People's Reactions to Technology

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Editors

The Claremont Symposium on Applied Social Psychology

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In Factories, Offices, and Aerospace

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Preface

This volume brings together chapters on one of the most pervasive issues of modern life—how people respond to the many kinds of technology that surround them and so completely affect their lives. This is a topic that applied social psychologists have studied from many aspects and with many different methods. Three types of technology are discussed in this volume: computerization of offices, use of robots and other computer-controlled machines in factories, and advanced technology in aviation and space exploration applications.

The chapters herein are expanded versions of presentations given at the sixth annual Claremont Symposium on Applied Social Psychology, held on February 4, 1989. This annual conference brings together outstanding psychologists from various sections of the country to join in the discussion and analysis of important topics and issues in the field of applied social psychology. The symposium has proven fascinating and informative to audiences of professional psychologists, students, and faculty members; and the chapters in this volume will be equally valuable and stimulating to readers, for they describe research at the cutting edge of this rapidly changing field.

We are grateful for financial support for the conferences from all six Claremont Colleges (Claremont Graduate School, Claremont McKenna College, Harvey Mudd College, Pitzer College, Pomona College, and Scripps College). We are also grateful to Dr. Rudi Volti for his thoughtful comments in moderating a panel discussion among the participants at the conference. Our personal thanks go to Shawn Okuda for her help with indexing and to Catherine Cameron and Mike Nichol for their support.

To provide integration of the content from the various presentations, we have included an introductory chapter that highlights key issues in people's responses to technology, summarizes some of the basic research findings, and draws together common themes that ran through several of the authors' presentations.

The expanded versions of the papers presented at the conference make varied and valuable contributions to the social psychology of technology. It is our hope that this volume will be interesting and useful to researchers and practitioners in the areas of both social psychology and technology, as well as to scholars who want to know more about applied aspects of implementing technology in various settings.

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People's Reactions to Technology

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Technology is probably the most dominant influence on life in the modern world. Of course, technology isn't entirely new. Our ancestors had to adapt to the development of horse-drawn vehicles, sailing ships, steam engines, railroads, telephones, and automobiles. It is the *pace* of change in modern technology and its *pervasiveness* in all areas of our lives that are entirely new phenomena.

People have very different reactions to both the pace and pervasiveness of new technology in their lives, and that is the topic of this volume. In this chapter, we first sketch some of the ways in which new technology has affected our lives and then give a brief preview of each of the following chapters. Finally, we discuss several key themes that recur frequently in this volume and that reflect the most important principles and aspects of research on the human-technology interface.

Pace of Technological Change

Three areas of technology that have evidenced rapid change in recent years are those of computers, robots, and the aerospace industry. A few

costs and benefits of new developments in each of these fields are discussed briefly below, and in greater detail in the chapters to follow.

Computers

Probably uppermost in many people's minds when they think of technology are computers. And it is no wonder, for recent data suggest that the rate of diffusion of personal computers has steadily increased in the last five years (McPadden, 1988). However, there are markedly conflicting reports of the value of computers in many areas of modern life. A report from a recent psychology convention proclaimed the great virtues of computers in college teaching, illustrating this conclusion with data from classes in experimental psychology (Bales, 1988a). The advantages reported included the following: Teachers can present more material in the same class time, study materials are available freely and easily at any hour of the day, students can progress at their own pace, tests can be conveniently given and scored by computer, and students learn more and get better grades.

On the other side of the ledger, another research report described many problems in the use of microcomputers in high school classes (Schofield & Verban, 1988). Among the major barriers to computer use, the report listed general inertia, minimal understanding of computers on the part of most teachers, the overload on the few computer-knowledgeable teachers, and a feeling of threat to their self-esteem that learning about computers poses for many teachers.

Computers also have an entertainment function. Just like VCRs, sports cars, cellular car phones, or stereo headsets that will play "music wherever you go," computers are "toys for adults" and status symbols that we use to impress ourselves and others (Adams, 1988).

Robots

In recent years, robots have taken over many factory jobs that involve repetitive and/or precise movements. On the other hand, a recent research paper reported that where robots have been introduced in factories, some are sitting unused since their implementation was not always a success (Fleischer, 1988). There are a variety of reasons for

this difficulty in getting technology to be used effectively, and this volume discusses many aspects of both the problems and the promise of factory automation.

Outside of factories, many of us may soon become more familiar with robots. A brand-new breed of "service robot" is already in use in an increasing number of hospitals and office buildings, delivering meals to nursing units, distributing office mail, and making security patrols. Before the end of the 1990s, it is predicted that many homes will utilize similar robots—"kindly androids that will dust, scrub, vacuum and, yes, even do windows" (Koenenn, 1988).

Aerospace

In the aerospace area, extensive investigations have revealed that airline crashes often are due to problems relating to the interaction of humans with the complex aircraft technology. Also, at high speeds and under multiple stresses, problems in communication or interaction among the cockpit crew or with air controllers became especially dangerous. A recent article (entitled "Wild Blue Blunders") described some of the research findings in this area and concluded that "most accidents in the air are due to poor management in the cockpit" (Stark, 1988, p. 30).

Technological Disasters

Other catastrophe stories emphasize the same theme that human reactions to technology can be fraught with perils. In many catastrophes, there was even technology available to prevent a technological disaster, as in the Chernobyl nuclear meltdown. In that instance, the anticipated human reaction of fear kept plant officials from having employees practice and learn the emergency procedures that could have averted the disaster (see Kanki & Foushee, this volume, Chapter 6). In other cases, it is the sheer amount of technical information and related responsibilities that overwhelm human decision-makers and set the stage for impending crises. We all remember the tragic decision errors that led to the space shuttle *Challenger* explosion (including the decision to launch when the weather was too cold). More recently, the

shooting down of an Iranian airliner by the U.S. missile cruiser *Vincennes* was attributed to the difficulties of dealing with masses of technological information in fleeting moments of time while under many other pressures. Four psychologists testified at congressional hearings that "findings from psychological research could have predicted or helped avoid some of the errors that led to the tragedy" (Bales, 1988b, p. 10).

This volume won't solve all these problems and questions regarding human interactions with technology. It does, however, discuss many aspects of these three major types of technology (computers, robots, and aerospace) and presents many principles derived from research that are applicable to people's dealings with technology.

Pervasiveness of Technology

An indication of the degree to which a given phenomenon pervades (or sometimes, invades) our lives can be derived from the ways in which the term crops up in our everyday language. For example, several writers have pointed out how the jargon formerly used only by computer hackers is now commonly found in reference to the self—we speak of being in a "work mode" when engaged in a consuming task; an interpersonal conflict with a colleague may now be called an inability to "interface"; when mentally exhausted, we apologize for a "slow processing speed"; we call our reflexive responses part of the "hardwiring" of our "system"; attending a business luncheon is part of our efforts to "network"; and, when left out of such luncheons, we feel we need to get back "in the loop" (see Turkle, 1984). References to technology in general have also crept into our language, as illustrated by the following four examples.

The "Technological Fix"

As many writers have pointed out, Americans are considerably more favorably disposed toward new technology than people in most other countries, including Japan (Volti, 1988). In our culture, it appears that most people welcome the promise of new technology as an asset in their

lives. In commerce, fortunes are made by those who first produce talking dolls, advanced home video systems, or better lawn mowers or snowblowers. Occasionally, however, after people's experience accumulates, a technology may be rejected as being too ineffective or more of a torment than a help (e.g., computerized phone solicitation, video telephones, or electronic mail for executives). A key variable in determining acceptance of new technology seems to be whether users have control over the decision of whether and when to use it (see the section on personal control later in this chapter).

As a society, we seem to believe in the idea of a "technological fix." In the case of environmental crises, people seem to think that the solution "only requires the right technology" (Fisher, Bell, & Baum, 1984, p. 346). Rather than adopt personal conservation behaviors to cope with the problem of waning energy resources, we look to nuclear and solar technologies instead; rather than carpool or use public transportation to lessen air pollution, we install car-exhaust antipollution devices as a "technofix." In our personal lives, rather than adopt a healthy lifestyle, some of us fantasize that medical technology in the form of a new magic pill or treatment will allow us to "live as immoderately as we choose, and not contract either cancer or heart disease" as well as not to gain weight (Naisbitt, 1982, p. 53); we pray for a technical cure for AIDS, rather than practice safe sex and abandon a life of intravenous drug use. We even look to new technology to fix the problems created by previous technological innovations: We finally have a technological fix for the telephone—considered by some an "instrument of torment"—in the form of the answering machine. But that "solution" is in turn generating new sources of confusion and avoidance of interaction, and now we await a technofix for answering machines (Volti, 1989). Thus new technologies are generally welcomed in our society, and, at least initially, usually receive a "good press."

Technophobia

Some people do, however, fear, hate, loathe, or agonize about technology. One example of this is seen in our earlier description of the resistance by high school teachers to the use of microcomputers in their classrooms. Another example is reported by Nieva, Newman, and Bottlik (this volume, Chapter 3), who found that factory workers with

more complex jobs were more accepting of additional, new technology than were employees with simpler jobs. A suggested explanation for this is that the latter group probably expected bad things (e.g., job loss) to happen as a result of the new technology.

A new term has been coined for these kinds of reactions – *technophobia* – and it is often bandied about in reference to any tendency to avoid advanced technology. An individual may, however, have several reasons for not using the new technology. Managers may avoid using their office computer because they are simply too busy to learn how, they believe it is somebody else's job to use it, or they find it to be a demeaning, clerical type of task. In other cases, a sophisticated piece of equipment may seem unnecessary when it really doesn't improve performance above and beyond the familiar "low tech" alternative. An intriguing illustration of this is the preference by astronauts for a roll of duct tape instead of a complicated vacuum-suction device to hold down small objects in a zero-g (gravity) work environment (see Wichman, this volume, Chapter 7). One could hardly accuse astronauts of being technophobic!

Whatever the underlying motivation for a reluctance to use new technologies, electronics manufacturers spend a great deal of effort trying to make their products attractive enough to surmount the obstacle of technophobia. An ad from AT&T declares that "even the most advanced technology is of little use if people are afraid of using it," so the company employs many psychologists who "observe people to test their reactions to new products. To find out what they're comfortable with. And what they're not" (*Time*, 1988, p. 51).

Technostress

Despite the efforts of advertisers and others concerned with making new technology "user friendly," there are many concerns about the health effects of the technology inherent in such areas as nuclear plants, pesticides, and supersonic transport. These real or anticipated effects, which cause concern, worry, and anxiety in some people, have been called *technostress* (Brod, 1984). Even one's own personal computer may be a source of technostress beyond just the usual frustrations people experience when "interacting" with this machine. For example, an apparent health epidemic of computer-related stress and actual

physical pain, known as *repetitive strain injury* (RSI), is rampant among Australian clerical workers; it is so extensive that the resulting claims are threatening to overwhelm the nation's workers' compensation system. The fact that this complaint is rare among computer workers in many other industrialized nations illustrates how the social context of work and technology influences people's reactions to them (Kiesler & Finholt, 1988).

"High Tech – High Touch"

The idea that the social context of work and technology may in some way compensate for the costs we incur in embracing new technologies was suggested in the early 1980s (Naisbitt, 1982). In outlining the directions that our sophisticated technology would take us, futurist Naisbitt predicted that "high tech – high touch" would be one of the ten key transformations of our lives. In analyzing past developments, he noted that in some cases high tech has facilitated high touch (e.g., jet airplanes led to more face-to-face business meetings; the Pill led to a revolution in sexual lifestyles) while in other cases the two have appeared almost simultaneously (e.g., high touch quality circles moved into U.S. factories along with high tech robots; the hospice movement developed alongside the advent of life-sustaining medical equipment). In still other cases, high touch represented a backlash against high tech (e.g., ultra-complex heart transplants and advanced hospital equipment have led to renewed interest in the concepts of a family doctor, home birthing, and natural medicine; word processing has led to more handwritten notes; and high tech firms have turned to "management by wandering around" – Peters & Waterman, 1982). In more extreme cases, there has been outright rejection of "high tech" (e.g., laws prohibiting high tech polygraph tests in some states because they are "dehumanizing"; refusals to accept a corporation's automatic payroll deposit of one's wages and consequent lawsuits). High tech – high touch, claims Naisbitt, is a trend in our society that represents our efforts to seek the necessary balance between physical technology, the social context, and the spiritual aspect of our lives. This trend forms a backdrop against which all of the following chapters – indeed, all of the social psychology of technology – may be viewed.

Overview of Following Chapters

The authors of the chapters in this volume are all active researchers and experts in their particular aspect of the human-technology interface, and many of them have published recent books on human reactions to new technology in factories, offices, and aerospace. In this volume, they focus on the principles that can be derived from such research findings, and they discuss how these principles can be applied to many different technological settings.

Factories

Majchrzak and Davis provide a broad overview of flexible factory automation in Chapter 2. While they focus on the human side of this topic, their chapter is also noteworthy for its introduction to some of the technical aspects that may be unfamiliar territory to social psychologists. They review the four "classic" human issues involved—human resource practices, organizational structure and culture, employment and displacement, and implementation processes—and dispel any illusions readers may have as to the eventual reality of a paperless, workerless factory. As discussed in a later section of this chapter, these authors propose that a sociotechnical systems (STS) perspective may be best for integrating human and technological aspects of industrial changes, and they suggest that STS researchers should explore the identification of sociotechnical matches and mismatches, and how to facilitate matches in organizations. After describing several specific studies in this tradition, Chapter 2 concludes with advice to social psychologists who may be interested in adopting an STS approach.

In Chapter 3, the conversion of a manufacturing facility to a computerized "factory of the future" was the setting for a 3-year longitudinal study by Nieva, Newman, and Bottlik. The conversion was accompanied by major shifts in organizational culture, and both sets of changes were prompted by corporate desires to regain a competitive edge in the international marketplace. The authors studied changes in the number of jobs, the structure of tasks, and job quality. Data were obtained from lengthy interviews with key organizational personnel, archival records

and two waves of surveys of nonsupervisory employees. Chapter 3 gives an overview of findings regarding job changes as a result of new technology and also provides an excellent follow-up to several points made in Chapter 2. For example, the authors found that fears about massive layoffs and a "workerless factory" were not fulfilled, and sizes of individual work groups shifted in both directions, with some becoming larger and others smaller than at the outset of this 3-year study.

Offices

In Chapter 4, Gutek and Winter report on a study of the effects of office computerization on the job satisfaction of employees. Because earlier research had revealed that computer use had no consistent, direct effects on job satisfaction, the authors focused on two possible mediators of the effects: "symbiotic interaction" (feelings that one works well with the computer as one's partner) and perceived control over the computer. They also hypothesized that several aspects of computer use, such as the individual's computer tools, skills, and experience, would be associated with job satisfaction. Drawn from 49 Southern California organizations, their sample of 89 computer-using work groups ranged from managerial to clerical units. Their descriptive results show that the extent of computerization in many office settings is only partial and that computerized surveillance by supervisors is only reported in a minority of work groups. Though symbiotic interaction, perceived control, and experience with computers were each related to job satisfaction, routineness of work was by far the strongest predictor of low job satisfaction. The authors conclude by discussing implications of these findings for integrating computers in office settings.

The research of authors Kraut, Fish, Root, and Chalfonte, presented in Chapter 5, aims to improve the communication technologies that work groups have available to them, particularly those groups that are geographically separate. The authors focus on the area of informal communication because it is an important, and often overlooked, mechanism for achieving both the task goals and social goals of groups. In one study of informal communication in an R&D (research and development) organization, they found that the vast majority (over 85%) of interactions in their sample were informal, and that such conversations