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New Communication Technologies and the Information Worker: The Influence of Occupation

by Stephen D. Reese

Attitudinal differences among professionals, managers, clerical staff, and blue-collar workers hint at emerging class and gender differences in the information society.

Many of the most important questions regarding our post-industrial "information society" revolve around the changing nature of work. Whose jobs will be eliminated? Whose will be enhanced? What training and skills will be needed to advance? Questions of larger social impact are equally compelling. Will there be more or less occupational and social mobility? Will an eroding industrial middle class leave gaps between the elite and underclass of a growing information-based sector? This article focuses on information work, particularly how information workers differ from others and among themselves in their use of and relation to the key tools of the information work force: communication technologies.

Occupations locate workers in the social structure. By virtue of their jobs, some workers have more advantageous locations in the system hierarchy than others—better chances to take advantage of information society trends to advance or consolidate their position. These locations, in turn, color the views and affect the behavior of those who hold them. This study is not concerned so much with what information workers do but with how what they do spills over into other areas of their lives. Specifically, having an "information job" should help predict not only how or if workers use technology on the job but also what use they make of technologies at home and how they regard larger issues of science and technology in general. Most research has focused on information work from an economic standpoint; little has been done to examine this work as it relates to individuals (but see 20).

The production and use of information, and the technologies that facilitate that work, are said to occupy a central role in the "knowledge industries," which are supplanting an industrial economy revolving around the production of objects. These new industries are based on handling information and symbols (15). As Bell (1) says, "a postindustrial society

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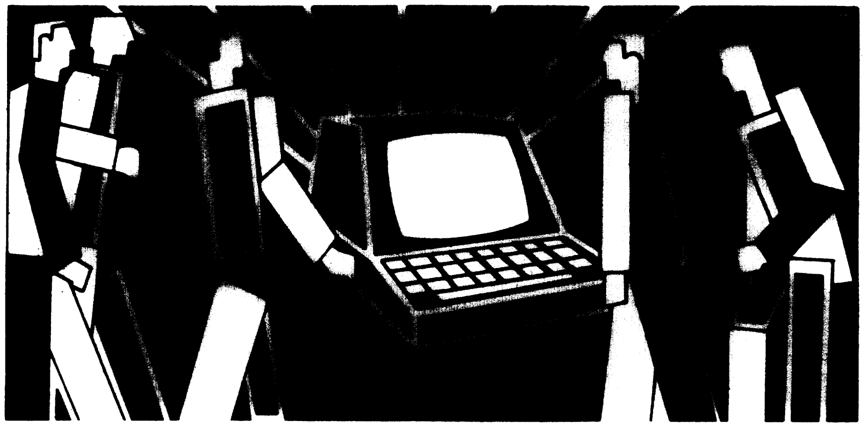

is based on services. What counts is not raw muscle power, or energy, but information."[1]

In 1958, Machlup (9) placed the value of "knowledge industries" at 29 percent of the gross national product (GNP) and rising faster than the industrial sector. Almost ten years later, Porat (14) assessed information-related activities at 46 percent of GNP (47 percent of the work force). Occupations may be considered information work if they result in a primarily informational product. The analysis of the "information economy" by Porat (14), for example, evaluated jobs based on whether their output was related to the "production, processing, or distribution of information," as opposed to traditional industrial, service, and agricultural work.

Porat's work for the U.S. Department of Commerce sought to determine the contribution of information work to the total national output. Once he had identified the workers producing information, however, he further categorized them by their position in an information hierarchy (ranging from creative and close proximity to "new" information to more routinized information jobs).

Schement (21) advocates a more fine-grained behavioral analysis of information work. He suggests that the work of Machlup, Bell, and Porat defines an information elite in a way that reinforces the traditional professional and blue-collar class hierarchy. Schement's analysis groups together workers who carry out similar behaviors regardless of professional status. Behaviors, though, cannot be understood in isolation from their objectives. Both a bureaucrat and a scientist may perform information tasks (interpretation, synthesis, listing, categorizing) yet have different purposes and different feelings about the tasks

Bell's quote implies that services are equatable with information, although other analysts discussed below have identified an information sector extracted from both the service and industrial sectors.

themselves. This study adheres more closely to Porat's rationale. That is, workers may be described both by the information behavior associated with their job and by the control they have, implied by their position, over the product of their labor.

In Porat's scheme, "knowledge producers," including scientists, engineers, doctors, and lawyers, originate and market knowledge to others, often through the "knowledge distributors," who include educators, professional communication workers, and librarians. Like Schement (21), who called these groups jointly "information producers," the present study combines these two categories for analysis. "Market specialists"—for example, salespeople, administrators, and planners—represent the planning and control apparatus of the economy. As such, they monitor and create information within market systems and shuttle it about via "information processors"—clerks, bookkeepers, secretaries, tellers, etc. (see 16).

Based on this information-use criterion, this study reconceptualizes a traditional set of occupational categories: professional, administrative/managerial, clerical/service, and blue-collar. Professionals roughly encompass both the "knowledge producers" and "distributors," given their largely creative informational orientation involving advanced education, mastery of a body of knowledge, and a largely informational output. Managers and administrators, who are similar to Porat's "market specialists," operate within systems, monitoring the environment, relaying and acting on information passed on from above and below. Clerical and service workers most resemble Porat's "information processors," although they include technically non-informational service workers. A previous study, however, suggests that those service workers would constitute 47 percent of this category and be demographically similar to the clerical/information processors (16). Finally, blue-collar workers are those in the traditional industrial occupations.

Although all but members of the blue-collar category could be considered information workers in a broad sense, professionals, administrators, and managers occupy a more advantageous occupational location than clerical/service workers. They have a more creative role in message production and greater control. Lasswell (6, p. 90) made a similar distinction in a different context when he spoke of separating "symbol specialists. . .into the manipulators (controllers) and the handlers; the first group typically modifies content, while the second does not." Therefore, those information workers, including both professionals and managers, who modify content we will call "knowledge workers."

This study compares workers in their on-the-job use of technologies, specifically computers. How do they differ in the extent to which they use computers and the applications to which they are put? Equally important, how do these workers differ in their adoption of home communication technologies (cable TV, videocassette recorders, and home computers)? Finally, how do workers' relative strategic occupational positions affect their views of science and technology?

Workers clearly differ in their need for communication technologies on the job, but we might also expect them to differ in their adoption of home communication technologies. For example, information workers would have a potentially greater need than non-information workers for home computers. This blending of workplace and homeplace for the information worker is a growing phenomenon (see, e.g., 26, p. 136). And if information workers in fact are valued based on what they know, it should make little difference where they acquire the information they hold.

In addition to adopting technologies that are purely functional to their work, information workers should be more likely to adopt and use related technologies outside of the workplace. Several studies of new communication technology adoption support this notion. For example, Rogers's (19) concept of "technology clusters" suggests that the adoption of one device triggers the adoption of other, related innovations. Familiarity with one technology increases one's understanding of and receptivity toward others; even knowing how automatic bank teller machines operate is related to holding more positive attitudes toward new media technology (2). Other studies have found that experience with personal computers is associated with positive attitudes toward other new media (7, 24).

Given the strategic advantage of knowledge workers, they should also hold more favorable attitudes toward science and technology. Public attitudes toward science, technology, and computers (e.g., 5, 8, 25) are generally positive, though they cannot be characterized by a single pro- or antitechnology dimension (4). Demographic predictors have been mixed as well. In the 1960s the young and well educated were portrayed as antitechnology in books such as Reich's *The Greening of America* (18). But empirical data from the 1970s do not wholly support this view. For example, the 1972 *Science Indicators* (11) showed a more negative attitude toward technology among the young but a more positive attitude among the well educated. Elsewhere, the young and "liberal" were said to form the core of potential opposition to technology (5).

However, these studies predated the large-scale introduction of information technologies for both home and office use. In a 1987 study (17), those of high socioeconomic status were more optimistic about the social impact of the new technologies, and young people showed optimism toward both their social impact and the personal control they would bring.

Other research supports the more general conclusion that those in a position to take advantage of new technologies evaluate them more favorably than others (13, 27; see also 3). Based on these findings, an individual's occupation should color attitudes toward science and technology beyond the effect expected from socioeconomic status alone. Those workers who stand to benefit most from technology should be most favorable toward it.

The data were gathered in late July and early August of 1986 as part of the Texas Poll. The poll, a regular statewide survey of 1,000 respondents age 18 and older, is conducted by the Texas A & M Public Policy Resources Laboratory.[2] The cooperation rate (the number of completed calls divided by the sum of completed calls, refusals, and terminations) was 82 percent. The sample closely mirrored the total Texas adult population, based on comparison with projected state demographic characteristics.[3] Respondents' occupations were coded into one of the four categories described earlier (professional, administrative/managerial, clerical/service, or blue-collar). Three Likert-type items measured respondents' attitudes toward the risks of and provision of jobs by science and technology, and the social benefit of computers. These were combined into a summed index (0, 1, 2, or 3) representing the number of positive responses (disagreeing that science and technology carry risks, agreeing that they produce jobs, and agreeing that computers benefit society). A factor analysis indicated that they shared the same underlying dimension. Another Likert-type item evaluated how much respondents felt they knew about science.

Respondents were asked whether or not they had cable TV, pay TV channels "like HBO," a satellite dish, a videocassette recorder, or a home computer. In addition they were asked if they used a computer at work and at home, and the primary uses to which it was put.

Table 1: Occupational differences in computer use and uses

	Information workers			
	Knowledge workers			
	Professional (n = 170) %	Administrative/ managerial (n = 125) %	Clerical/ service (n = 200) %	Blue-collar (n = 140) %
Use computer at work	58	58	53	19
Use computer at home	29	30	16	12
Primary uses of computer at work[a]				
Accounting	6	11	9	4
Information retrieval	8	8	9	3
Data entry	4	4	9	1
Word processing	5	2	5	1
Programming	5	3	3	3
General office	2	5	5	1
Analysis	3	1	0	2
Other	5	2	4	1

Excluded are those keeping house (14 percent), retired (16 percent), and unemployed (6 percent) in the total sample (n = 986).

[a] Ranked in order by most frequently cited application across occupational categories.

[2] This particular instrument was developed as a joint project of the Public Policy Resources Laboratory (James Dyer, Director) and the Center for Research on Communication Technology and Society at the University of Texas at Austin (Frederick Williams, Director).

[3] According to the Texas State Department of Health, males represented 49 percent of the population (compared to the Texas Poll's 45.7 percent), while Anglos and blacks represented, respectively, 70 percent and 10.8 percent (compared to the Texas Poll's 70.8 percent and 9.3 percent).

The figures in Table 1 emphasize just how pervasive computers have become in the workplace. A majority of information workers use a computer at work; the figures differ little across the three information-work categories. Even 19 percent of blue-collar workers reported using a computer at work. However, the knowledge workers (professional and managerial) were almost twice as likely as clerical workers to use a computer at home. Given the conceptual basis of their product, knowledge workers are more likely than others to put computers to uses that transcend those of the workplace. A variety of computer work applications were also reported (although the numbers of respondents reporting each are too small to permit the detection of any significant subcategory differences). It appears, however, that business applications predominated. No single application predominated in any occupational category.

Table 2 compares respondents' adoption of new technologies and their attitudes toward science and technology. Workers did not differ significantly in adoption of cable or pay channels. Knowledge workers were more apt than clerical and blue-collar workers to have the more costly VCRs and home computers. They also differed in their attitudes toward and perceived knowledge about science and technology. Clerical workers were most likely to think that technology carries substantial risks. Along with blue-collar workers, they expressed more negative responses than the knowledge workers (that is, less agreement that science and technology produce jobs, less agreement that computers benefit society, and more agreement that they don't know enough about science).

These differences, however, could easily be confounded with differences in

Table 2: Occupational differences in adoption of home communication technologies and attitudes toward science and technology

	Professional (n = 170) %	Administrative/ managerial (n = 125) %	Clerical/ service (n = 200) %	Blue-collar (n = 140) %
Percent who subscribe to or own:				
Cable TV	60	62	60	49
Pay TV channels	42	37	40	36
Satellite TV dish	4	10	8	6
Videocassette recorder	57	68	42	49
Home computer	31	33	20	14
Percent who "agree" or "strongly agree":				
Scientific and technical development is accompanied by bigger and bigger risks for society that are difficult to overcome	41	44	55	45
Science and technology have produced more and better jobs for people	89	85	73	69
Increased use of computers has been a great benefit to society	86	88	80	74
I find it difficult to talk about science because I don't know enough about it	34	45	56	51

Table 3: Multiple regression analysis of new technology adoption using demographic, occupational, and attitudinal predictors

	Technology adoption[a]		
	Cable	VCR	Computer
Step 1			
Education	.05	.04	.12**
Black	.02	.00	.02
Hispanic	.07*	−.01	.01
Gender[b]	.01	−.05	−.02
Age	−.09**	−.25**	−.15**
Family income	.12**	.28**	.15**
Step 2			
Clerical	.04	−.06	.01
Managerial	.04	.08**	.07*
Professional	.04	−.01	.04
Blue-collar[c]	−.01	.01	−.06
Step 3			
Use computer at work[d]	−.02	.01	.09**
Step 4			
Positive regard for science[e]	.02	.04	.09**
Feeling informed about science[f]	.05	.00	.06
Total R^2	.04	.20	.12

Figures are standardized beta coefficients for variables entered hierarchically and reported at the step entered.

* $p < .05$ ** $p < .01$ N = 1,000.

[a] Dummy coded with adopting the technology = 1, else 0.

[b] Three dummy coded variables: 1 if black, Hispanic, and female, else 0.

[c] Dummy coded occupational variables: 1 if respondent's occupation fell in each category, else 0.

[d] "Do you use a computer in your work?" 1 if "yes," else 0.

[e] Summed positive responses (0, 1, 2, or 3) to three science attitude items: disagreeing that science and technology carry risks; agreeing that they produce jobs, and that computers benefit society.

[f] Disagreeing that respondent doesn't know enough about science.

socioeconomic status. If occupation is a useful analytical concept, it should predict differences beyond those attributable to other demographic differences. The regression analyses in Table 3 were performed to determine how occupational and attitudinal factors were related to technology adoption.

Entertainment and work-oriented technologies have been frequently lumped together in other studies; a comparison of their different predictors is revealing. In each case, cable TV, VCR, and computer adoption was associated (although weakly) with youth and wealth. Those, however, were the only common predictors. As expected, computer adoption were more predictable from occupational factors—being a managerial worker and using a computer at work. In addition, education and positive regard for science and technology were also

Table 4: Discriminant analysis of occupational groups with demographic, attitudinal, and technology adoption predictors

	Function 1		Function 2		Function 3	
	Standardized canonical coeffic.	Structure coeffic.	Standardized canonical coeffic.	Structure coeffic.	Standardized canonical coeffic.	Structure coeffic.
Education	.82	.92	−.13	−.26	−.43	−.27
Family income	.20	.53	−.13	−.25	.15	−.27
Black	−.11	−.22	.01	.05	.09	.04
Regard for science	.14	.39	−.19	−.30	.03	.06
Gender	.28	.12	.79	.83	.03	−.05
Hispanic	.16	−.07	.26	.30	.00	−.02
Use computer at work	.15	.44	.37	.17	.37	.33
Age	.15	−.09	−.13	−.10	.32	.16
Satellite TV dish	.04	.00	.13	.05	.40	.40
VCR	−.01	.21	−.21	−.26	.62	.58
Home computer	.08	.27	.05	−.06	.28	.34
Eigenvalue	.52		.24		.04	
Canonical corr.	.59		.44		.19	
Degrees of freedom	33		20		9	
Wilks' Lambda	.51		.78		.96	
Significance	p = .000		p = .000		p = .01	

A stepwise procedure was used to identify the significant discriminating variables in the order of their contribution: education, income, age, gender, Hispanic, black, regard for science, computer at work, and the technology items. Variables are ordered above based on their function loadings.

positively associated with computer adoption, lending further credence to the conceptual relationship between computers and information-age mobility.

The analysis thus far has followed the implicit model in which occupations are perceived as social locations. These locations may partly be viewed as a function of demographic factors, on which workers in one occupation differ from those in another. But workers in different occupations should also differ in their attitudes toward and uses of technology.

Only by analyzing all these factors simultaneously can we determine the unique contribution of occupational influences in conjunction with other factors. Table 4 presents the results of a discriminant analysis. Treating the occupational categories as four groups, discriminant analysis constructs a dimension that maximally separates the groups. Thus, the contribution of any given variable to the discriminating dimension can be evaluated holding all others constant. The demographic, science, and technology attitude index and technology use variables were used as predictors, and a stepwise procedure of discriminant analysis was employed to eliminate those variables without satisfactory discriminating power. The procedure locates the variable that best discriminates between the groups, finds the next best discriminator given the first, and so on.

Multiple discriminant function analysis based on the remaining variables yielded three significant discriminating functions (Wilks' Lambda = .51, .78, and .96, $p < .01$). Table 4 reports standardized canonical coefficients, which may be interpreted like beta weights in multiple regression.[4]

As can be seen, Function 1 ("learned") is primarily a function of education and, to a lesser extent, income, race, and regard for science and technology. High values of Function 1 are associated with being well educated, well off, and nonblack, and holding positive views toward science. High values of Function 2 ("born"), on the other hand, are associated with being female and Hispanic, as well as with holding a negative view of science and technology. Function 3 ("acquired") accounts for the least variance but does significantly separate the groups with a dimension primarily characterized by adoption of technology, including using computers at work, and owning satellite dishes, VCRs, and home computers.

Figure 1 shows the relationships among the groups more vividly. The key discriminator among information and blue-collar workers is, of course, education, a qualification greatly affecting mobility in the work force. This is coupled with a favorable view of science and technology, which separates professionals at one end from blue-collar workers at the other.

Function 2 reflects the predominance of females in the clerical and service occupations. Gender is the variable that loads most strongly. Interestingly, although clerical workers use computers in their jobs (as Table 1 showed), this does not translate into a favorable view toward science and technology in general. The attitudes variable loads negatively on Function 2, indicating that clerical workers are more negative than the rest.

On Function 3, the "acquired"/technology dimension, managers are distinguished from other occupations by their greater tendency to use computers at work and to acquire satellite TV, VCRs, and computers at home. Thus, taken as a whole, these dimensions suggest that the strategic position of the knowledge producers is reflected not only in their socioeconomic status but also in their use of, adoption of, and attitudes toward technology.

This study shows that one's occupation clearly affects use of communication technologies and how they are regarded. Of course, it is also possible that workers who feel positively about information technology "self-select" into jobs involving those technologies. This study could not address the direction of influence, although the model considers occupation to be logically prior to and more powerful than attitudes. One's attitudes have much less to do with determining one's line of work than family background factors established at birth.

The structure coefficients reported are analogous to loadings in factor analysis and represent the correlation of a variable with the underlying function. Pehadzur (12) notes that these loadings are useful in naming a function, as their square indicates the squared variance between the measure and the function, and suggests that values of .30 and above be treated as meaningful. Based on these coefficients and loadings the three functions were likened to social location axes and named as described below.

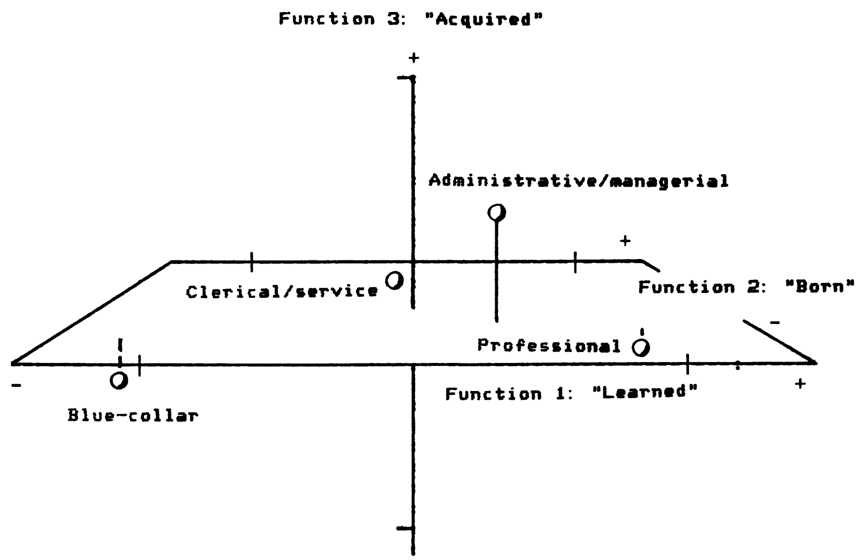

Figure 1: Spatial analysis of occupational group centroids plotted along three discriminant analysis functions (or "social location" axes)

Note: Hatch marks on Functions 1 and 3 represent one standard deviation. Function 2 is two standard deviations from front to back. Locations are approximate.

Not surprisingly, information workers use computers much more at their jobs than blue-collar workers. Beyond that, however, the higher-level "knowledge workers" (professional and administrator/managers) are more likely to use computers at home as well, in addition to other technologies. They also tend to have a more positive regard than other workers for science and technology. Combining these findings with demographic differences helps us conceptualize occupations in terms of strategic location, which here is viewed as a function not only of socioeconomic advantage but also of optimism toward science and technology and acquisition of communication technologies.

This focus on relative position derives from the belief that many of the most important questions to be asked about the information society are "distributive" in nature. The distinctions in occupational location should remind us that not all information workers will occupy the elite levels of an information age (as indeed they did not in the industrial age). Rather, as many critical scholars have charged (10, 22, 23), information-age trends may have a bifurcating effect on the work force, enabling some to consolidate their position while creating a large underclass of low-paid service workers. Although these workers may be considered part of the information work force, they will not occupy as advantageous a position as the knowledge producers.

An information-based economy, according to Schiller (23), creates new forms of organizational behavior mobilized around issues not based on the work site, thus contributing to the breakdown of organized labor and the polarization of the work force. Meanwhile, business capitalists exploit information as a pivotal feature of the new economy, both as a means of control and as a market to be privatized, commoditized, and marketed (23). The attitudinal differences between groups of workers found in this study hint at emerging class differences revolving around information and technology. This study cannot address occupational trends directly, given that it presents only a cross-section of the work force. Research is needed to monitor these suggested changes and evaluate whether information-age tendencies facilitate or constrain social and occupational mobility.

This initial analysis does show that the concept of occupation accounts for meaningful differences in information-related characteristics: uses of and regard for technology. Future research might identify more explicitly the essential features of information work that cause some workers to think and behave differently than others. Who are the workers who fill the jobs in the growing information work sector, what do they do, and what do they think? By beginning to understand how workers differ as a function of their work, we can anticipate the tools, attitudes, and resources that will be required for future mobility in the information society.

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