of years and were realigned recently in teaching a graduate seminar at the Newhouse School of Public Communications. Students contributed directly to the design.

of information technologies (fig. 1).² This model distinguishes between *design*, *storage*, *distribution*, and *interactive* technologies.

Obviously, entertainment content and other types of information cannot be stored or distributed until they are designed; thus, the design phase (conceptualizing and writing creative or informational content) is a key component. Many items we consider media are storage components only: film, videocassettes, and computer software. Distribution technologies include broadcast TV and radio (both stressed in many communication colleges), microwave technology, satellites, and modern paging systems.

Before examining the interactive component of the model, I will reflect upon two major characteristics of new technologies: their convergence and their interactivity. Communication and computer technologies are so integrated that it is impossible to distinguish between them in many media components. This complicates public policy issues, such as the amount of regulation needed and the impact on society. There have been varied regulatory approaches taken in both communication and computer fields, and these are also affecting how we teach these technologies to students.

The second characteristic of current communication technologies is their interactivity. Because these tools are two-way modes of communication, with feedback as part of the media, they will lead to developments in communication research. The eminent scholar Everett Rogers commented that we are at an “epistemological turning point” in communication analysis; he added: “Driving this epistemological revolution in communication science is the interactivity of the new communication technologies.”³

In my model, it is clear that many newer media channels allow interaction, or at the very least, more individual choice. Video stores are listed because they represent a more targeted and involved option; with the videocassette recorder (VCR) and an inventory of video choices, the consumer is a programmer—a choice not permitted in broadcast TV, for example. Ted Koppel, Robert MacNeil, Jim Lehrer, and others are interactive when guests and hosts are in direct dialogue from distant points through satellite interconnection.

Other interactive technologies include computer systems, teleconferencing (conducting meetings with audio or video interconnection), fiber-optic cable, and teletext or videotext. The last two technologies mentioned have not developed significantly in the United States but are currently successful in France. And one only has to review the dramatic penetration of the VCR and cable in the last five years to realize that once a technology has found its niche, rapid development occurs.

Edwin Parker cited seven ways that new technologies can serve individuals who value information.⁴ (1) The amount of information available increases, and (2) greater variety is offered in the packaging of information. (3) The power of selection is placed in the hands of the individual receiver, and (4) the user’s information-processing capacity is improved. (5) More effective feedback is possible in these newer information systems. (6) Communication can increasingly replace transportation, as it does in teleconferencing, for example. And (7) social barriers to accessibility of information can be removed because the information is conveniently available.

There are at least two additional concepts concerning new technologies to consider here. In a provocative study entitled *Technologies of Freedom*,

3. E. M. Rogers, *Communication Technology: The New Media in Society* (New York: Free Press, 1986), 194.

4. E. B. Parker, “Technological Change and the Mass Media,” in *Handbook of Communication*, ed. I. de Sola Pool, W. Schramm, F. W. Frey, N. MacCoby, and E. B. Parker (Chicago: Rand McNally, 1973), 631.

Ithiel de Sola Pool warned that freedom of expression may be undermined if our public policies are not crafted to respond to merging interactive technologies.⁵ Will newspapers delivered on the video screen have the same First Amendment protection our courts have allowed the traditional press? How will intellectual property be protected if our copyright laws cannot keep pace with information retrieval systems? These and similar policy challenges will face communication and information professionals in the next century. Communication educators can provide direction here in their own research and writing and in the preparation of students to confront these issues when they move into leadership roles in the years ahead.

Another perspective on technological growth is offered by John Staudenmaier, who cites three stages of a successful technology: design, momentum, and senility.⁶ The design stage refers to the moment when the design is not yet a source of further technical or societal change; here much flexibility exists. The individual or group representing the technology's source is called the design constituency. Many nontechnical factors can be influencing designers, such as their value systems or the prevailing cultural modes of society. The technology of the moving assembly line and machine tool production systems, for example, evolved when workers, mainly immigrants, were considered in need of paternalistic management.

As technologies move into the momentum stage, flexibility is lost and design rigidity may emerge as many people invest in the design. For example, once mass-produced automobiles were available, many auto-related businesses (e.g., gas stations, motels, insurance companies) were established and institutionalized. Such businesses and accompanying public policy initiatives (funds for highway construction) all represent the maintenance constituency. Staudenmaier, a technology historian, says key questions exist at this stage: Which individuals and groups profit from the technology? What strategies do they adopt to foster its momentum? How is their worldview—personal and societal—affected by their investment in and dependence on the technology in question?

Finally, because the larger world is continually changing, it will not retain its "fit" with any successful technology forever, and the cycle will lead to a form of "senility." Staudenmaier urges us to be conscious of the "impact constituency"—those "individuals, groups, or institutions who lose because of the design of a technology, those who suffer from the rigidities and limitations inherent in the technical dynamic."⁷

Today's communication students and their faculty face technological concepts that go far beyond the hardware. And in an information age dependent upon increasingly complex communication channels, the work done in communication classrooms should benefit the whole university community and all of society. When thoughtful study and systematic analysis accompany the training that communication majors receive, all of these constituencies should benefit.

A TECHNOLOGICAL CASE STUDY

A bold new technological shift is underway and provides a specific case study for communication faculty and students. This brief review will char-

5. I. de Sola Pool, *Technologies of Freedom* (Cambridge: Harvard University Press, 1983).

6. J. M. Staudenmaier, SJ, *Technology's Storytellers: Reweaving the Human Fabric* (Cambridge: MIT Press, 1985), 192.

7. *Ibid.*, 198.

acterize many other technological changes and will show that accommodations are being made in the curriculum of most communication schools.

My students have been researching high-definition television (HDTV) for several years, and the practice has seemed quite theoretical. It is, however, moving beyond the design stage and developing momentum, to use Staudenmaier's language. HDTV, also called advanced television (ATV), refers to systems that provide wider screens with more lines of resolution than conventional TV sets do, resulting in greater clarity or definition in video—clarity that formerly was limited to motion pictures.

One scenario links the development of HDTV with direct broadcast satellite (DBS) delivery. Largely undeveloped in the United States, DBS offers transmission from high-powered satellites directly to the home without going through cable or any other medium. Michael Hirrel, a communications attorney, believes that HDTV is causing dramatic changes in program delivery in the United States and that it will be delivered by a newly developed DBS industry,⁸ providing a broadcast spectrum through which high-definition signals can be transmitted.

HDTV requires a totally new equipment configuration, which presents a major problem for its development. Current studio equipment and TV sets would be unable to function with HDTV because the broadcast standard is different. Yet, the networks are seriously interested in HDTV to revive their flagging popularity in light of cable and VCR competition. HDTV's development is also vital for the protection of the U.S. role in global telecommunications markets, since Japan and other nations will move to HDTV even if this country does not change.

Hirrel sketched some possibilities with these dynamics in motion in this rather realistic scenario:

1. HDTV could be offered by the broadcast networks over direct satellite transmission, thus eliminating the need for local broadcast affiliates for HDTV. This also deals with the current Federal Communications Commission's requirement that no new spectrum be allocated for HDTV. The DBS spectrum has already been assigned.
2. HDTV could lead to the development of a successful DBS industry, giving DBS the product differentiation it has lacked until now to attract investors.
3. Cable companies will have to rewire their systems with fiber-optic cable, first, to compete with DBS in high-definition delivery, and second, to compete with telephone companies, since the latter already use fiber-optic cable. Optical fiber permits much more information transmission than does copper wire.
4. Telephone companies will offer sophisticated switching services called ISDN (integrated services digital networks), which can be used with HDTV.
5. With high-capacity HDTV switches and fiber, video "gateways" to homes will eventually emerge. Hirrel notes that such gateways "will contain huge libraries of video programs, from cinematic releases to educational tutorials to syndicated television shows. Gateways can also offer live programs such as sports events and may store that day's original network programs for time-shifted viewing."

8. M. Hirrel, "Making HDTV Viable via Direct Broadcast Satellite," *Broadcasting* (October 1988): 26.

6. Existing media will be altered. Individual broadcast stations will face steep challenges. They will be the only medium that can reach portable receivers; they may emphasize local programming. Video stores may disappear since home gateways would provide immediate access to such varied program choices.⁹

9. Ibid.

These technological changes in the communication industries are startling enough; when combined with computer-related information technologies, integrated as they are with communications, the challenge is immense.

It is daunting, indeed, for today's communication scholars and students to handle this mediated new technology information. One approach, adopted often by communication schools, is to stress *conceptual* analysis more heavily than *technical* consideration of equipment particulars since there are constant changes in hardware. This is why even television production majors at the Newhouse School of Public Communications at Syracuse University earn a majority of credit hours in liberal arts subjects and communication theory courses.

PRIORITIES FOR COMMUNICATION STUDY AND ANALYSIS

One concept that helps me move about in these waters is the value of collaboration. The changes are so rapid, the opportunities so great, and the risks so real (for entrepreneurs and the public) that we must improve our skills in research, policy formulation, and instruction. Cooperating with colleagues in other fields at the university seems to be more and more desirable as we struggle to learn about, analyze, and advise on technological change with our students. Collaboration is especially valuable in efforts to offer research and development and public policy guidelines for a society staggered by continuing change. Also, collaborative efforts may ease some of the tensions that exist on some campuses between colleagues in "professional" schools and those in the traditional disciplines.

There are some specific issues that can bring university colleagues together in research, analysis, and policy efforts. One major consideration is the public interest, of which communication faculty are conscious since it is a significant part of the Communications Act passed by Congress in the thirties. Attention to the public interest has been a criterion for license renewal in broadcasting, but in an age of deregulation and varied communication and computer technologies the interest guidelines need to be continually researched and restructured. University faculty, including communication faculty, can offer public interest monitoring, including testimony at congressional hearings, and research studies clarifying the public interest. Much communication research has been done in areas such as media violence and children's television, for example; but today, with a wider variety of media sources and with interactivity built in to many of them, new research directions need to be developed.

Accountability is another underlying theme of our collaborative research and teaching efforts. Educators at many prestigious institutions are realizing their responsibility for probing ethical dilemmas in the classroom so that graduates will be prepared to make conscientious choices when they

are in the marketplace. Faculty in communication schools and in other areas of the university share this duty. In a world mediated by communication technologies, why not work jointly at these tasks in our analytical writings and in our classroom teaching? Instead of debates about which department is more “authentic” to a university’s role, collaboration brings the strengths of varied departments and colleagues together for an undertaking that is important and large enough to require cooperative efforts.

SPECIFIC COMMUNICATION AND INFORMATION ISSUES

To clarify the specific ways university colleagues can collaborate, I examine here some actual information-age issues requiring attention. Many ideas could be cited, but I have selected the following ones as examples: (1) the need for public policy analysis; (2) recognition of institutional realities; (3) awareness of new management forms; (4) innovation diffusion research; and (5) the view of communication as forum.

In *Policy Research in the Social Sciences*, James Coleman lamented the lack of a comprehensive methodology for studying the impact of public policy as an aid to future policy.¹⁰ Significant differences exist between research within an academic discipline and research for social policy, according to Coleman. On a philosophical level, the goal of research within a discipline is to further the development of theory about relevant phenomena. Policy research, however, provides an information basis for social action and is especially appropriate when dealing with resource distribution. (For example, broadcast spectrum as a resource has long been a major issue for communication specialists; a major new technology issue is the question of *access* to communication and information resources. Thus, the HDTV area will probably require governmental, business, and academic collaboration.)

The technique of tracing the distribution of a resource to intended receivers is labeled a “social audit” by Coleman. He noted that change to a social audit design would give much greater insight into what kind of modifications are needed for effective policies. This, clearly, is an area for effective collaboration between communication faculty and other university scholars. Parker commented:

*. . . the core of the policy analysis is in the explication of values and in the historical, legal, economic, and political analysis necessary to explicate goals and policy proposals. Behavioral communication research is necessary, but not sufficient for these tasks. . . .*¹¹

The public policy dimension must be integrated into classroom instruction of communication technologies. I have found that students respond with enthusiasm to the challenge of providing leadership in the policy arena as they grow in their communication careers; many, indeed, plan to make this public service sector the locale for their professional work.

There is a close connection between policy analysis and institutional realities: “. . . the short-to-medium-range social effects are determined not by the technology itself, but by the social institutions that can stimulate, inhibit, apply, or divert the technology.”¹² Parker concluded:

10. J. Coleman, *Policy Research in the Social Sciences* (Morristown, N.J.: General Learning Press, 1972).

11. Parker, “Technological Change and the Mass Media,” 641.

12. E. B. Parker, “Social Implications of Computer/Telecoms Systems,” *Telecommunications Policy* (December 1976): 3.

*Policy analysis should begin, however, with the social problems and aims that need urgent attention, and both the technology and institutions controlling the technology should be structured to accomplish long-term policy objectives.*¹³

13. *Ibid.*, 4.

Thus, awareness of institutional realities is necessary in communication school classrooms and interdisciplinary analyses by faculty colleagues.

We may tend to think of institutions rather narrowly, assigning the concept to bureaucratic institutions only. In fact, an institution is a collective social habit, consisting of beliefs, attitudes, and behaviors that have become habitual in society for a variety of reasons (e.g., education, laws, economic forces). Institutionalization can take place gradually or suddenly, and a degree of formality or intentionality is inferred.¹⁴

Institutional realities pervade the telecommunications arena; these institutional patterns, however, are changing rapidly. Cooperative attempts are needed to deal with these patterns because of the pace of change and the pervasiveness of telecommunications in our culture. Again, agents of such cooperation will be found in government, industry, and the academy.

One of the greatest challenges for communication scholars is to examine the process through which new technologies become institutionalized and incorporated into society. For example, Ithiel de Sola Pool, in *The Social History of the Telephone*, provided an interesting case study of the impact of that new technology.¹⁵ Pool was a model of the interdisciplinary scholar—a political scientist who invested in communication analysis, often from the perspective of institutional research. He was aware of the need to consider communications within the context of social organization and cultural norms. Telephones, for example, have certainly had an effect on social and economic institutions. Computers are creating similar institutional upheavals. These concepts need to be explored with students in our classrooms and among colleagues in our research and writing.

14. I am grateful to Olin J. Murdick for his institutional analysis. Murdick's doctoral study at Catholic University of America documents a theoretical basis for the institutionalization of shared responsibility in church governance ("A Study of the Policy Process As It Relates to the Catholic Educational Mission at the Local Level," [Ph.D. diss., Catholic University of America, Washington, DC, 1975]).

15. I. de Sola Pool, *The Social History of the Telephone* (Cambridge, Mass: MIT Press, 1977).

Generally, then, it is important for communication faculty to analyze new technologies in mass communication as social and cultural phenomena. One aspect alone, the interactivity of new technologies, has the potential of redefining the terrain of communication scholarship in this new decade. We should hope that faculty in communication schools offer leadership here for their students and their colleagues.

A third information-age issue is the awareness of new management forms emerging as a result of telecommunications tools. Peter Drucker heralded "the coming of the new organization"; he observed that computers communicate faster and better than layers of middle management do and that they demand knowledgeable users. Drucker predicted that in two decades the typical large business will have one-half the levels of management and one-third the managers of its counterpart today. He feels work will be accomplished by specialists who come together in task forces, cutting across traditional departments. Change is already underway:

*In pharmaceuticals, in telecommunications, in papermaking, the traditional sequence of research, development, manufacturing, and marketing is being replaced by synchrony; specialists from all these functions work together as a team, from the inception of research to a product's establishment in the market.*¹⁶

16. P. F. Drucker, "The Coming of the New Organization," *Harvard Business Review* (January–February 1988): 47.

In building the information-based organization, the “managerial challenge of the future,” there are four management needs, according to Drucker. First, we must develop rewards, recognitions, and career opportunities with specialists in mind. Second, a unified vision must be created; this will be more difficult, perhaps, in an organization of specialists. Third, a new management structure will have to be devised for an organization of task forces. And, fourth, it will be a challenge to ensure the supply, preparation, and testing of top management people for these new structures.

With telecommunication technologies serving as the infrastructure of the corporate community, more and more communication majors will enter this employment arena. Once again, communication faculty are called upon to acquaint students and colleagues with telecommunication realities and their organizational impacts. Corporate training departments are already employing many communication majors; and corporations produce more video than all three broadcast networks combined. The new technology revolution, however, goes far beyond the production of video. The integration of telephone and computer technologies with other communication media will, as Drucker notes, result in *organizational* restructuring.

Major conceptual changes are underway that are challenging communication schools and the university at large. The three information-age realities discussed so far are the need for public policy and analysis; a recognition of institutional realities; and an awareness of new management forms. Two important concepts remain: research on innovation diffusion and the view of communication as forum.

Everett Rogers has contributed significantly to the innovation diffusion literature. In *Diffusion of Innovations*, he defined diffusion as “the process by which an innovation is communicated through certain channels over time among the members of a social system. It is a special type of communication, in that the messages are concerned with new ideas.” He perceived the communication of innovation “as a two-way process of convergence, rather than as a one-way, linear act in which one individual seeks to transfer a message to another.”¹⁷

An interesting development in the scholarship concerning information technology innovation is that

*the importance of equality as an important consequence of diffusion activities began to be realized. . . . When a system's structure is already very unequal, the consequences of an innovation . . . will lead to even greater inequality in the form of wider socioeconomic gaps.*¹⁸

Again, the telephone provides a specific example of the significance of this idea in an emerging information technology environment. As today's telephone becomes computerized, offering many communication options, the cost of telephone service increases, which can provide hardships for some individuals living on fixed incomes. These individuals often have dire need of telephone service, but they see new technology putting the service beyond their reach. As information gateways to homes develop in the decades ahead, issues of equity and access to new technologies will require major innovation diffusion research and policy analysis.

17. E. M. Rogers, *Diffusion of Innovations*, 3d ed. (New York: Free Press, 1983), 5.

18. *Ibid.*, 412.

Finally, communication needs to be viewed within the framework of communication as forum. This paradigm has special significance in an era of ever-increasing *interactivity* in telecommunications. I find it especially engaging because of my own growing interest in a model of *cooperative interaction* in telecommunications policy development. There can be little doubt that we are becoming a wired world. As advances in telephone, computer, and satellite technologies allow us to network in new ways, a technological forum emerges, and interactivity grows as interconnecting becomes easier and more natural. After years of communication scholarship on mass media and their effects, we need to focus again on the original idea of communication as exchange. And yet, the growth of interactive technologies and of accompanying group communications is building a more authentic *forum* for social, political, and economic interaction. This is similar to the emerging interactive networks of exchange among academic colleagues, such as the computer network BITNET.¹⁹

IN SELECTING five information-age issues to review here, I have neglected many others, but they, too, are real. Much could be said about the cultural context of these changes. New technologies provide more options, more choices; and yet, there is the question of diversity: more does not necessarily mean either better or more diverse. We have seen the cable television “revolution” result in more sitcoms and movies rather than provide the wider spectrum of diversity expected earlier. There is the whole issue of the philosophy of technique: how have many systems, bureaucracies, and new electronic technologies altered humanity and the science of knowing? What are new technologies actually contributing to the commonweal? Is much of this progress a myth?

There is, indeed, much here that provides a broad context for *all* of our intellectual inquiries. As Staudenmaier noted:

*By telling the stories of technological development while respecting the full humanity of the tale, the contextual scholar rescues technology from the abstractions of progress talk and, in the process, takes part in the very ancient and very contemporary calling of the historian, reweaving the human fabric.*²⁰ ♦

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19. The potential for solidarity and exchange in interactive technologies is examined more fully in Clifford Christians, Tom Cooper, Frances Forde Plude, and Robert White, *Communication Ethics and Global Change: International and National Perspectives* (New York: Longman, 1989).

20. Staudenmaier, *Technology's Storytellers*, 201.