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A Word from the Editor

This volume consists of speeches presented at a symposium entitled "Humanizing and Dehumanizing Potentials of Communication Technology" that Doctors John H. Proctor and Ronald W. Manderschied chaired. The symposium marked the Centennial Celebration of the Washington Academy of Sciences. We are reminded daily of the importance of good communication and the difficulty of remaining abreast of changing technology that facilitates the accomplishment of that goal. We trust that readers will find this volume interesting and informative.

Volume 86 in its entirety appeared in December 2000. It should have appeared in 1999 but did not. Thus, there was no publication of the Journal in 1999. The current volume, Volume 87, also appears as a single issue for the year 2001. Volume 88 will appear in 2002 and should reestablish our regular publication schedule. Some of the articles that are expected to appear in Volume 88 are:

- Analytical Model for the Temperature Distribution in a Cylindrical Thermal Battery with Internal Heat Generation, Gaunaurd, G. C. and Zoski, G. D.
- Formative Period Human Remains from Coastal Ecuador: La Emerenciana Site (OOSrSr-42), Ubelaker, D. H. and Jones, E. B.
- New Evidence for Pre-Columbian Transpacific Contact between China and Mesoamerica, Xu, M.
- On Electrodynamic Processes of Electrified Bodies in Motion, Gluckman, A. G.
- Resonance as Phase Matching Effects in Electromagnetic-Wave Scattering, Guo, Y., Taylor, D. J., and Uberall, H.

Guidelines for Contributors appear near the end of this issue and on the Academy's Web site, http://www.washacadsci.org. This site is an excellent source for current information about the Academy and its activities. We hope you will visit it often.

On behalf of the Board of Managers and all members of the Academy, we thank each of the contributors for their continued interest and their patience. We also express our appreciation and gratitude to Marilyn R. London, who is now President Elect, for her excellent and dedicated service to the Journal.

Thomas E. Smith

Journal of the Washington Academy of Sciences,
Volume 87, Number 1–4, 1–1, October 2001

Centennial Celebration Symposium Issue of the *Journal* of the Washington Academy of Sciences

The Washington Academy of Sciences (WAS) had its origin in the Philosophical Society of Washington, which was organized in 1871. In 1898, the Academy was formed as a federation of the more specialized scientific societies in the greater Washington area. The purpose of the new academy was to encourage the advancement of science and "to conduct, endow, or assist investigation in any department of science." Over the years, the number of affiliated societies has increased from the original eight to over fifty. The *Proceedings* of the WAS was published during the period 1899-1911. *The Journal* superseded the *Proceedings* in 1911, and it has been published ever since.

Dr. Ronald W. Manderscheid and I co-chaired a symposium "Humanizing and Dehumanizing Potentials of Communication Technology" as one of a number of events celebrating the 100 years of contributions by the Academy to the affairs of science and technology in our nation's capitol. *The Journal* presents the papers delivered at this symposium.

John H. Proctor, Ph.D.
Life Fellow, Centennial Chair

Journal of the Washington Academy of Sciences,
Volume 87, Number 1–4, 3–3, October 2001

Welcome, Symposium Objectives, and Introductions

Cyrus R. Creveling, President

As part of the Centennial Celebration of The Washington Academy of Sciences, the Academy hosted a seminar entitled "Humanizing and Dehumanizing Potentials in Communication Technology." The seminar was held on October 19, 1998 at the Cosmos Club, 2121 Massachusetts Ave., NW in Washington, DC. The Centennial Committee of the Academy recognized that society has been changed forever by the Internet. Time and distance no longer modify human communication. This tool for the mind gives rise to new ideas at an ever-increasing rate. The Academy invited a panel to present its views and to respond to queries from the audience. The panel included Professor Vil Rakhmankulov from the Institute of Systems Analysis, Russian Academy of Sciences, Moscow; the distinguished Academician Igor M. Makarov, Past Scientific Secretary, Russian Academy of Science, Moscow and a Fellow of the World Academy of Arts and Science; Dr. Paul-Georg Gutermuth, Division Head, German Ministry of Economics, Bonn; Ronald W. Manderscheid, Ph.D., Past President of the Washington Academy of Sciences, Fellow of the World Academy of Arts and Sciences; and John H. Proctor, Ph.D., Past President of the Washington Academy of Sciences, Chairman of the Centennial Committee and former Secretary General of the World Academy of Art and Science. The seminar was led by Cyrus R. Creveling, Ph.D., Scientist Emeritus of the National Institutes of Health and President of the Washington Academy of Sciences. Following the presentations, a very lively discussion period ensued. The audience was most expert as revealed by the sophistication of the questions. The session continued all afternoon and well into the reception which followed. After the reception the group met for dinner. During the dinner, Dr. Creveling presented Dr. Paul-Georg Gutermuth with a certificate of Fellowship in the Washington Academy of Sciences.

Journal of the Washington Academy of Sciences,
Volume 87, Number 1–4, 5–8, October 2001

Humanizing and Dehumanizing Potentials in Communication Technology: An Overview

Cyrus R. Creveling

An old Chinese proverb states, "...once on the back of a Tiger you can never get off..." It is very clear that this proverb describes the present rapidly expanding state of communication technology, specifically on the Internet. Despite the fears and cautionary statements by many people, the world cannot get off the Tiger. Little did the initial designers realize the far-reaching effects of their creation! When the system was first designed some thirty years ago, it was intended to allow communication in the event of war or some catastrophic disaster. The designers reasoned that communication centers would be the first targets of attack or systems failure. To be successfully protected, there could not be central control points. Further, it had to function even when parts of the system were destroyed or rendered inoperable. The design was simple in principle and the originators had no idea that they had created the basis for the greatest change in history since the invention of the printing press. All "nodes" in the system would be able to originate, pass, and receive messages. The messages would be divided into packets, each separately addressed. The pathway that each packet would take would be undetermined with only the final address specified. The packet system was designed for efficiency as well as security. Initially, the scientific centers in Great Britain and the United States set up test networks. By 1969 the United States, the Advanced Research Projects Agency, installed a node at the University of California with similar nodes at the Massachusetts Institute of Technology and Stanford University. In three short years there were thirty-seven nodes. While the official intent of this initial system was to permit high-speed transmission of scientific data and mathematical computation, it quickly became a means for personal communication. The development of "Transmission Control Protocol" or TCP/IP in the public domain coupled with the commercial availability of more powerful personal computers led to a virtual explosion in use. Today, in almost every country on the planet and in space, there may be in existence as many as four million "nodes." The scale, speed, and lack of geographic limitation of the "Internet" have resulted in many apparent humanizing as well as dehumanizing effects. The natures of these effects are still not understood. Furthermore, the rapid growth of the Internet has nearly outdistanced the attempts for governments to legislate controls and

for the judicial system to deal with undefined legal questions relating to the Internet. At each turn, exploration of the beneficial or humanizing aspects of the Internet reveals a problem or dehumanizing aspect. I have attempted to illustrate this paradox with some examples.

Many of the humanizing aspects of this incredible communication system are clearly evident. The availability of instant access to information on practically any subject from anthropology to zoology has revolutionized scholarly pursuits. This is particularly evident in schools—students have access to multiple dictionaries; encyclopedias; maps; books of all descriptions; and, more recently with the advent of 3-D graphics, a growing variety of virtual pictures. It should also be noted that because impetus of the commercial aspects of the Internet in the entertainment industry the Internet can provide movies, plays, documentaries, and music from Mozart to rock. Such sources of information are available at essentially no cost to the user and have no geographic limitations. Despite the benefits of this vast source of information, because of the essentially uncontrollable nature of the Internet, it is also clear that much misinformation is present and much information of an unsavory nature is available.

Another example of the advantages and disadvantages is growing extension of print versions of scientific journals by electronic versions. The table of contents and article abstract of many journals are now available on the net at no cost. The cost for printed scholarly journals, however, is rapidly becoming unsustainable for both the individual and for libraries. In the field of physics, electronically archived journals have become the primary means of communication. A similar change is occurring in the larger biomedical field. Several of the major publishers have hundreds of journals on line. This phenomenon is bringing about a major change in publishing costs. Some of the problems engendered by electronic publishing are mechanisms by which scientific papers receive the essential critical review. Another major concern of scholars, libraries and publishers alike is the questions of how electronic materials are to be saved for posterity. Paper has a great advantage over electronic records; it lasts! Consider that the first codex of the Bible is dated in the 500 AD period; further, the Dead Sea scrolls are well over 2000 years old, and cuneiform records from Babylon may be over 5000 years old. Magnetic tape and compact discs have a very limited physical lifetime. In addition, changes in software and hardware are such that tapes and compact discs are generally unreadable after only a few years. The digital content of the Web is even more transient. Fortunately, many groups are vitally concerned with developing solutions to the archiving of information on a permanent basis.

The very available nature and partial anonymity of the Web makes it vulnerable to invasion by unscrupulous and destructive persons. An amazing advertisement on the Web is an offer to sell a "hacker kit." Ostensibly, such a kit is designed to teach one how to illegally break into a protected computer system or someone's database, or to introduce a virus. These actions are clearly unethical and criminal. The electronic invasion

of computers range from annoyance to creating untold damage costing both time and money. It should be noted that increasingly sophisticated programs to combat these intrusions are constantly being designed. In the United States, the law against the export of effective cryptographic programs is being hotly debated. Further, the courts are now successfully beginning to charge persons with "felony computer trespass" and "misdemeanor computer fraud." Programs are being developed to track and locate the so-called "Webfreaks." Various search programs are developing "Trust" programs to promote user confidence in the Internet by using principles of disclosure and informed consent. Many commercial sites now use a program called PGP (Pretty Good Protection) which involves opening and closing keys known only to the users. The question of the privacy of information is critical, especially as regards successful commercial development. The application of credit card payment for commercial transactions on the Internet has led to a massive effort to protect the privacy of both buyer and seller. The United States Federal Trade Commission publishes a continually updated report on "How to Protect Your Privacy".

The potential for the expression of a wide variety of political positions permits the freedom of expression on a scale never before achievable. This level of expression and debate certainly can be viewed as humanizing. Without some controls, however, the bounds of freedom of expression can easily be overrun. For example, a recent suit was filed by a group of doctors who provide abortion services. Their names, families, office addresses, home addresses, and telephone numbers are listed on a particularly vile Web page produced by a group associated with an anti-abortion position. The doctors filing the suit feel that the information not only slanders them but also endangers their health and life. The name of a recently murdered doctor is listed with his name crossed out. This implication of an execution list is not lost on the courts. This suit has been upheld and as a result one can expect considerably more caution in the content of Web pages. Some of the Web pages representing the far left and the far right of political positions, for example the Nazi Party pages, those from the Ku Klux Klan, and various radical anarchist parties, have moderated their pages to remove statements for which they could be held liable. There is no question that conflicting political messages and positions will continue to be available on the Internet, but with the passage of time and experience the action of both the courts and the market place will provide a "civilizing" or humanizing effect on its content.

One cannot fail to recognize the social effects of the use of the Internet for personal communication. I have been receiving e-mail messages sent by the wife of a good friend who is fighting cancer. She is able to communicate with a group of friends and family with one message. We all know that the others in the group have received the same message. This knowledge and our responses provide an exceptional avenue of personal support. This is only one of many benefits of communication with others through e-mail. Children keeping in touch with parents; parents keeping in touch with children;

friends communicating around the corner or across the ocean; friends locating lost friends—the list is endless, and clearly these interactions have a humanizing effect. However the humanizing effects of the growing ability to communicate with strangers through "chat rooms" or multi-user dungeons (MUDs) are not as clear and may have provided avenues for asocial interactions.

One curious effect of the Internet is the inadvertent establishment of English as a nearly universal language of use—much to the consternation of the French and Germans. Apparently, symbolic languages like Chinese, Japanese, South Asian languages, and even Arabic, Hebrew and the Cyrillic are not "user friendly." While programs are available to translate one language to another, usually to English, to-date they perform very poorly. This hegemony of English may be a humanizing effect, but one can be sure that it is only temporary.

In conclusion, it is not certain that the world will be able to successfully "...ride the Tiger" for the potential humanizing benefits of people and avoid the dehumanizing pathways. One aspect, however, is emphatically clear—we can never "...get off the Tiger."

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Humanizing and Dehumanizing Potentials in Communication Technology: Towards A Value Based Perspective

Paul-Georg Gutermuth

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Abstract

All information and communication influence people. This includes the new information and communication technologies (ICT), which feature readily available information, a high degree of networking, and the possibility of interactive use. The ICT are transforming our society into an information and knowledge society. An a priori assumption that ICT either conflict with human interests or foster them would not be valid. Their impacts must be examined on a case-by-case basis to identify humanizing and dehumanizing potentials, thus allowing us to draw consequences. Two levels are to be distinguished in this process: the new communications' technology level and the application level of the technologies. At the application level, the theoretical distinction could further be made between the actual act of application and the contents of the communication itself. In practice, however, this would create considerable definition problems, above all as relate to psychological impacts. We generally require no new criteria for an ethical assessment of ICT contents since we can rely on the framework created by human rights and, within those lines, on general criteria already conventionally applied for weighing conflicting goods and interests. The necessary use of the terms "sustainability" and "future-friendly," which regularly turn up in discussions nowadays, in no way contradicts this thought. ICT are thus to be viewed above all from the perspective of the following questions. Are they individually appropriate, socially acceptable, and sparing of the environment? In attempting to arrive at an ethical assessment, the distinction between individual communication and distributed communication as suggested by literature on the subject helps us only to a limited extent since ICT, after all, link together the formerly separate areas of telecommunications, data processing, and consumer electronics. A more constructive and pragmatic approach would be to proceed by sectors. This will be done in the following. The areas selected are the private sphere, social sphere, work process, business, and policymaking.

Communication technologies are transforming our society

What is so special about the new communication technologies? Haven't information and knowledge always influenced and helped to shape our lives? The modern day is increasingly characterized by the ready availability of information (compressed formats, high speeds), the high degree of networking (overcoming the bounds of time and space), and the simultaneous possibility of the interactive use of information systems.

While mechanical power replaced human labor in the industrial age, the information age is seeing computers forge ahead into areas previously reserved for humans. Land, labor, and capital as the traditional factors of production, are thus increasingly

losing importance relative to the factors "information" and "knowledge" (1 p. 93). The term "information and knowledge society" is therefore no mere cliché. It has been forecast that some 50 percent of the German labor force will be employed in the information sector by the year 2010 (2 p. 8). Just as high a percentage of German employees are already working with ICT products (1 p. 96). There is no real alternative to this trend. The new technologies for communication have an enormous potential to influence people's lives, both physically and psychologically.

Similar influences witnessed in the transformation from an agrarian to an industrial society resulted in the development of structures such as our comprehensive systems of protection and assistance (some examples are social legislation, self-help associations, and a reorganization of the working process). Must comparable initiatives now be taken in light of the new ICT?

Criteria for the ethical assessment of communication technologies

The new ICT are classic "enabling technologies," that are both open to and in need of structuring (6,99). An *a priori* assumption that they either conflict with human interests or foster them would not be valid. It is obvious that, on the one hand, they are responding to the basic human need for communication while, on the other hand, they open up possibilities of misuse and conflicts of interest.

We must therefore look at individual impacts of ICT on humans to see if and what humanizing and dehumanizing potentials they offer and what action might be needed in response. Two ICT levels may be distinguished in this process: the technology itself; and the application of the technology, including application and processing of the information.

Strictly speaking, there are actually three levels that can be distinguished: besides the technology itself there is the level of the use of the technology independent of its contents, and as the third level the contents of the communications. But in practical terms, the use of the technology and information cannot always be clearly distinguished, above all in terms of their psychological impact. As a result, I will refrain in the following from making a distinction between levels two and three.

Ethical assessment of the ICT does not require the drafting of new criteria (3 p. 417). We may apply the framework created by human rights and, within those lines, the general criteria already conventionally applied for weighing conflicting goods and interests (3 p. 417). Spinello is right in his assertion that "These 'revolutionary' problems can be confronted with the same analytical tools and ethical categories used for more traditional concerns" (4 p. 173).

The question of the humanizing factors is closely connected here with the global ideal of sustain-able development. In other words, the question also has a future-oriented dimension. This was all too obvious in the results of the World Conference on

Environment and Development (UNCED in Rio, 1992). In the words of the Brundtland Commission, sustainable development means "...meeting the needs of the present without compromising the ability of future generations to meet their own needs."

It is thus appropriate for us to look at the two levels of ICT I have described for the purpose of answering the following questions (3 p. 416):

a) Are they individually appropriate?

b) Are they socially acceptable?

c) Are they sparing of the environment and of our natural resources? (Key aspect here: Are environmental pressures and the use of natural resources kept to a minimum in ICT's production, use, and disposal, or by their application?)

First Level: humanizing and dehumanizing potentials of communication technologies *per se*

Individual appropriateness includes on the one hand respect for individual human rights which are an outflow of human dignity and, on the other hand, a user-friendly and ergonometric design (3 p. 416). In evaluating the technology per se, there is above all the question of user-friendliness. This is an ongoing process of adaptation to various human features in close cooperation between users, providers, and industry.

The question of whether the technology spares the environment and natural resources in its production, use, and disposal is a technical, scientific, and medical question that cannot be treated in detail in the framework of my remarks today. Generally, however, we can assert that ICT devices tend to miniaturize, and thus to allow minimal material input and energy saving operations. As regards the raw materials needed, silicon-based glass fibers are increasingly replacing metal conductors. On the other hand, the positioning of satellites requires major amounts of energy (3 p. 416).

Second Level: humanizing and dehumanizing potentials in the use of communication technology in selected areas

In the ethical assessment of the contents of ICT, the suggestion is made in the technical literature to distinguish between individual communication and distributed communication (3 p. 417). Since, however, the special quality of ICT is the capability of integrating the previously separate areas of classic telecommunications and data processing (computer technology), as well as consumer electronics into a single complex, the line separating individual and distributed communication will become increasingly hazier and difficult to identify (5 p. 11).

I would therefore like to proceed in a pragmatic manner, sector by sector. In the face of the wide variety of affected areas and the limited time available for my remarks, this can only be done in excerpts. I will confine my discussion to five fields that would appear to me to be especially important. They are the private sphere, social sphere, work process, business, and policymaking.

Private sphere and new communication

Information and communications are influence factors (2 p. 31). They must fully observe the dictate of dignity for all people and the basic rights derived therefrom. The right to and freedom of personal and economic development must also be guaranteed in global information network insofar as possible. This right is one of the pillars supporting our culture.

Negative influence or manipulation—and the resulting restraints on individual freedom—can occur through untruthful, incomplete, inexact information and through a flooding with information (2 p. 30). An excessive offering of information does not foster liberty but confines it (6 p. 1). Quantitative improvement in this area may result in qualitative losses. Moreover, tests show that the capability of free decision-making does not increase with expanding knowledge (6 p. 1).

Such possibilities of manipulation are not peculiar to ICT, they are also found outside the realm of the new ICT. This is an area where the individual must use his or her opportunity for self-determination. It is not, for example, society that must set limits on the flood of information (6 p. 2).

An integral part of human dignity is personal privacy, both consumer privacy and employee privacy (4 p. 50). Also included is protection from unauthorized access to personal and other data, and the security of electronic money transfers. More and more confidential data flow through international networks. Security problems in the network (e.g. hacking, computer espionage) are increasingly becoming a serious barrier to the wider use of electronic commerce. The protection of data systems must stand alongside the user's self-protection measures. This helps avoid, for example, the collection and use of personal data already at the phase of designing the system architecture. Absolute security, however, will probably never be possible. But absolute security is also not possible in other parts of our lives influenced by technology.

Copyrights also relate to the rights of personality by protecting intellectual property. Some see copyrights as obstacles blocking the road to the information society. At any rate, the new possibilities of copying and distributing material, they allege, will make copyrights either senseless or at least reduce their significance. Others forecast just the opposite. They claim that copyrights are taking on even more importance. For without legal protection, no valuable information would be put onto data networks. We may safely assume that the protection of authenticity is gaining additional importance. This requires measures for safeguarding this aspect at many levels.

The procedures for safeguarding rights to knowledge and knowledge products, however, must not be allowed to become so restrictive that it endangers access to information, which is a prerequisite for equal opportunity (both on an individual scale and at the level of nations).

In addition, there is the question of *protection against the violation of the rights of personality* and against other illegal and damaging contents on the networks. Most significant here are:

- pornography, sexual exploitation,
- defamation and slandering of minorities,
- instigation to racial hatred,
- subornation of criminal offenses,
- inciting violence,
- computer fraud.

Anonymity is helpful to those seeking to commit criminal offenses on the Internet. The possibility of feeding incriminating data into the Internet from anywhere in the world frequently makes it almost impossible to pursue some criminal investigations. The screening of contents is made considerably more difficult, if only because of the quantity of material. In this respect, ICT are thus considerably different from conventional media. Needed here would be ever-present government monitoring and thus comprehensive controls. But major technical barriers prevent such supervision. "The state can no longer meet all of the functions here that fell to it in the course of history" (5 p. 83).

On the other hand, account must be taken of the basic right to freedom of information. Even commercial interests in globally expanding markets find their limits in the recognition of the informational rights and dignity of each and every individual. In this situation, we would be well advised to build on the capabilities and willingness for self-regulation and on increased international cooperation.

But we cannot dispense with statutory framework conditions, if only in the interest of providing legal clarity. A German court (Munich), for example, handed down the following decision. If a commercial provider puts onto the network his own criminally relevant material or third-party material that he has recognizably appropriated as his own, he shall be liable for prosecution. By contrast, if he has only made third-party material available for use, he shall be liable for prosecution only if he is aware of the incriminating contents and if it is technically possible and would not require unacceptable effort to prevent the use of such material.

Social compatibility comprises the preservation of a certain historical continuity, the safeguarding of tradition and history. In view of the medium's vulnerability—data loss, for example, cannot be ruled out—overall system security and the security of diachronic development are fundamental questions that must be addressed. Owing to the rapid increase of information and knowledge stored in electronic data media, prob-

lems here could mean socially unacceptable losses for mankind as a whole. It is my opinion that more attention must be given to ensuring greater protection from such a catastrophe.

Social sphere and new communication

A right to access to the new services must at any rate be assumed whenever they are an integral part of meeting people's basic needs, thus when certain vital information and services can only be obtained by electronic networks. The individual situation dictates when this is the case. Apart from these rather clear cases, free access to the new media possesses a considerable socio-economic and socio-structural aspect.

The average user of online media in Germany is thirty years of age, male, has enjoyed an above-average education, and often has a rather high income (4 p. 96). There are, therefore, clear points of emphasis among the many users, also in terms of social structure. However, social differentiation as to knowledge and to communication competence is not automatically unsettling (5 p. 96). They have always existed. But underneath the surface there may well be a problematical social situation, namely, differences between the "opportunity-rich" and the "opportunity-poor," as it were (5 p. 96). Such distinctions would be dehumanizing.

The danger of separating the world into the information-rich and the information-poor, into an information-elite and a consumer-proletariat, must therefore be prevented and the gap between the computer-literate and the computer-illiterate must be closed insofar as possible (7 p. 27). We need measures aimed at ensuring access to information and the availability of information for the broadest possible groups of the population and at fostering opportunity-poor groups' abilities to use the new technologies for their purposes (5 p. 96). Equal opportunity begins in the schools. But it also extends to senior citizens, to small and midsize companies, and to the field of interaction between citizens and government agencies.

Of decisive importance in this connection is training in the skills of media competency at all levels of society and the economy. And we must make sure that costs do not prove prohibitive for some groups (fair access). An effective way of providing low-cost offerings is to ensure as much competition as possible among the media. The liberalization of the telecommunication market in Germany has clearly illustrated how within only a short time intensive price competition can have a beneficial impact on the consumer. But we must reject making demands for equal opportunity into demands for an all-encompassing basic provision of services, for example, an Internet guarantee for everyone. Governments would not be able to finance such a measure. The guarantee of free access to information, while it is indispensable as a condition for equal opportunity, must, however, largely be left to stand as a principle.

There is dispute about whether the ICT tend more to promote or to prevent community and thus *humanitarian cohesiveness*. In digital space, gender, skin color, social status, etc. are left open to the imagination. Territoriality no longer plays a role in cyberspace. And this could produce a renaissance of community feelings across borders. Experience, however, shows that the lack of correspondence between real and social areas and the Internet chat rooms hardly leads to community forms. And when this does happen, the forms are easy to disrupt and destroy (7 p. 45). Virtual communities are extremely fragile (7 pp. 44, 63).

But does this also mean that the lack of direct social contact automatically makes a "digital loner" out of the surfer in the worldwide web? Will the Internet thus become the "medium of egocentric individualism"? Less family, less contact to neighbors, less church to impart values, less literature as transmitter of values, less regional awareness? Theoretically speaking, such dehumanizing potentials cannot be denied. But in analyzing these potentials we should take account of the following:

* Individualism is not identical with egotism; neither is collectivism the same as altruism. Social responsibility is possible not only as collectively organized responsibility (7 p. 57) but in other forms. The United States, after all, is a good example of this.
* Surfer need not inevitably stray from reality into the arbitrary universe of virtual landscapes but can also expand their horizons by traversing plains of acquired experience.
* Interaction is ultimately not technically induced but socially motivated. Interaction aims at purpose fulfillment (7 p. 41). The virtual world remains plugged into the real human world (7 p. 52). We can see that the Internet reinforces our yearning for direct encounters, for example, with political figures, with art works, and similar persons and things. Experience teaches that eye-to-eye exchange between persons is more exact, more intensive than any electronic communication (7 p. 62).

- The age of Gutenberg still has a long way to go before drawing to an end—and I personally doubt that it will ever be over.
- Finally, the new media open up previously unknown possibilities of self-realization and thus provide the self-confidence of individual responsibility and independence.

Work process and new communication

The information and communication technologies intervene in the network of work structures, independent of the communicated contents, since they replace direct with transmitted (indirect) communication, and they blur terms such as work time and workplace. When, and where, the work is done is increasingly insignificant in terms of communication. It must be assumed that this will cause serious dislocations, above all in the working world, just as happened during the transition from the agrarian to the industrial society of the 19th century (5 p. 48).

In overall terms, our new reality must offer us humane working conditions. On the one hand, the new ICT must increase the possibilities of self-employment and self-determination and create new employment possibilities, particularly for frequently disadvantaged groups such as women, the impaired, and the elderly. On the other hand, since the possibility of monitoring individuals has been expanded for virtual firms, "Say good-bye to the office" should not now be turned into "Say good-bye to your night off." And wage earners' drift into the gray areas between dependent work and self-employment should also not result in their losing the protection of the social systems (payroll and salaried employees should not be forced into bogus self-employment to save employers' outlays for social insurance). In practical terms this means that new types of working relationships must be created which consider the interests of both sides and, among other things, replace roll calls at the office with quality control of the work performed.

Business and new communication

The information and communication technologies are accelerating *commercial globalization* by enhancing market transparency and opening up new possibilities to provide services from anywhere in the world via the net (5 p. 112). This increases national productivity, strengthens international competition, creates more jobs in overall terms according to experts, and thus helps advance human development. But observers rightly point out that the consumer does not always have a better market overview as a result. And this is true whenever, as indeed happens, providers block search engines' access to their networks because they have no interest in consumers being able to compare conditions.

The *elimination of the need to work in any given place* favors the employment of foreign workers via the net in the form of service imports. This can bring with it the danger of tax evasion and customs duty circumvention and it can neutralize national measures aimed at job safety, minimum-wage statutes, consumer protection, and environmental protection (7 p. 56). This means that the globalization of commerce facilitates tendencies that cast doubts on the decision-making competencies of national law-making bodies as well as regulations enacted to protect human values.

Experts ask with some skepticism whether the complicated decision-making processes of democratic governments in national and supranational sectors can effectively counteract these tendencies in the light of global companies flexibility (8 p. 366). Are institutionalized coalitions of non-government organizations (churches, labor unions, etc.) a way out of this dilemma (8 p. 366)? In my view, this is extremely doubtful (despite individual cases such as the Greenpeace/Shell affair about the sinking of an oil rig in the North Sea). On what would such coalitions base their legitimacy to act, what

moral and customary values would they be working with? An international institution equipped with decision-making powers would be desirable here, but in view of the different international situations and interests it is not likely ever to come about.

Coordinated and harmonized action by governments at the international level would therefore seem to be all the more important. To illustrate this I would mention that, at the Bonn Conference in July of 1997, thirty countries, including the United States, Japan, and Russia, initiated this process of determining internationally accepted guidelines for the use of global information and communication networks ("Bonn Declaration"). EU Commissioner Martin Bangemann submitted a procedural proposal for more efficiently coordinating the activities of international organizations (such as the OECD, WTO, etc.) so as to develop a global framework to regulate the new media.

Policymaking and new communication

The information and communication technologies can help bring together people, nations, regions, and cultures through communications that cross material and immaterial boundaries, thus fostering *a humane manner of living together.* Authoritarian regimes are shocked to find out that they can no longer effectively seal their countries off from unwanted information from abroad. A wide range of opinions and beliefs are crossing international borders (5 p. 101). They are surmounting the walls erected by dictators. And secret police are unable to control this information swell (7 p. 55).

Internet has thus arrived at a point of confrontation with social systems that restrict personal freedom (spreading of Western democratic ideas, the call for human rights, pluralism, liberalism, etc.). On the other hand, the communication network also stands as a new instrument for manipulation, one that enables control over individuals and, at the very least, facilitates the individual's observation. It can be used to spread undemocratic thought and thus threaten democracy (7 p. 11). "Novel threats to internal and external security" are emerging as the result of expanding networks and such threats demand completely new methods of defense (5 p. 113).

It is all the more important that no single country and no individual company be allowed to control events. The United States and American companies have been meritorious in their achievements in developing Internet standards. "But this cannot mean that the standards, the central fields of application, and even the language is dominated from there" (9 p. 7). International cooperation is the need of the day.

ICT offer the state *better possibilities to provide citizen-friendly government* (information directly to citizens, participation of citizens in appropriate processes), and to enhance government efficiency. On the other hand, we should not rule out the possibility that the position of the state in the information society is being increasingly weakened by the fact that it is subject to growing competition to gain the favor of capable and ever more mobile companies and citizens (5 p. 113). Neil Postmann (2 p. 11) thinks that

democracy is actually the big loser in the face of the new technologies. He is certain that plebiscites will increasingly be carried out via the net, and that by decisions taken in microseconds on data highways without the auspices of institutional responsibility, the powers of elected representatives sitting in parliaments will be undermined. Government can meet such threats by responsible participation of the citizen in the political process and by boosting its own efficiency (5 p. 113).

Pointing the way to value-based conduct as the key to a humane information and knowledge society

My remarks would indicate that the innate ethical ambivalence of every technology also applies to ICT. There is no doubt but that the competence of the individual in handling the new media will decide whether "cyber-cash" will become a "cyber-crash." Undeniable problem cases justify only criticism about human behavior and ultimately about mankind's inadequate moral responsibility. Educating the public to deal with the media and to approach the new technologies from the perspective of a given value system is the key to answering whether the humanizing or the dehumanizing potentials of ICT will be dominant characteristics in the future. Providers and users, but also the state and the society that is its foundation, have a great deal of responsibility here.

Far more is at stake than merely the practicing of new techniques. What we have here is a journey into a fundamentally different world. "I am talking about the formation of a personality," (10 p. 566) an education of the human "to freedom in the age of information" (10 p. 566). "The school of the future must place the quality of learning on center stage, not the quantity of knowledge" (10 p. 566). This means orientation to the selection of information, pointing the way to self-competence, to responsibility, to a "passion for democracy and the value of freedom" (10 p. 568). The key to solving the problems of dealing with the new technologies lies in education, but not only in the education, training, and advanced training in the school room, but also in the moral equipment of the members of our society.

Humans in the information society stand out by displaying a high degree of (2 p. 430):

- technical competence
- media competence
- social and communicative competence and
- the willingness for continued learning throughout life (rapid obsolescence of know-how and information).

The state is called on to foster this development above all by reliable and adaptable government-set framework conditions in data security; data protection; the protection of juveniles; product liability; consumer protection; and statutes on commerce, copyrights, and criminal offenses, also in the international context (2 p. 10).

The globalization of communication technologies should be the occasion on an international scale to continue efforts toward greater harmonization of the differing legal views. "At any rate, these differences are becoming more obvious and reveal national restrictions as backward in the face of the universal and transparent technologies. One might view this as a step toward a global ethos" (11 p. 173). Such efforts will at least strengthen community identity and be able to help regain "social cohesion" (2 p. 20) as an important pillar supporting the peaceful and humane future of our society.

References

(1) Enquete-Kommission "Schutz des Menschen und der Umwelt - Ziel und Rahmenbedin-gungen einer nachhaltig zukunftsverträglichen Entwicklung," Abschlußbericht, Deutscher Bundestag, Bonn, 26.06.1998, Drucksache 13/11200

(2) S. Höfling, Informationszeitalter—Informationsgesellschaft—Wissensgesellschaft, Hanns Seidel Stiftung, aktuelle Analysen 6, München, 1996

(3) G. Bachleitner, Kommunikationstechnik, in: *Lexikon der Bioethik*, Gütersloh, 1998, Band 2

(4) R. A. Spinello, *Ethical Aspects of Information Technology*. Englewood Cliffs, NJ: Prentice Hall, 1995

(5) Enquete-Kommission "Zukunft der Medien in Wirtschaft und Gesellschaft—Deutschlands Weg in die Informationsgesellschaft," Schlußbericht, Deutscher Bundestag, Bonn, 22.06.1998, Drucksache 13/1104

(6) A. Keller, Informationsgesellschaft, in: *Stimmen der Zeit*, Freiburg, 1996, Nr. 214

(7) S. Eisel, M. Scholl, *Internet und Politik*, Konrad Adenauer Stiftung, Sankt Augustin, Interne Studien Nr. 164/1998

(8) J. O. Zöller, Weltherrschaft durch Weltwirtschaft, in: *Anzeiger für die Seelsorge*, Freiburg, August 1998, Heft 8

(9) G. Rexrodt, Wirtschaft und Kultur im Internet: Kulturwirtschaft, F.D.P.-Bundestagsfraktion, Bonn, 18. Mai 1998

(10) R. Herzog, Erziehung im Informationszeitalter, Bulletin des Presse- und Informations-amtes der Bundesregierung, Bonn, 18.06.1998, Nr. 43

(11) G. Bachleitner, Die mediale Revolution, in: *Forum interdisziplinäre Ethik*, Band 15, Frankfurt a. M., 1997

(12) D. Tsichritzis et al., Informationstechnologie—Fakten, Perspektiven und Visionen, Konrad Adenauer Stiftung, Sankt Augustin, Interne Studien Nr. 130/1996

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Greetings From The Russian Academy of Sciences

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Mr. President of The Washington Academy of Sciences, Dr. C.R. (Bob) Creveling, Fellows of the Washington Academy of Sciences, and Guests. It is a great pleasure for me to express on behalf of the President and Presidium of Russian Academy of Sciences our greetings on the First Centennial Jubilee of Washington Academy of Sciences. I particularly wish to convey the best wishes of some 15 Russian scientists who are Fellows of the Washington Academy of Sciences for the continued successful development in all of the Academy's endeavors. To all Members and Fellows of the Washington Academy, I thank you for including us today. These one hundred years have marked the unprecedented progress of science and the widespread recognition of the Washington Academy by the scientific communities of the world. It is my hope that the Academy continues to advocate science, to reach out to young people and to attract to its activities not only US scientists and professionals, but also many specialists from over the world. I am most pleased to recognize a major sign of it's excellence and importance by the growing number of affiliated scientific societies creating a good core structure which helps to integrate scientific endeavors and achievements from different branches of science. Using this opportunity, we express our thanks for being invited to the celebration and, in turn, we invite our kind hosts to take part in the 275th -year celebration of the Russian Academy of Sciences, which will be held in the spring of 1999.

Now it is my honor to introduce my presentation prepared together with my colleague and Fellow of the Washington Academy Prof. Vil Rakhmankulov under the title "Humans, Technologies and the World of Communication."

Thank you.

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Humans, Technologies and the World of Telecommunication

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Introduction

Today we can see two major trends expressed by modern technology. The first one is a widespread "invasion" of microchips and semiconductor devices into every electrically powered piece of equipment or technological process. The second one, obviously related to the first trend, is the more and more growing tendency towards replacement of a good portion of traditional work activities with intelligent, software-based work performance.

Software becomes an important part of the work scope in any field of practice. For instance, when we make a product at the shop level, we use CNC, DNC, or CAM software in order to write a software program for Numerical Control (NC) machine-tools. That is, before we get an output, we have to add a quite important step to the whole production process, which makes it possible to automate the product's manufacture.

When we design a product with the help of a computer, we use Computer Aided Design (CAD) software. Again, we write a software program in order to make drawings or to perform an engineering analysis.

When we manage a whole company's computer system, we use Data Base Management System (DBMS) software. In fact, we write a program which helps to search for desired data or aid in presenting decision making choices.

With the emergence of communication technology like INTERNET, EXTRANET and other means of electronic communication, both trends mentioned above allow unprecedented possibilities for this technology to be integrated and logically interrelated under a common umbrella. Such an umbrella is capable of incorporating diverse sets of technologies with embedded semiconductor devices, hardware and software into a new universal media helping human beings work in a more efficient and productive way as well as giving birth to the new forms of human activity covered by terms such as: "virtual enterprise," "virtual reality," and "virtual design."

More generally speaking, with this last trend we face a new paradigm or phenomena which could be called "virtuality": a specific electronic working environment which allows the combination of multiple remote and distributed work efforts into strongly integrated actions dedicated to a united aim or target [1–3]. If we take the communication technology and software integration away from this new paradigm, then the main idea of virtuality disappears, becoming a traditional vendor-supplier or customer-supplier interplay with all the known burden and inefficiency. Therefore, we may argue that in the future of human work, the greater the use of computer software, the greater the opportunities are opened for virtual forms of human activities. Is this development harmful or humanizing? Perhaps, we should be prepared to expect both kinds of impacts.

Let us focus on different design activities, since contemporary Computer Aided Design (CAD) is positioned on the frontier of the process and provides an illustration of successful implementation of the concepts of virtuality.

Work Humanization During The Spread and Growth of Software Design and Development

The concept of virtuality has widely been used in the field of mechanical design and even more so in the design of electronic devices such as chips, microprocessors and printed circuit boards. Having on hand very sophisticated and intelligent virtual prototypes and models in CAD systems for electronic design, engineers and designers can create, analyze, and test new products without building the expensive physical prototypes/test versions used before the era of virtuality. With this virtual approach to designing, it is possible to explain why the generations of computers have been changing and progressing so rapidly.

For the most part, computer aided design is the process of continual development and active use of a particular application software. The main humanizing advantage of this kind of software related work is a great opportunity to perform it "on the fly," that is, outside of the formal organizational structure of a face-to-face staff working within limited physical locations presented by a single firm or company. Under the virtual environment, a designer is free to choose how to create software. He can do it either at the main design office, at the customer site, at the supplier company, or even at home. Now many companies use remote teams of home-based workers integrated by telecommunication technology. In addition to the purely commercial benefits of that virtual activity, people belonging to the industrial technological areas receive the same kind of freedom which has mainly been experienced thus far by certain intellectual and creative professions such as writers, composers, and artists.

As design software becomes a more and more sophisticated and complex artifact, it is not enough just to buy a commercial software package for direct usage. Now there exists a need to interpret all the specifics and complexities of the commercial package

before it can be used to the fullest extent in practical tasks. This job is done by special teams of developers who interpret the commercial package by developing dedicated applications aimed at repetitive use by end users. In this sense, virtuality is supporting the professional "intermediaries" and thereby is expected to lead to a significant growth in demand for these new professionals in the future. It would not be reasonable from an economic point of view for every design office to keep such teams strictly as in-house staff. Having been integrated by networks, agile teams of software professionals are able to create new jobs and generate fast growing markets in the field of application software development.

Another humanizing aspect of virtuality is tele-existence and teleconferencing. Usually, software related work requires a quite clear, precise and formal presentation of tasks, procedures, and data handling instructions. Different design systems have different formats for describing this formalized knowledge. Many efforts have been expended to solve the well known difficulties of translating between proprietary CAD, CAM, and CAE formats. Several standards (e.g., IGES or PDES/STEP) have been developed to facilitate exchange of the formal data defining drawings, geometry models, and graphics for engineering products and associated manufacturing processes. However, any design process is directed by formal as well as informal data. The informal knowledge, rarely exchanged through rules and standards, can be translated through interpersonal contacts of the participating developers. Multimedia communication, allowing transfer of audio, video, and graphics data together with the techniques of teleconferencing, provide a solid basis for exchange of informal knowledge, data, personal know-how, practical tips, and experiences.

At present it is well known that changes in software and hardware happen rapidly; consequently, new releases of popular products, usually adding new functionality, become obsolete in a matter of months. This tendency gives rise to the necessity for a continuous re-training of the end users and software developers. This constant re-training is a sort of enforced compensation for the rapid change. In the virtual environment it is much easier to provide the desired conditions for training and education of specialists through access to electronic documentation, virtual training courses, and highly reactive "hot lines." Telecommunication technology and virtuality provide a similar level of increased efficiency to those who work with innovations and who need to analyze large flows of information worldwide.

Advances and achievements of information technology are accompanied by different humanizing cultural implications stemming from the widening use of modern telecommunication technology and virtual forms of human activities. Perhaps, the most inspiring one is the rich access via Internet to a diverse global culture. In some cases we can observe how purely technical solutions help to generate a cultural change. For instance, many countries in the world are now fighting against the illegal use of licensed software products. This problem is probably more important from the cultural point-of-

view rather than simply from the commercial viewpoint. In this respect, the global Internet system has been providing a very interesting mechanism that is called "free downloads." These free downloads are restricted to some extent by versions of the corresponding licensed software products, which can be tested and evaluated by the users free of charge. The result of such testing is often surprising when the users come to the opposite conclusion that buying the licensed product is a preferable action for them if they want to improve the professional quality of their work. This cultural change would probably happen much more slowly without the widely used free download mechanism. Considering the humanizing aspects of communication technology and virtuality, we should also be aware of some problems and possible negative impacts which can be potentially harmful to people and society.

Dehumanizing Impacts of Telecommunication Technology on Virtual Forms of Human Activities

The most recognizable and understandable problem is the vulnerability of electronic communication and virtuality. Vulnerability to unauthorized entry into a private system creates an issue that makes achieving complete security of information in networks still questionable. This problem creates a sensible reluctance in potential users facing overly fast moves towards the new and attractive potentials of electronic commerce. Examples of this type of vulnerability abound: losses incurred from breaking into a banking software security system are much larger than the amount of money usually lost in a typical bank robbery. The design of new products is also a quite sensitive area in terms of information security and know-how protection. Of course, this problem becomes even more difficult to solve when the design has been performed under the distributed environment and conditions of virtuality. Many technical protective measures have been proposed and developed to assure information security including encryption, techniques of data compression, and access control mechanisms. But, as usual, human vigilance and responsibility will be of greater value than all these techniques in providing guarantees for secure and reliable functioning of systems. Perhaps, the immense complexity of the design process provides some advantage in design procedures for providing technical security, since the more complex and intelligent are the transactions in a system, the more applicable and protective are purely technical methods.

In general, virtuality creates a basis for self-organization and self-responsibility. However, with higher priorities assigned to the autonomous status of work, the possibility arises for the emergence of social isolation in people's virtual activities. This social isolation might take place due to the weakening of live contacts. Communication via models and software interfaces may diminish the role of "socializing" effects asso-

ciated with face-to-face contacts within the working environment. Sometimes this kind of isolation could negatively impact the fundamentally positive features of organizations such as individual and group adaptation and learning.

Virtuality can build new boundaries between professions dividing them into several categories, each with a different degree of labor compensation. For example, the obvious division for software specialists could be in three conditional groups—"code producers," "software interpreters," and "systems problem solvers." Having been less dependent on the virtual environment, the code producers would feel themselves perhaps more comfortable at work with reduced overall responsibility and, accordingly, they would be paid less. Virtuality could, with this scheme, put this category of professionals at a lower devaluated status in comparison to the systems problem solvers or software interpreters.

The problem of copyright and intellectual property protection is very important in the field of software development and operation. Virtuality adds new dimensions to this problem by opening opportunities to more broadly shared software. Probably the main focus toward solving this problem will be on "pre-installed" type of software, particularly in view of the trend toward significant reductions in hardware costs. Now vendors sell hardware together with the pre-installed software such as MS Windows or MS Office. In most application areas, the cost of software has proven to be much higher than that of the hardware. When hardware costs are a small part of the overall cost, then this situation might turn out to be just the opposite. Vendors will sell software together with the "pre-installed" hardware. The idea of a cheap communication computer is, in my view, the best example of this in our foreseeable future.

Virtual companies can integrate many different teams of specialists and companies, sometimes including competitors or independent companies. Less formal obligations within such a structure could bring instability to the system under strong competitive conditions. Virtual organizations will create new challenges for corporate management of distributed organizations, as well as to the control systems providing access to data.

Sharing Experience In The Virtual Firm

Since the middle of the 1990s my institute has been investigating and testing the concepts of virtual companies. The aim is to implement this approach for practical tasks. The purpose was to create an agile team of software experts capable of working on different projects initiated by different organizations ranging from academic institutions and technical universities, to industrial, finance and business companies. This kind of a virtual team should not belong to any of the formal organizations with which it is working. However, some members of the team may be included from other organizations due to particular needs during the project. All work is done on a contract/agreement basis. The team itself has a relatively small permanent core of specialists and a

variable rotating staff of non-permanent specialists. Rotation depends on the type of projects, volume of work, software tools used by the team, and availability of personnel. Projects can be carried out in a mixture of ways, ranging from conventional non-electronic environments to communication through networks among widely separated team members.

Our experience has shown that the most valuable features of developing and working in virtuality are agility and flexibility. Both of these features could be applied with humanizing effects to the involved people and organizations as well as professional maturation, which grows in relation to the choice of projects, ways of working, and software development tools and packages. On the other hand, due to virtuality this new kind of activity certainly faces many of the above mentioned problems associated with the distributed nature of work under virtual conditions.

Conclusion

Modern communication technology is a remarkable human invention made in the 20th century. Together with other electronic and intelligent computer based technologies, it opens greatly increased opportunities for human beings to improve their quality of life. It creates a new paradigm, herein called "virtuality;" capable of significantly changing the way people perform their activities. Like many other great inventions, electronic telecommunication can have positive and humanizing, as well as negative, de-humanizing impacts on individuals and society. Special attention to and awareness of all impacts and problems is needed in order to avoid negative implications in the development of innovative and promising potentials inherent in these new technologies.

References

1. Akhrem, A.A.and Rakhmankulov, V.Z., "Virtual Design and Decision Making." J. *Design* Automation, #4, 1997, pp. 20-30 (in Russian).

2. Tarasov, V.B., "Enterprises in XXI Century: Problems of Design and Management," J. *Design* Automation, #4, 1998, pp. 45-52 (in Russian).

3. Artamonov, E.I., Markovsky, A.V., and Shipilina, L.B., "Organization of Work of CAD Users through INTERNET." J. *Design* Automation, #4, 1998, pp. 21-26 (in Russian).

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Freedom and the New Information Technology

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As we race toward the new Millennium, we are also engaged in a race to understand and control the new information technology in order to preserve and expand our essential freedoms. In this brief paper, we hope to be able to characterize the current state of modern information technology, describe some principles developed for the mental health field that may have more general applicability, and propose some as yet unanswered questions about the role of modem information technology in American society.

Few would deny that modern information technology represents a radical departure from anything experienced in the recent past. Modern information technology replaces interpersonal contact as the primary vehicle for communication and social organization. Nothing in human history is comparable. We are now able to transcend space, time, and culture in our communication. A "group" can come into existence anywhere in cyberspace, remain anonymous and a-historical and go out of existence without further trace.

What does all of this mean for us at the Millennium? Can we really get our hands (and minds) around this issue? What consequences will ensue if we don't? These are all questions that are not currently being articulated in society, let alone answered. This paper is intended to begin that journey.

The Status of Modern Information Technology

Modern information technology derives its power through amalgamation of several other technologies: information processing, telecommunications (voice, fax, data), video technology, entertainment media (television, CDs, and radio), and the World Wide Web (www). When harnessed together, these technologies make it possible to have video communications with anyone, anywhere, at anytime; to have access to *virtually unlimited* information on any topic; to receive instantaneous world-wide news and entertainment; to collect, process, and transform any type of data over the Internet; to purchase any product over the Internet; to do all of these functions simultaneously; and to do many other tasks. The sheer enormity of the change, its complexity, and its vast potential make consequences difficult to analyze.

Two concepts have emerged to reflect some major consequences of this change. They are prosumption and disintermediation. Each will be depicted briefly below.

Prosumption refers to the capacity of modern information technology to "reach out" to you wherever or whenever you are. Companies cart "reach out" and sell products. For example, a major clothing manufacturer is now selling custom made jeans over the Internet. You provide measurements and a credit card number, and the company will custom tailor and deliver a pair of jeans through a fast delivery service. Organizations/people can reach out anonymously and entice, seduce, and scapegoat. Witness the concept of "spamming" for example, the sending of thousands or millions of e-mail messages to targeted politicians in support of or against President Clinton's impeachment. Health care firms can "reach out" to monitor symptoms at home in real time. For example, the monitoring of acute diabetes can be done at home using monitoring technology and the Internet without the intervention of medical professionals. Federal agencies can "reach out" to collect taxes and other data over the Internet. Clearly, the effects of prosumption are very broad; some are positive; others are dangerous.

Disintermediation means exactly what it says. Modern information technology permits one to escape traditional social structures. The president of a company can communicate directly with any employee, thus disintermediating intermediate supervisors. Traditional retailing structures—transportation, warehousing, wholesaling and retailing can be eliminated through direct selling by companies to ultimate purchasers—Federal and State governments can bypass Local governments and directly tax, influence, and communicate. They, in turn, can also be disintermediated through direct international and regional communications. An example of the latter is Internet therapy, in which the Internet is used to provide psychotherapy. The therapist may be in Australia or Canada; the patient, in the U.S. Effectively, all U.S. laws and regulations governing psychotherapy are abrogated by this arrangement.

Principles Governing Modern Information Technology

What can be done to direct this technology toward goals that are *humanizing*? To address this question, a small work group was formed early in 1998 to develop a set of principles to be used by the mental health field when modern information technology is acquired.

The principles are intended as guidelines to action, and different principles may be predominant at different times. These principles are displayed in Figure l.

The principles were subsequently tested in a case study of information technology acquisition by the mental health agency of Jefferson Parish Human Services Authority, Metairie, Louisiana. The case study, problems in applying the principles, and potential course of action can be found on the Internet at www.mhsip.org.

How do these principles relate to the current discussion? The principles provide one potential course of action toward modern information technology. They can stimulate discussion, guide acquisition, and provide a basis for future guidelines.

Modem information technology is well organized. Our social reaction to it is uncoordinated and disorganized. Further discussion will need to be stimulated to foster an appropriate social response. The principles reflect the work of one small concerned group over a short period of time.

Figure 1. Principles for Acquisition and Application of Information Technology

1. **Technology:** Implementation of any system should be based upon technology that is consistent with the current state-of-the-art viable for the service setting, and as adaptable to future needs as possible.
2. **Difference Between Haves/Have Nots**: Access to technology should be broad within organizations and between organizations and their customers.
3. **Humanization/Dehumanization**: Technology should humanize i.e., increase positive human interpersonal behavior, rather than dehumanize.
4. **Efficiency/Effectiveness**: A major purpose of acquiring information technology is to help managers, staff, consumers etc., improve their performance and be more efficient in their work.
5. **Access**: The introduction of new technological methods should increase cast of access to traditional services.
6. **Consumer Oriented**: Technology should be consumer-oriented.
7. **Recovery:** Technology should support recovery principles and encourage consumers to actively participate in recovery-oriented treatment through its use.
8. **Risk/Cost Benefit Analysis**: The risks and benefits of adopting or of not adopting the technology should be examined.
9. **Compatibility With Hardware/Software That Already Exists**: New hardware and software should be compatible with what is currently available.

The principles were developed by a Work Group on Technology, for the 1994 Southern Regional Conference on Mental Health Statistics. Members were: David Brown, Ronald Manderscheid, Gordon Neligh, Edward Payne, Mary Smith, and Carole Taff.

Major Current Issues with Modern Information Technology

In this section, we want to describe a few major issues with modern information technology. The list is intended to be neither unique nor exhaustive. It is intended to stimulate discussion and action.

Home Sweet Home: With modern information technology, our home, so to speak, is where our cyberspace is. In this context, one can be a virtual stranger in one's physical home and family. This raises very significant questions about the socialization of children in the future, social supports for disabled and elderly persons, and the nature of one's family, community, societal, and cultural identity. Will socialization and support be a-family, a-community, a-societal, a-cultural, and a-historical in the future? What does this imply regarding the concept of human?

The Neighborhood is "a Changing:" If one's community is in cyberspace, then one is less likely to focus attention on one's geographical community. Geographical communities may cease to be sources of identity, nurturance, and support. Social commentators have long noted that many American housing developments exhibit a fortress mentality with gates, walls, and guards; that houses are designed to look inward rather than outward; and that many people do not take responsibility for community social control. "Virtual" communities would appear to promote and to accelerate these trends. The negative impact will be a further erosion of our community structures, some of which have almost disappeared even in rural heartland areas. Those who derive identity, support and satisfaction from virtual groups are likely to have different personalities and values as well.

Cyberpersonality: A not unimportant question facing us at present is whether it is possible to socialize children in cyberspace. Can sufficient nurturance and support be programmed into our new information technology to foster development, personality formation, and value transmission? Currently, we do not know the answer to this question; yet tens of thousands of children are on the Web daily. We already know that some children require more positive reinforcers (cookies, in Web parlance) than their elders. This would suggest a need for short-term gratification. This is likely to be accompanied by less tolerance for frustration.

Finding Immortality: Some have even suggested that cyberspace is where immortality can be found. By retaining sufficient detailed information about a person, that person could be recreated virtually and remain across the generations. It is unclear how these concepts relate to more traditional cultural concepts of after life, of soul, and of God.

Conclusion

By now, it should be clear that modern information technology does not represent simply an extension of past technology, but rather a radical departure from anything human society has experienced in the past. It is critical that discussion be stimulated about how we can address and control this technology. The technology will cause us to think about who we are, how society operates, and our own natural limitations and aspirations. It would seem prudent to begin this dialogue quickly and to pursue it earnestly. A lot is at stake.

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A Call for Scientific Study of Humanizing and Dehumanizing Potentials of Technology in Communications

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Centennial Chair

Introduction

I believe that most of you know most of what I have to say about Humanizing and Dehumanizing Potentials of Technology in Communications. But we do not know that we share this knowledge. The purpose of this paper is to provoke the interests of scientists, particularly information scientists, to study the impact of global information sharing and provide their results to decision makers rather than allowing politicians to set the rules for global information sharing without the benefit of facts gained scientifically.

After all, it is by science that communication technologies were and are being produced. Modern science: experimentation, replication of results, analysis and factual documentation to test hypotheses, is a singular characteristic of one of the twentieth century's most influential belief systems. But it is a curious fact that science has not undertaken to study the impact of technology in communication as a major global challenge for humankind. Previous generations have faced major disturbances to their worldview, but never before on our planet

> "...have our destinies been so tied to one another in such an intricate maze of changes, forces and institutions that are global in proportion and scope. Telecommunications, mass transportation, and linked economies have created a new global context of daily human life." (2a, p1 289).

The technologies of communication, while providing data through and around existing institutions, pose additional problems by their incomprehensible speed and reach. And today's telephones, both wire and wireless, facsimile machines, television and the computer based Internet, are providing print, voice, and pictures cheaper, faster and to more locations than ever before. Indeed, the World Wide Web may dramatically alter how and where science is accomplished in years to come—telecommuting from home (3), voice interaction with the computer (4), and virtual enterprises and environments, "virtuality" as Makarov and Rakhmankulov call these software created forms for human activity (5). Please refer to Figure 1. Most technologies of communication have been

improved, invented, and employed during our lifetime. Some say that advances in communication technology are outstripping humankind's ability to form moral judgments about it: what is helpful and what is hurtful; what is good and what is bad. In my view, third millennium communication of one person with one other person, one person with many for people, many to one, many to many, at any and all levels of human aggregation, rich field of inquiry scientists, particularly into questions of consequences.

FIGURE 1: Selected Steps in the Evolution of Communication of Ideas

4000 BC	Earliest known form of writing is cuneiform developed by the Sumerians.[7]
1454	German inventor, Johann Gutenberg prints first book, A Bible, using moveable type.[7]
1839	First commercial telegraph system in Great Britain.[6]
1874	Emile Baudot (France) invents binary code of 5 bits to represent characters; used until 1930.[6]
1876	Alexander Graham Bell invents the telephone (USA).[7]
1884	Herman Hollerith patents the first data processor (USA).[7]
1888	Henrich Hertz detects and produces radio waves for the first time—called Hertzian waves.[6]
1895	Guglielmo Marconi first succeeds in sending wireless Morse Code (Italy)[7]
1897	Physicist Alexander Popov (Russia) uses antenna to transmit radio waves over 5km (3 miles).[7]
1904	John A. Fleming (England) files patent for the 1st vacuum tube called the "Fleming valve."[6]
1907	Lee DeForest (USA) and R. Von Lieben invent the triode amplifier vacuum tube.[6]
1913	Edouard Belin invents the portable fax machine capable of using ordinary phone lines.[6]
1919	William H. Eccles and F. W. Jordan write first paper of flip-flop circuits.[7]
1936	First transmission of scheduled television program: BBC in London.[6]
1945	First full description of stored-program computer by John von Neumann.[7]
1946	ENIAC is fully operational (USA)[7]
1948	Bell Telephone Labs first demonstrate the transistor by W. R. Shockley, J. Bardeen and W. H, Brattain.[7]
1955	N. S. Kapany, Indian physicist first introduces fiber optics.[7]
1951	UNIVAC I built by J. W. Mauchly and J. P. Eckert. (USA)[6]
1960	Kenneth Olsen (USA) introduces first commercial computer with keyboard input and a monitor to show user input.[6]
1967	Olof Soderblom introduces closed loop computer network; precursor to networked systems.[6]
1977	First mass produced personal computer, the Commodore PET (USA).[7]
1984	IBM introduces megabit RAM (random access memory)[7]
1985	Togai & Watanabe (Japan) develop a logic chip that operates on fuzzy logic.[7]
1996	New software JAVA for Web developers is most important since Mosaic, the Internet browser that opened up the World Wide Web to a general audience.[7]

Communications

Communication requires at least one human transmitter, a message, at least one human receiver, a value system and at least one point of view. Technology can enable or inhibit the humanizing features of communication, intentionally or unintentionally, directly or indirectly, swiftly or slowly. It is a key feature of all learning, of providing choices, of confirming beliefs. Although technology of communication, in general, shares with all technologies the "help" or "hurt" impacts upon humankind, it appears different in several respects. While physical improvement in the quality of life and physical maiming characterizes the benefits and harm of second millennium technologies, the telecommunication technology of the third millennium might be characterized by a potential for psychological harm. Control the technology of communication and you control access, dissemination, reception—the very shaping of human thought, our institutions, markets, and value systems. Open the information highway to everyone and you permit the introduction of child pornography and misinformation, while simultaneously you have freed global communication at the personal level enabling greater understandings, sharing of information, and more choices. "Do you have scientific studies to support that last statement," you may ask? Not many, and that is why I present this paper: to encourage you to do these studies, to raise this subject to a level of importance in your eyes.

Conceptual Frames of Reference

I recall three great awakenings in my life: women, a knowledge of Jesus Christ, and systems theory. Having been educated in the 300-year-old reductionist approach to science, I was utterly fascinated by the unfolding of the then 30-year-old holistic approach for applied research: information theory (Claude Shannon), general systems theory (Ludwig Von Bertalanfy) and cybernetics (Norbert Weiner) and particularly the "viable systems" modeling of cybernetician Stafford Beer (8). From a focus upon individual differences of humans as information processing problem solvers after World War II (9), I shifted my interests to the problem solving behavior of groups, and groups of groups, using and devising methods of computer assisted simulations (10,11). With E. John Burns, I developed a general systems conceptualization which has proved useful for over 35 years; an Organization (O) Relating (R) to its Environment (E) through Time (T). We call it the ORET model and used it to study organizational behavior as process as well as structure (12). As general system theorists observed, structure is static process and process is dynamic structure. I suggest that we would do well to study the impacts of technology in communication using holistic as well as reductionistic approaches.

Level of Aggregation

Whatever conceptual model we decide to use to study the humanizing and dehumanizing potentials of technology in communications, we must choose and describe the level of human aggregation we wish to study. For example, using the ORET, the "O" can be defined at the individual, family, city, region, nation state, continent, or global level. One study by Robert Kraut and his colleagues investigated if time on the Internet was changing the lives of average citizens in the United States ("O" = individual); whether the Internet computer technology is improving or harming participation in community life and social relationships. The results of examining the social and psychological impact of the Internet usage on 169 people in 73 households during their first 1 or 2 years on-line indicate negative impacts. "...[G]reater use of the Internet was associated with declines in participants' communication with family members in the household, declines in size of their circle, and increases in their depression and loneliness" (13).

Selecting the relevant attributes with which to describe the chosen level of aggregation, (O) as well as "R" (relating) to the "E" (environment) through "T" (time) is no trivial matter. In my view, one of the reasons so few of us have attempted applied research at the global level is because of the difficulties of describing phenomena at that level, devising experimental designs and taking measurements.

Point of View

In addition to level of aggregation, we must select our point of view. From what position or set of values will we make our observations, ask questions, take measurements and analyze data? If we want policy makers to accept our findings at our chosen level of human aggregation, it seems reasonable to expect them to question our point of view. Who is paying for the research and what is their point of view? Has the research been peer reviewed? Who are the peers and what is their point of view?

These questions seem particularly relevant when working at the global level. Information scientists must guard against the unreasoned rejection or acceptance of any one cultural point of view or haphazard mixtures of viewpoints. For example, the political and economic dominance of Western nation states is Westernizing other cultures. This seems to be the case at least at the surface or current superficial levels in terms of business ethics, consumer behavior, life styles and personal preferences and beliefs. Western economic, military, and political power is influencing how people think and act and the Internet, e-mail, television and radio are carrying a bias for making judgments on how to improve quality of life. Dr. Anthony Marsella recently stated:

> "Although many people are dismayed by the possibility of a world committed to consumerism, materialism, individualism, competition, and unlimited and rapid change... the Westernization of many of the world's cultures is occurring at a frantic pace." (2b, p.1288).

The philosophical issues surrounding research on the humanizing and dehumanizing potentials of technology in communications should be discussed by scientists as a means of suggesting hypotheses to test. Is cultural homogenization the future of global culture? Is cultural diversity valued as is biodiversity for this planet? Academician Rem V. Petrov and I believe that scientists form a global subculture. "Strong global bridges of art and science can help block the insanity of war, genocide and other possible inhumanities in the coming century while sustaining morality, preventing disease, increasing literacy and raising the dignity of individual human beings." (14).

Guidelines

Some guidelines or agreed upon definitions are needed that we all could apply in studies to determine whether a particular configuration (ORET) of communication technology is humanizing or de-humanizing. For example:

* The extent that technology enhances the impaired faculties of the listener or of the transmitter to parity, it is judged to be favorable communication—potentially humanizing.
* To the extent that technology maintains the faculties of the listener or of the transmitter within the limits of parity, it is judged to be favorable communication—potentially humanizing.
* To the extend that technology departs from parity and distorts the discourse between listener and transmitter, it is judged to be unfavorable communication—potentially dehumanizing.
* To the extent that technology departs from parity and diminishes the faculties of listener or transmitter, it is judged to be unfavorable communication—potentially dehumanizing.

Obviously, many terms will need to be defined. For example: Parity could be defined as a standard obtained by consensus (a threshold or band of performance expected by reasonable people), and protected by law. Setting performance expectations with standards will bring in a whole set of ideas about rewards and penalties: who does what to whom and how would the standard be implemented and enforced.

Dr. Paul-Georg Gutermuth suggests that we do not need new criteria for ethical assessments of information and communication technologies (ICT).

> "...Since we can rely on the framework created by human rights and, within those lines, on general criteria already conventionally applied for weighing conflicting goods and interests... ICT are thus to be viewed above all from the perspective of the following questions. Are they individually appropriate, socially acceptable, and sparing of the environment?" (15,p2).

Policy makers are beginning to shape a strategy of inclusiveness, not only for the traditionally disenfranchised, such as the hearing impaired, learning disabled, and people poor economically, but also controls to protect children, patents and copyright, and personal medical records.

> "...Governments must create a favorable environment for the development of the Information Society and reduce the potential for misuse by adopting the legal and regulatory framework." (16, pg. 3).

Conclusion

Around 1000 AD, science and technology had developed in China: gunpowder, paper money, moveable printing type, and the production of cast iron. Arabic texts translated into Latin helped spread knowledge of mathematics, astronomical maps and instruments, and intellectuals in India had created a numerical system of nine numbers followed by a "zero" (17). In 1999 AD, scientists around the globe share a stewardship of knowledge. Policy makers view scientists as "knowledge brokers." In our disciplines we are accountable for additions to the knowledge base and responsible for the use of knowledge.

As we enter the century of three zeros, much of what we information scientists regard as modern and contemporary in our scientific discipline, in music, literature and architecture, quickly becomes history. With scientific research helping shape global information sharing, coupled with our products offered as tools for the betterment of all people, science and governance, the view from Circa 2099 should be dazzling. Exercising your scientific curiosity, with unfettered access to data through joint, collaborative efforts, constrained only by God and self-control, those that follow us will be proud of the base you have provided for their attainments.

References

1. Based upon the Co-chair's paper delivered at the Centennial Celebration Symposium of The Washington Academy of Sciences, The Cosmos Club, Washington, DC, October 19, 1998. Dr. Proctor is a Life Fellow, Past President, and Centennial Chair of The Washington Academy of Sciences.
2. Marsella, Anthony J. "Toward a 'Global Community:' Meeting The Needs of a Changing World," *American Psychologist*, Vol. 53, No. 12, December, 1998, p 1289.
3. Staunton, J. M. "An Empirical Assessment of Data Collection Using the Internet," *Personnel Psychology*, Vol. 51, 1998, pp. 709-725.
4. Craiger, Philip and Weiss, R. Jason "Traveling in Cyberspace: Voice Recognition Systems," *The Industrial-Organizational Psychologist*, Vol. 36, No. 3, January, 1999, pp. 79-84.
5. Makarov, I. M., and Rakhmankulov, V. Z. "Humans, Technologies and the World of Telecommunications," Institute of Systems Analysis, Russian Academy of Sciences, Moscow, Russia; a paper delivered at the Centennial Celebration Symposium of the Washington Academy of Sciences, The Cosmos Club, Washington, DC, October 19, 1998.
6. Bunch, B. and Hillmans, A. *The Timetables of Technology*. New York: Simon & Schuster, 1993.
7. Bruns, Leonard C., and Olendorf, Donna, Editors. *Science & Technology Firsts*. Detroit, MI: Gale Research, 1997.
8. Beer, Stafford, *Brain of The Firm*, Second Edition. New York: John Wiley & Sons, 1981.
9. Proctor. John H., "Man-Machine Communication in Problem Solving." A paper presented at the symposium, Cybernetic Aspects of Man Machine Relationships, sponsored by the University of South Florida and the American Institute of Aeronautics, Tampa, Florida, 13 February 1965.
10. Proctor, John H. "Operations Research, Simulation and Gaming," an instruction module presented at the Department of Defense Computer Institute (DODCI), Flag Officers Course, 1964-65.
11. Proctor, John H. "Normative Exercising: An Analytical and Evaluative Aid in System Design," IEEE Transactions on Engineering Management, Vol. EM-10, No, 4, December 1963, pp. 183-192.
12. Proctor, John H. "A Theoretical Basis for Intentional Organizational Change from a Thirty Year Perspective," Journal of The Washington Academy of Sciences, Vol. 82, No. 1, March, 1992, pp. 1-18.
13. Kraut, Robert; Patterson, Michael; Lundmark, Vicki; Kiesler, Sara; Mukopadhyay, Tridas; Scherlis, William; "Internet Paradox, Social Technology That Reduces Social Involvement and Psychological Well-Being?", *American Psychologist*, September 1998, Vol. 53, No. 9, pp. 1017-1031.
14. Proctor, John H., Ph.D., (USA) and Academician Rem V. Petrov, Ph.D., MD (Russia) "Culture and Science: Their Significance for All People," Science In Russia, Russian Academy of Sciences Presidium and the Ministry of Science and Technology of the Russian Federation, No. 4, July-August, 1998, pp. 29-31.
15. Gutermuth, Paul-Georg "Humanizing and Dehumanizing Potentials in Communications," Federal Ministry of Economics, Bonn, Germany, a paper delivered at the Centennial Celebration Symposium of the Washington Academy of Sciences, The Cosmos Club, Washington, D. C., October 19, 1998. See also, Enquete Kommission "Zukunft der Medien in Wistschaft und Gesellschaft- Deutschlands Weg in die Informationsgesellschaft," SchluBbericht Deutcher Bundestag, Bonn, 22.06.1998. p. 113, Drucksache 13/ 1104.
16. European Ministerial Conference, "Global Information Networks: Realizing the Potential," Bonn, Germany, July 6-8, 1997. Introduction, p. 3.
17. Swerdlow, Joel L., "Making Sense of the Millennium," *National Geographic*, Vol. 193, No. 1, January, 1998, p. 9.

Journal of the Washington Academy of Sciences,
Volume 87, Number 1–4, 41–41, October 2001

International Advancement of Science

John H. Proctor

Past President, Life Fellow, Chair, Centennial Committee

Over the years, the Washington Academy of Sciences has contributed to the advancement of science beyond the borders of the United States. Currently we have 20 Foreign Fellows residing in 9 countries elected in recognition of their contributions to science. Our members and Fellows publish papers in foreign journals and attend conferences and meetings throughout the world.

In December, 1994 it was my privilege to represent the Washington Academy of Sciences in the *International Symposium on Science and Power* held in Genoa, Italy. Work there led to the formation of *the Genoa Forum of UNESCO on Science and Society, which* produced the *Genoa Declaration on Science and Society* in October, 1995. Past President Reverend Frank Haig, S.J. represented us and signed this declaration on behalf of the Washington Academy of Sciences. That Declaration is published here in its entirety. Building upon these efforts, a UNESCO sponsored *World Science Conference* is planned for the latter part of 1999 probably to be held in Budapest, Hungary.

Let us affirm that the Washington Academy of Sciences will forge more linkages with academies of science and cooperative technology programs throughout the third millenium.

Journal of the Washington Academy of Sciences,
Volume 87, Number 1–4, 43–44, October 2001

Remarks

Paul-Georg Gutermuth
German Ministry of Economics, Bonn, Germany

Mr. President, my dear friend John, Ladies, and Gentlemen. Thank you for the great honor you have bestowed upon me today. I am very moved to be the first German to be inducted by your Academy into its elite ranks. And I am delighted that this has given me a unique and even deeper contact to a place and country that have long meant a great deal to me.

My first visit to Washington D, C. was forty-two Years ago when I was on a Fulbright scholarship as a post-graduate at William & Mary. Washington fascinated me, not only as a center of power, but as a lively and truly beautiful city, full of culture and science.

I am also pleased to accept fellowship in the Academy as a sign of the strong bonds of friendship and trust between the United States and Germany. I am not so much thinking of the fact that every fifth American can claim German lineage, although these ties naturally further help to link our two peoples. Also impressive is that fact that over the past few decades, some seven million American soldiers have served in Germany. Counting family members, that means that approximately fifteen million Americans have helped to maintain peace in the world, far away from their own homes. They have established contacts and personal relationships to their German neighbors and thus become a strong pillar in the friendship-bridge joining our two countries. But more than this, in the five decades after the second world War we have together witnessed significant milestones in the relationship between our nations, and these events are the expression of a vibrant friendship.

I need only mention the magnificent humanitarian initiative of the United States and individual Americans who sought to lessen the plight of many million Germans starving in the ruins of our cities by launching the Marshall Plan and sending Care Packages. I will never forget the moment when such a package arrived at our home. All of us children were full of joy and gratefulness. It was for us like the giving out of Christmas presents.

And I haven't forgotten the Berlin Airlift. It was Washington's determination and resolute action that turned back the Communist threat and ensured the survival of an encircled and free Berlin. We Germans know:

> "Without the support of the United States, we would never have been able to rebuild our country. Without America's enduring friendship our people, our country, would never have been able to accomplish reunification in peace and freedom....
>
> When dramatic changes appeared on the horizons of Eastern Europe, and when the Wall was finally opened, no one gave as much help and support as our friends across the Atlantic." (Chancellor R. Kohl on the occasion of the visit of president W. Clinton in Berlin on May 13 and 14, *1998).*

We will never forget your encouragement and assistance.

We have sat down together here today to confer on the ethical issues raised by modem communications, I hope that my modest contribution has also made clear that German-American friendship rests on common values. Together we advocate the dignity of man, freedom and government by law. Let us seek to guarantee that Americans and Germans will continue to achieve success on this basis and work together in the spirit of a shared history toward the peaceful future we all desire.

Thank you very much for your kind attention.

Journal of the Washington Academy of Sciences,
Volume 87, Number 1–4, 45–48, October 2001

Genoa Declaration on Science and Society

Frank Haig, S.J.
Past President

Recognizing that the future of humanity depends critically on the continued vitality of science and its applications, representatives of world's major Academies of Science and of the international scientific community have gathered in the City of Genoa, on the threshold of a new millennium, to foster global awareness of science and of its importance for the welfare of mankind.

The last three centuries have witnessed the birth of modem science and its explosive growth. The impact of science now extends to nearly all fields of knowledge and applications thereof, from physics to biology, from agriculture to ecology, from neurosciences to psychology, from material science to information technology, from medical to social sciences, etc.

In this century alone, the conceptual framework of human knowledge and understanding underwent radical transformation. Determinism has gradually given way to a more open vision, one that offers humanity a growing consciousness of its freedom and of its responsibilities.

Moreover, the progressive transformation of the base of technology from empirical to scientific has generated for science a critical role in all activities ranging from socio-economic and industrial to philosophical, ethical, cultural and political.

Science has contributed immensely to society, even though its applications can be and have been misused at times. However, it is important to ensure that this positive relationship between science and society continues and is strengthened. Among the potential threats to this relationship, which may differ from society to society, are irrationality, various constraints on freedom in the conduct of science and dissemination of the results of science, and undervaluation of the role of science.

Universality, freedom and critical thinking constitute basic elements in the scientific process and form a common bond between all cultures. Accordingly, science can make a significant contribution to constructive dialogue between different cultures and thereby act as a powerful antidote to intolerance and to ideological and racial barriers.

Moreover, the progress and application of scientific knowledge can offer effective means for solving many of the problems which face humanity, including those generated by the misuse of science.

Recognizing the important and distinctive potential of science to contribute to a better future for mankind, in which the culture of peace prevails, we reassert our adherence to the following general principles:

— respect for the diversity of cultures within societies and promotion of science as a distinctive and important contributor to bridging such diverse cultures and promoting peaceful coexistence in accord with the principles of freedom, autonomy and rationality;
— mutual cooperation, reflecting the recognition that the production and utilization of scientific and technological knowledge are decisive for the future welfare of humanity and that science, with its universality, is uniquely positioned to serve as a laboratory in which mankind can work together to achieve a better future in accord with the principles of responsibility, solidarity and respect for the rights of individuals and nations.

Therefore, the Academies and other scientific institutions represented at this meeting reaffirm their commitment to the promotion of:

— the awareness that science, as a product of the history and creativity of mankind, is an integral part of all cultures;
— an increased effort in science education at all levels and in raising the young generations to be guided by a new vision of culture that embraces the scientific "ethos" and the spirit of free inquiry that characterizes science;
— wider dissemination and better public understanding of science and technology;
— balanced development of science and of technology, recognizing that both basic and applied sciences are vital for meeting human needs and for tackling problems such as hunger and disease, environmental degradation, rural and urban decline, and in the long run reducing disparities between rich and poor nations.

International cooperation is a striking feature of the present century. Witnessing the dramatic trend of transition to new socioeconomic structures, with the world in search of new goals and approaches, we strongly recommend that particular effort be focused on increasing the scientific and technological capabilities of developing countries.

We are meeting on the eve of the 50th Anniversary of the United Nations and of UNESCO, whose Constitution assigns to it the mandate for promoting intellectual and scientific cooperation within the UN Family. We call upon UNESCO to take a lead in implementing the principles and recommendations of this document.

This Declaration was approved at tire Meeting of the Steering Committee of the Genoa Forum of UNESCO on Science and Society "50th Anniversary of the United Nations and UNESCO: Science for the Dialogue Between Cultures and for Development" Genoa, Italy, 8-9 October 1995.

RUBERTI, Antonio	President, Steering Committee of the Genoa Forum on Science and Society
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*COLLINS, Peter	Head of Science Advice Section of the Royal Society (United Kingdom)
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*JOSHI, Shri Krishna	Fellow of the Third World Academy of Sciences

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Instructions to Authors

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Supersedes all other versions

Submission of Manuscripts

Manuscripts should be addressed to Editors, Journal of the Washington Academy of Sciences, 1200 New York Avenue, NW, Room 811, Washington DC 20005, USA.

Contributions appearing in the *Journal of the Washington Academy of Sciences* are normally original papers that have not been published elsewhere. The publication of a paper that has been widely disseminated is permitted only if the editors judge that the manuscript contains amplification or clarification of the original material of significant benefit to the scientific community. Prior appearance of material reported in the submitted manuscript must be noted in the cover letter. It is the obligation of the author(s) to inform the editors if there are any circumstances about the contribution that bear on this policy. The style of manuscripts should follow the model of the Publication Manual of the American Psychological Association, 3rd edition, with a few exceptions. The main exception is that text which is intended to be italicized should use word processor italic code rather than underline code. A second exception is in the use of numbers (see below).

Manuscripts may be submitted in either the traditional paper format or electronically. Microsoft Word or WordPerfect are the preferred word processors. In either case, editors will acknowledge the submission. With paper manuscripts, an original and three clear review copies of everything must be submitted. Each copy should include glossy or clear photocopies of all figures. Figures may also be submitted electronically as TIFF or other high-resolution format. If high resolution is not necessary for display of the desired photographic details, other formats such as JPEG and GIF may be adequate. Photocopies are acceptable only if they show all details necessary for critical examination of the data. This is particularly important for halftone photographs. Submission of three hard copies and a 1.44 Mb disk containing the exact content and format of the hard copies are preferred.

General Policies and Guidelines

Review Procedures

The editors and associate editors are appointed by the Washington Academy of Sciences and have final responsibility for all editorial decisions. The editors, in consultation with associate editors, select reviewers for their competence in a specialized area

of science or engineering. When a manuscript is received, the editors will first judge if its content falls within the scope of the *Journal of the Washington Academy of Sciences.* Manuscripts of a very specialized nature, or those that in the judgment of the editors are not of sufficient interest to the general reader of the journal, will be returned to the author(s) without review. If the manuscript is acceptable, it will be sent to two independent reviewers for evaluation. The reviewers are advisory to the editors and their reports are used to reach all editorial decisions. If the reviewers disagree, or if in the judgment of the editors the manuscript has not received adequate consideration, the manuscript will be given to a third reviewer. When a manuscript is returned to the author(s) for revision, they should reply to all specific recommendations of the reviewers in an accompanying letter, indicating the recommendations they have incorporated into the revision and their reasons for disregarding those they feel are unacceptable. Minor corrections may be made on the manuscript by typewriter; major corrections will require retyping of the entire page or section. Handwritten corrections will not be accepted. The revised manuscript, in triplicate, should be returned to the editors within 60 days. Revised manuscripts received more than 120 days after return will be considered as new submissions and will undergo a new review.

English Language

To assure the widest possible readership, only manuscripts in English will be considered for publication. Authors not entirely familiar with English usage should seek a native English-speaking colleague for advice on correct syntax and word usage. English-language editorial assistance is available when needed. Correct style and word usage, however, are the responsibility of the author(s).

References in the Text

All reference material should be accessible to the public (i.e., articles in standard journals and governmental reports). References should follow APA style: they are cited in the text by author and year (Fenchal & Finlay, 1992), or by year alone when the author's name is in the text; for example, "as described by Olive and Blanton (1980)..." Unpublished experiments or observations, personal communications, papers submitted for publication or in preparation, abstracts and dissertations should not be included in the References section but should appear parenthetically in the text.

Hyphenation

Do not use a hyphen at the end of a line to divide words, including compound words. If the words are unfamiliar to the printer, they may be incorrectly hyphenated. Compound words consisting of a noun and an adjective should be hyphenated, as in electron-microscopic examination. Noun-noun compounds used as adjectives should also be hyphenated, as in lymph-node cells.

Right-Justification

Do not justify right margin of text even if your word processor permits you to do so.

Boldface and Italics

Word processor code is sufficient. If your word processor does not have boldface and italic codes, then underline text to be italicized and put a wavy underline under text to be boldfaced.

Metric System

The metric system should be used in all instances. Use SI units with standard prefixes. (In 1990, the prefixes yocto- (y) (denoting 10^{-24}), zepto- (z) (denoting 10^{-21}), zetta- (Z) (denoting 10^{21}), and yotta- (Y) (denoting 10^{24}) were added to the SI system.) Do not use nonstandard units such as Angstrom, millimicron, cubic centimeter, etc.; rather use nanometer (nm), microliter (mL), etc. Compound units, such as newton-meter, should be denoted N m or Nm. Use appropriate symbols from your word processor or draw them carefully and accurately. Quotients of units, such as meter per second, should be denoted m/s, m s^{-1}, or ms^{-1}.

Preparation of Manuscripts

General Instructions

The instructions for the development and submission of a manuscript should be followed exactly to prevent delays in reviewing and handling. Before preparing a new paper for submission the author(s) are advised to examine carefully current issues of the Journal to familiarize themselves with the Journal's conventions and note any changes in style.

All pages of the manuscript must be printed or typed on one side of the paper, double-spaced throughout (including Acknowledgments, References, Footnotes, Tables, and Figure Legends) on 22 x 28 cm (8 heavy-bodied paper. Ample margins of about 2.5 cm (1") should be left on all sides for editorial corrections and queries. Number the manuscript pages consecutively in the upper right corner beginning with the title page. The author's name should not appear on the manuscript beyond the title page.

If typed, the manuscript should be prepared with a standard typeface, size Elite or larger, using a new black ribbon and solid white paper. Computer generated documents must be clear and readable of letter quality, using a font size of 12. Avoid using fonts that are not standard and/or common for the preferred word processors listed above.

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